NOT MEASUREMENT SENSITIVE

MIL-T-62032H
20 May 1991
SUPERSEDING
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25 March 1988

MILITARY SPECIFICATION

TRUCKS, TANK: FUEL SERVICING AND AIRCRAFT FUEL SERVICING, 1,000 TO 4,000 GALLON, DIESEL AND GASOLINE ENGINE DRIVEN, 16,000 TO 50,000 POUNDS GVW, 4x2, 4x4, 6x4, AND 6x6, MODIFIED COMMERCIAL

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers diesel and gasoline engine driven, four-wheel, two- or four-wheel drive, and six-wheel, four- or six-wheel drive, single or dual delivery fuel servicing and aircraft fuel servicing tank trucks, with product capacities from 1,000 to 4,000 gallons, having minimum gross vehicle weights (GVW) of 16,000 to 50,000 pounds for normal operating conditions. Vehicles procured under this specification are commercial items which are warranted by the manufacturer as specified in acquisition documents.

* 1.2 Classification. The vehicle shall be one of the combinations of type, class, size and model shown in table I, as specified (see 6.2):

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-UED, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC-2320

TABLE I. Vehicle classification.

Type	Body description	Class	Size	Model
I	Fuel servicing (single compartment)	16	1,000	4x2
		19	1,200	4x2
		19	1,200	4x4
		28	2,000	4x2
		34.5	2,400	6x4
		44	2,400	6x6
		50	4,000	6x4
II	Dual fuel servicing (2 compartments)	16	1,000	4x2
		19	1,200	4x2
		19	1,200	4x4
		28	2,000	4x2
		34.5	2,400	6x4
		44	2,400	6x6
		50	4,000	6x4
III	Aircraft dual fuel (single compartment)	19	1,200	4x2
		19	1,200	4x4
		28	2,000	4x2
		34.5	2,400	6x4
		44	2,400	6x6
		50	4,000	6x4
IV	Aircraft dual fuel servicing (2 compartment)	36	2,400	6x4
V	Bulk haul (single compartment)	19	1,200	4x2
		28	2,000	4x2
		34.5	2,400	6x4
		44	2,400	6x6
		50	4,000	6x4

* 1.2.1 Class. The class of the vehicle shall be determined by its minimum GVW rating, as follows:

Class	GVW
16	16,000 pounds
19	19,000 pounds
28	28,000 pounds
34.5	34,500 pounds
36	36,000 pounds
44	44,000 pounds
50	50,000 pounds

1.2.2 Size. The size of the vehicle shall be determined by the capacity of the tank body, as follows:

Size	Capacity
1,000	1,000 gallons
1,200	1,200 gallons
2,000	2,000 gallons
2,400	2,400 gallons
4,000	4,000 gallons

1.2.3 Model. The model of the vehicle shall be determined by the total number of wheels and the number of driving wheels, as follows:

Model	Wheels and wheels driving
4x2	4x2
4x4	4x4
6x4	6x4
6x6	6x6

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS), and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

W-B-131 - Battery, Storage: Vehicular, Ignition, Lighting and Starting.

* VV-F-800 - Fuel Oil, Diesel.

MILITARY

MIL-P-514 - Plates, Identification, Instruction and Marking, Blank.

MIL-C-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys.

* MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5.

MIL-N-5877 - Nozzle, Pressure Fuel Servicing, Locking, Type D-l, Nominal 2-1/2 Inch Diameter.

MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys.

MIL-F-8901	- Filter-Separators, Liquid Fuel: and Filter-Coalescer Elements, Fluid Pressure: Inspection Requirements and Test Procedures For.
MIL-C-10387	- Coupling, Clamp Pipe, with Bolts and Synthetic Rubber Gasket, for Grooved Pipe and Tube.
MIL-P-l0388	- Pipe Fitting, One or More Ends Grooved.
MIL-C-27487	- Coupling Halves, Quick-Disconnect, Cam-Locking Type.
MIL-B-46176	- Brake Fluid, Silicone, Automotive All Weather, Operational and Preservative.
MIL-F-52308	- Filter Element, Fluid Pressure.
MIL-N-52747	- Nozzle Assembly, Closed-Circuit Refueling.
MIL-M-81380	- Monitor, Contamination, Fuel Dispensing System.
MIL-T-83133	- Turbine Fuel, Aviation, Kerosene type, Grade JP-8.
MIL-C-83413	- Connector, Electrical Ground.
MIL-N-87963	- Nozzle: Fuel, Aircraft, Overwing: Type MD-3.

STANDARDS

FEDERAL

FED-STD-297	- Rustproofing of Commercial (Nontactical) Vehicles.
FED-STD-595	- Colors.

MILITARY

MIL-STD-1223	- Nontactical Wheeled Vehicles Treatment, Painting, Identification Marking and Data Plate Standards.

* (Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, Military Specifications and Standards, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings and publications. The following other Government documents, drawings and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

* DEPARTMENT OF DEFENSE

Department of Defense Index of Specifications and Standards (DODISS).

(Copies of the DODISS are available on a yearly subscription basis either from the Government Printing Office for hard copy, or microfiche copies are available from the Director, Navy Publication and Printing Service Office, 700 Robbins Avenue, Philadelphia, PA 19111-5093.)

DEPARTMENT OF TRANSPORTATION (DoT)
Federal Motor Carrier Safety Regulations
Federal Motor Vehicle Safety Standards
Regulations Governing Transportation of Dangerous Articles in Tank Motor Vehicles (Section 178).

(Application for copies of DoT publications should reference the Code of Federal Regulations, 49 CFR, and the Federal Register and should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

ENVIRONMENTAL PROTECTION AGENCY (EPA)
Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines.
Noise Emission Standards for Transportation Equipment - Medium and Heavy Trucks.

(Application for copies of EPA Publications should reference the Code of Federal Regulations, 40 CFR, and the Federal Register, and should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

NATIONAL BUREAU OF STANDARDS (NBS)
Handbook 44 - Specifications and Regulations for Commercial Weighing and Measuring Devices.

(Application for copies of NBS publications should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

TEST OPERATION PROCEDURES
2-2-614 - Toxic and Hazard Test for Vehicles and other Equipment.

(Application for copies of Teat Operation Procedures should be addressed to Defense Technical Information Center, Cameron Station, Alexandria, VA 22304-6145.)

* 2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are indicated as DoD adopted shall be those listed in the issue of the DoDISS

specified in the solicitation. Unless otherwise specified, the issued of documents not listed in the DoDISS shall be the issue of the non-Government document which is current on the date of the solicitation (see 6.2).

AMERICAN PETROLEUM INSTITUTE (API)

RP 1004	- Bottom Loading and Vapor Recovery for MC-306 Tank Motor Vehicles.
RP 2003	- Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents.

(Application for copies of API publications should be addressed to the American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code - Section VIII.

(Application for copies of ASME publications should be addressed to the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-910	- Standard Specification for Aviation Gasolines.

(Application for copies of ASTM publications should be addressed to American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.)

* THE EUROPEAN TYRE AND RIM TECHNICAL ORGANISATION (ETRTO)

Standards Manual

(Application for copies of the ETRTO publications should be addressed to the European Tyre and Rim Technical Organisation, 32, Avenue Brugmann, 1060 Brussels, Belgium.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

No. 10	- Portable Fire Extinguishers
No. 407	- Aircraft Fuel Servicing, 1985.

(Applications for copies of NFPA publications should be addressed to the National Fire Protection Association, Batterymarch Park, Quincy, MA 22269.)

NATIONAL ASSOCIATION OF ARCHITURAL METAL MANUFACTURERS (NAAMM)

Metal Bar Grating Manual

(Application for copies of NAAMM publications should be addressed to the National Association of Architectural Metal Manufacturers, 600 S. Federal, Suite 400, Chicago, IL 60605.)

SAE, INC.
SAE Standards and Recommended Practices.

J350	- Spark Arrester Test Procedure for Medium Size Engines (DoD adopted).
J537	- Storage Batteries.
J551	- Performance Levels and Methods of Measurement of Electromagnetic Radiation from Vehicles and Devices (30-1000 MHz).
J588	- Turn Signal Lamps.
J589	- Turn Signal Switch.
J688	- Truck Ability Prediction Procedure (DoD adopted).
J704	- Openings for Six- and Eight-Bolt Truck Transmission Mounted Power Take-Offs.
J1349	- Engine Power Test Code - Spark Ignition and Diesel.

(Application for copies of SAE publications should be addressed to SAE, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

STATE OF CALIFORNIA
Air Resources Board
Executive Order G-70-10-A.

(Application for copies of State of California publications should be addressed to the Air Resources Board, 1102 Q Street, P.O. Box 2815, Sacramento, CA 95812.)

THE TIRE AND RIM ASSOCIATION, INC.
Year Book

* (Application for copies of Tire and Rim Association publications should be addressed to The Tire and Rim Association Inc., 175 Montrose West Ave., Copley, OH 44321.)

* (Non-Government Standards and other publications are normally available from the Organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

* 2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document shall take precedence. Nothing in this document, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

* 3.1 Standard vehicle and accessories. Except as specified in 3.1.1 through 3.1.1.11, the vehicle, components, assemblies, and accessories to be delivered under the contract shall be

standard or optional items, which meet or exceed the requirements of this specification. Except as specified in 3.1.1 through 3.1.1.11, no removal, substitution or alteration of the chassis manufacturer's standard or optional chassis model components shall be made. All chassis items shall be as represented in the chassis manufacturer's technical data book. Special bodies or mounted equipment shall be as represented in the body and equipment manufacturer's technical data. Technical data shall be limited to specifications and technical material, identical to that furnished to the authorized company representatives for selection of vehicle models and components, and shall be available in the engineering offices of the procuring activity prior to delivery of the items. The chassis model furnished shall be not older than the chassis manufacturer's current model on the date of invitation for bids.

3.1.1 Special requirements. In addition to the standard vehicle and components specified in 3.1, the vehicle shall be furnished with special equipment as specified herein.

* 3.1.1.1 Treatment and painting. The vehicle shall be treated and painted in accordance with MIL-STD-1223. The exterior color shall be in accordance with the requirements of MIL-STD-1223 for the military service identified by the procuring activity (see 6.2); except the exterior color of type III and IV vehicles shall be gloss yellow, matching color chip No. 13538 of FED-STD-595.

* 3.1.1.2 Marking and data plates. As specified by the procuring activity for the appropriate military service (see 6.2), identification marking and data plates shall be in accordance with MIL-STD-1223. When specified (see 6.2), concealed markings shall be furnished.

3.1.1.3 Rustproofing. All welds of mild steel to stainless steel hidden from view from the exterior of the vehicle shall be rustproofed in accordance with FED-STD-297, whether other areas are required to be rustproofed or not. When specified (see 6.2), the vehicle shall be rustproofed in accordance with MIL-STD-297. When specified (see 6.2), tropical rustproofing in accordance with MIL-STD-297 shall be provided.

3.1.1.4 Drain plugs. All drain plugs installed in the transfer case, manual transmission and drive axle(s) shall be of the permanent magnet type.

3.1.1.5 Towing devices. Not less than two hooks, loops, or pins or a single center mounted towing eye for towing the vehicle shall be furnished on the front of the vehicle.

* 3.1.1.6 Bonding straps. Bonding straps shall be furnished between the chassis frame and the metal cab, metal fenders, metal engine hood and tank body and also between the cabinet doors, pump, meter, filter/separator (if a filter/separator is required), or other static-producing

devices and the nearest structural part of the body or chassis. Bonding straps shall be attached using corrosion-resistant bolts and nuts, and using two internal-external locking washers at each attaching point to assure positive electrical connection.

3.1.1.7 Exhaust system and spark arrester. As specified herein (see 3.4.4 and 3.4.4.1), the exhaust system shall be modified as necessary to minimize the chance of accidental fires and the entrance of exhaust fumes into the cab. A spark arrester shall be furnished except on turbocharged engines.

3.1.1.8 Silicone brake fluid. When specified for class A vehicles (see 6.2), and if available as the manufacturer's standard or optional brake fluid, brake fluid conforming to MIL-B-46176 shall be provided in the hydraulic brake system. A tag shall be placed near the master cylinder stating "CAUTION: USE SILICONE BRAKE FLUID ONLY, MIL-B-46176."

3.1.1.9 Brushguard. Model 4x4 and 6x6 vehicles shall be equipped with a radiator and headlamp brushguard. When the headlamps are recessed in and protected by the front bumper, a headlamp brushguard is not required.

* 3.1.1.10 Brake lights. At least one pair of brake lights shall override the four-way emergency flasher on the two systems shall be independent of each other. Modifications to the manufacturer's standard product to accommodate this requirement shall not compromise conformance to any Federal Motor Carrier Safety Standard. If additional lights are added to the vehicle, the lights shall be selected from the chassis manufacturer's standard matching hardware.

* 3.1.1.11 4x4 and 6x6 conversion. The chassis manufacturer's standard 4x2 and 6x4 truck chassis may be modified to provide all wheel drive conforming to the requirements specified herein if:

(a) The conversion axle manufacturer's engineering department specifically approves and certifies that all such modifications meet the design requirements and standards of the conversion axle manufacturer. Certification shall be based on both design analysis and proving ground test reports, which shall be made available to the engineering and quality assurance offices of the procuring activity.
(b) The chassis manufacturer's front axle before conversion has the same load rating as the conversion axle to be installed.
(c) Components used in the all wheel drive conversion are of current production.
(d) Components used in the all wheel drive conversion are approved for the conversion application by the component manufacturers.
(e) The converted vehicle is certified to conform to Federal Motor Vehicle Safety Standard, No. 121, by the intermediate or final manufacturer.
(f) Replacement headlights, if required to be added, shall meet the height requirement of not less than 22 inches and not more than 54 inches, measured above the road surface, in conformance with Federal Motor Vehicle Safety Standard No. 108.

Replacement headlights shall be equivalent in mounting, protection, and range and precision of adjustment to the chassis manufacturer's original standard headlights.

(g) Unused headlight cavities are covered in a neat workmanlike manner, treated and painted to match the chassis cab color with treatment and painting equivalent to the chassis cab manufacturer's process for the remainder of the chassis cab. Cavities and their covers shall be rustproofed in accordance with 3.1.1.3.

(h) Complete installation drawings are available to the procuring activity.

3.2 General design.

3.2.1 Federal Motor Vehicle Safety Standards. The vehicle and furnished accessories shall comply with all Federal Motor Vehicle Safety Standards in effect on the date of manufacture.

3.2.2 Air pollution controls. The vehicle shall comply with EPA Regulations governing Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines in effect on the date of manufacture. In addition, vehicles destined for California shall comply with State of California regulations governing air pollution control in effect on the date of manufacture.

* 3.2.3 Sound level. The cab interior sound level shall not exceed 84 db (A) when measured in accordance with Federal Motor Carrier Safety Regulation 393.94. The vehicle exterior sound level shall conform to EPA Noise Emission Standards for Transportation Equipment, Medium and Heavy Trucks. Recertification for noise emission, if the exhaust system is modified, shall be accomplished, if required by EPA standards.

3.2.4 Curb weight. The curb weight shall include the weight of the chassis and cab, with all attachments, accessories, and equipment; the body; and a full complement of fuel, lubricants and coolant.

3.2.5 Gross vehicle weight. Gross vehicle weight (GVW) shall consist of curb weight, operator weight (computed at 175 pounds), and a payload to provide not less than the specified GVW.

3.2.6 Weight distribution. The distribution of GVW for the purpose of establishing suspension, axle and tire capacities shall be determined with the payload uniformly distributed over the load area. In addition to meeting the load imposed, the gross axle weight rating (GAWR) on the front shall be not less than as specified in table II.

TABLE II. Minimum GVW and GAWR ratings.

Vehicle class	GVW rating (pounds)	Front GAWR (pounds)
16	16,000	5,000
19	19,000	7,000
28	28,000	9,000
34.5	34,500	9,000
36	36,000	9,000
44	44,000	12,000
50	50,000	15,000

* 3.2.7 Ratings. Vehicle ratings shall be the manufacturer's published ratings. Component and vehicular ratings shall not be raised to meet the requirements of this specification. When published ratings are not available, verification of ratings shall be available to the engineering office of the procuring activity. Minimum GVW ratings shall conform to table II for the specified class of vehicle. In addition, the actual GVW rating of the vehicle furnished shall exceed the minimum GVW rating specified in table II if required to provide for a payload weight equal to 7.2 pounds per gallon times the size of the tank body in gallons (see table I).

* 3.2.8 Dimensions. The vehicle cab-to-axle or cab-to-trunnion dimension shall be not less than that specified in table III. The vehicle height shall be not more than 106 inches when the spotlight and any other easily removable projections are removed for shipping. The overall width of the vehicle, exclusive of tires and safety related items such as mirrors, lights and reflectors, shall be not more than 96 inches. The width over the tires shall be not more than 100 inches.

TABLE III. Dimensions.

Class	Cab-to-axle (inches)	Cab-to-trunnion (inches)
16	102	---
19	102	---
28	102	---
34.5	---	102
36	---	120
44	---	120
50	---	144

3.2.9 Accessibility. The design of the vehicle and optional equipment shall permit access for routine servicing and shall permit access for replacement and adjustment of component parts and accessories with minimal disturbance of other components and systems.

* 3.2.10 Asbestos. Asbestos material shall not be used in any form in any part of the vehicle.

3.3 Performance. Performance requirements for model 4x4 and 6x6 vehicles shall be met with the front wheel drive disengaged and with front wheel hubs (when furnished) unlocked, except that a vehicle equipped with interaxle compensating devices shall meet performance requirements with the front wheel drive engaged.

3.3.1 Speeds and gradeability. High and low speed requirements shall be met with the vehicle loaded to the specified GVW.

* 3.3.1.1 High speed gradeability. The vehicle shall ascend continuous grades specified in table IV at 50 miles per hour (mph). Gradeability requirements shall be met with the main transmission in direct drive, and when a multispeed axle is furnished, with the axle in high speed range. Gradeability shall be verified with calculations in accordance with SAE J688 (see 6.3).

TABLE IV. Gradeability.

Vehicle	Percentage grade
16	2.5
19	1.5
28	1.0
34.5	0.5
36	0.5
44	0.5
50	0.5

3.3.1.2 Low speed. Low speed for vehicles with a manual transmission shall be calculated with the engine operating at not less than 35 percent of the recommended governed speed, and shall provide not more than the vehicle speed specified in table V for the corresponding number of available speeds.

TABLE V. Vehicle low speed requirement.

Number of forward speeds	Speed (mph)
4 or 5	4.5
7	3.5
8	3.0
9 or 10	2.5

3.3.1.3 Maximum geared speed. Maximum geared speed at engine governed speed shall be not less than 58 mph for 4x2 and 6x4 models and not less than 52 mph for 4x4 and 6x6 models. Conformance to geared speed specified shall be determined by calculating in accordance with the following formula:

$$\text{Maximum geared speed (mph)} = \frac{\text{Governed speed (rpm)}}{\text{Total gear reduction x tire factor (see 6.3)}}$$

3.3.2 Service brakes. The service brakes shall control and hold the vehicle, when loaded to its specified GVW, on a 30 percent grade. The service brakes shall stop the vehicle, loaded to specified GVW, within the stopping distance requirements of Federal Motor Carrier Safety Regulation 393.52.

3.4 Chassis components.

3.4.1 Engine. The engine furnished shall be the chassis manufacturer's standard or optional engine for the commercial model truck which meets or exceeds the requirements of this specification.

* 3.4.1.1 Diesel engine. Unless otherwise specified (see 3.4.1.2), the vehicle shall be equipped with a liquid cooled, compression ignition, two-stroke or four-stroke cycle diesel engine. The engine net horsepower figures used in performance prediction calculations shall be determined in accordance with SAE J1349. The engine shall demonstrate the performance characteristics specified herein when using diesel fuel conforming to VV-F-800. In addition, when specified (see 6.2), the engine shall operate satisfactorily on grade JP-4 and grade JP-5 fuel conforming to MIL-T-5624 under emergency, short duration conditions and on grade JP-8 fuel conforming to MIL-T-83133 under normal conditions. A power loss when operating on JP-4, JP-5 or JP-8 is acceptable.

3.4.1.2 Gasoline engine. When specified (see 6.2), class 16, 19, and 28 vehicles shall be equipped with a liquid cooled, internal combustion, four-stroke cycle gasoline engine with not less than six cylinders. The engine shall produce the required vehicle performance when operated on unleaded fuel with a research octane rating of 91, at an engine speed not more than the manufacturer's recommended operating speed. The engine shall be capable of warranted operation on unleaded fuel, when used in accordance with the operator's manual. Engine net horsepower used in performance prediction calculations shall be determined in accordance with SAE J1349.

3.4.1.3 Oil filter. A full flow type oil filter shall be furnished.

3.4.1.4 Governor. An engine governor shall be furnished and set and sealed to limit the engine speed to the engine manufacturer's recommended operating speed.

3.4.1.5 Cooling system. The cooling system shall maintain the engine coolant at a temperature below the boiling point with the vehicle loaded to rated GVW and operated at an altitude of 10,000 feet above sea level or in ambient air temperature of not less than 125 degrees Fahrenheit (°F). The coolant system shall include a surge tank or a coolant recovery reservoir of not less than two-quart capacity. On tilt cab models, a radiator servicing access door shall be provided to allow verification of the coolant level.

3.4.1.6 Coolant temperature control. Thermostatic control of engine coolant temperature shall be provided. On diesel engine driven vehicles, control shall include partial thermostatic control of coolant flow through the radiator and thermostatically controlled radiator shutters or complete thermostatic control of all coolant flow through the radiator.

* 3.4.1.7 Fan clutch. A fan clutch shall be provided. The fan clutch shall reduce the fan speed automatically when the fan is not required for engine cooling. The fan clutch shall be asbestos free.

* 3.4.1.8 Power plant heaters and fuel warmer. When specified (see 6.2), a coolant heater, an engine oil heater, and a fuel warmer (diesel engine driven vehicles only) shall be provided. Unless otherwise specified (see 6.2), a battery beater shall be provided, when power plant heaters are specified. Heaters shall operate on 120-volt alternating current (ac), and shall be wired through a junction block, including a fuse or circuit breaker, to a single three-pronged (male), weatherproof, slave receptacle for receiving external power and grounding of the vehicle. A three-wire connecting cable, 25 feet long and of adequate line capacity to supply power for all heater units simultaneously, shall be furnished. Connecting cable shall include a matching female connector at the vehicle end and a standard, weatherproof, three-pronged (two power plus one ground) male connector at the other end. Electrical apparatus shall conform to Federal Motor Carrier Safety Regulation 393.77(c)(7). Electrical insulation of connecting cable shall withstand normal operating stresses in low ambient air temperatures (down to minus 600 °F) without cracking or loss of dielectric capacity. All heated lead wires shall be installed without interfering with vehicle component operation, and without loose excess wire. A carrier for the connecting cable shall be mounted within the cab or engine compartment and shall provide positive cable retention during vehicle operation. Heaters shall be furnished as follows:

(a) A coolant heater, 1500-watt minimum rating, shall be installed in the engine block or lower coolant inlet hose. Engine thermostat with an operating range of 170 °F to 195 °F shall be installed

* (b) An oil pan heater of the permanent external surface mount, permanent in-pan mount, or immersion type that meets the following requirements, shall be installed:
  (1) Not less than 22 watts per quart heating capacity
  (2) Not more than 18 watts per square inch heating capacity

(3) Thermal balance design or thermostat control providing for uninterrupted operation
(4) Provision for mounting below minimum service oil level.

(c) Battery heater shall have a capacity to maintain the battery electrolyte at a temperature of not less than 10 °F during vehicle exposure to ambient air temperatures as low as minus 60 °F, and shall embody a thermostat to limit the temperature of the electrolyte to not more than 80 °F

(d) A fuel warmer or preheater shall be provided on diesel engine driven vehicles to prevent clogging of fuel filters due to wax crystallization in the fuel. The fuel warmer shall use engine coolant to transfer sufficient heat to the diesel fuel to heat it from an inlet temperature of minus 40 °F to an outlet temperature of plus 9 °F, with a flow rate not less than the maximum fuel demand of the engine fuel system. A coolant shutoff valve shall be provided for the coolant inlet side of the fuel warmer unit.

3.4.2 Electrical systems. Electrical systems shall be in accordance with Federal Motor Carrier Safety Regulations 393.27 through 393.31 and 393.33.

* 3.4.2.1 Starting system (diesel). For diesel engine driven vehicles, a 12- or 24-volt direct current (dc) starting system with 12-volt lighting system. Engine starting equipment shall include an ether starting system, glow plug or grid heater. If an ether system is furnished in lieu of a glow plug or grid heater, it shall be of the measured shot type. The measured shot type ether system shall be key operated or manually operated from the driver's compartment and shall be inoperative with the engine warm. Complete provisions for a replaceable ether reservoir of not less than 12 fluid ounces shall be furnished. A reservoir need not be furnished.

* 3.4.2.2 Ignition system (gasoline). For gasoline engine driven vehicles, a 12-volt dc ignition system shall be furnished.

* 3.4.2.3 Alternator. Unless otherwise specified (see 6.2) on diesel engine driven vehicles, a minimum 65-ampere alternator shall be furnished. The alternator output with the engine at engine idle speed shall be not less than 45 amperes. Unless otherwise specified (see 6.2) on gasoline engine driven vehicles, an alternator of not less than 85 amperes rated capacity, and which provides not less than 45 amperes dc output at normal engine idle speed, shall be furnished.

* 3.4.2.4 Lighting. All vehicle lights and reflectors shall conform to Federal Motor Carrier Safety Regulations 393.12, 393.19, 393.20 and 393.22 through 393.26(d). Lights and reflectors shall not be mounted on vertical surfaces of rub rails or on vehicle bumpers (unless recessed and fully protected).

* 3.4.2.5 Turn signals. Turn signal lamps shall conform to SAE J588. Operating units shall conform to SAE J589 class A and shall be mounted on the steering column. Turn signal units shall be installed in accordance with J588. Turn signal operating units shall be of the self-cancelling type with visible and audible type flash indicator.

3.4.2.6 Batteries. Each battery shall be of 12-volt potential. The total reserve capacity rating and the total cold cranking rating at 0 °F, both measured in accordance with SAE J537, shall be not less than specified in table VI. The batteries shall be of the maintenance-free type having the maintenance-free characteristics listed in W-B-131.

TABLE VI. Batteries.

Engine type	Reserve capacity (minutes)	Cold cranking (amperes)
Diesel (less than 220 gross horsepower)	320	1,200
Diesel (220 gross horsepower and over)	480	1,740
Gasoline	100	450

3.4.2.7 Radio interference suppression. The vehicle shall be suppressed to limit electromagnetic radiation in accordance with SAE J551. Any body equipment emitting electromagnetic radiation shall be suppressed to the same level as the vehicle chassis.

3.4.3 Fuel system. The fuel system shall conform to Federal Motor Carrier Safety Regulations 393.65 and 393.67.

3.4.3.1 Air cleaner. An air cleaner shall be furnished.

* 3.4.3.2 Chassis fuel tank(s). The chassis fuel tank(s) shall have not less than 50 gallons total capacity (43 gallons for vehicles destined for California). When more than one tank is furnished on diesel engine driven vehicles, means shall be provided to assure an equalized fuel level in both tanks. When more than one tank is furnished on gasoline engine driven vehicles, a selector valve connecting either tank to the engine fuel intake shall be provided, and means shall be provided to monitor the fuel level of either tank from a single fuel gage; or an equalizing pump shall be used to maintain the same fuel level in both tanks.

3.4.4 Exhaust system. The exhaust system shall conform to Federal Motor Carrier Safety Regulation 393.83 and paragraph 4-3.4 of NFPA No. 407. The exhaust outlet shall be located immediately behind the cab (between the cab and the tank body) or on the side immediately in front of or to the rear of the rear wheels. The exhaust outlet, if to the side, shall

be on the side opposite the fuel dispensing equipment. For dual fuel servicing vehicles, the outlet, may be on either side. All portions of the exhaust system which project to the rear of the cab shall be fully shielded from fuel sources. The shield(s) shall direct fluids spilled from the tank, leaking from the tank, spraying from any leaking seals, or from any other source, away from the exhaust system. Shields shall be separated from the exhaust system component to be shielded by at least 0.50 inches for the top half of the component and shall extend vertically down from the horizontal center of the component to at least the bottom of the component. The shielding shall not interfere with the servicing of the pump line strainer or any other component under the tank body requiring periodic servicing. A spark arrester conforming to SAE J350 shall be furnished except on turbocharged engines. The spark arrester shall have an 80 percent efficiency rating when rated in accordance with SAE J350.

3.4.4.1 Exhaust gases in cab. The exhaust system shall be installed in a manner that will insure that the concentration of oxides of nitrogen (NO_x) shall not exceed 5 parts per million (ppm), the concentration of carbon monoxide (CO) shall not exceed 50 ppm and the concentration of sulfur dioxide (SO_2) shall not exceed 5 ppm in the driver's compartment after eight hours of operation with all windows and doors closed, with cab air intakes open, with and without all cab heaters operating, and with the chassis engine operating in accordance with 4.3.11.

3.4.5 Transmission. Unless otherwise specified (see 3.4.5.3), a manually shifted transmission shall be provided. The input torque capacity of the transmission shall be at least equal to the maximum torque delivered by the engine. The vehicle shall be provided with not less than the number of forward speeds specified in table VII. When more than five forward speeds are required, a multispeed transmission or an auxiliary transmission shall be provided. Gear ratios in the transmission and axle shall be matched to provide a progressive shifting pattern throughout the complete range, and shall provide the vehicle performance required in 3.3.1 through 3.3.1.3. The transmission shall provide for maximum ease of shifting in all speeds. SAE J704 power takeoff opening(s) shall be provided.

* TABLE VII. Vehicle number of forward speeds.

Vehicle class	Vehicle model	Number of forward speeds
16 – 19	4x2	4
19	4x4	8
28	4x2	5
34.5 – 36	6x4	9
44	6x6	9
50	6x4	9

3.4.5.1 Transfer case. Model 4x4 and model 6x6 vehicles shall be furnished with a transfer case. Unless a two speed transfer case is specified, either a one- or two-speed transfer case may be furnished. Unless the transfer case is equipped with devices which compensate for differential torque and speeds between front and rear axles, the transfer case shall provide for driver selection of two-wheel or four-wheel drive on model 4x4 vehicles and four-wheel or six-wheel drive on model 6x6 vehicles. When furnished, interaxle compensating devices shall provide for positive transfer of power to all driving axles. When specified (see 6.2), a two-speed transfer case shall be furnished.

* 3.4.5.2 Clutch. The clutch shall be the largest capacity clutch offered for the vehicle and engine furnished, with the clutch torque capacity exceeding the maximum delivered engine torque. The clutch lining shall be asbestos free.

* 3.4.5.3 Automatic transmission. When specified (see 6.2), types I, III and V vehicles shall be provided with an automatic transmission. The input torque capacity of the transmission shall be at least equal to the maximum torque delivered by the engine. The transmission shall include a hydraulic torque converter and not less than four forward gear ratios. Normal driving range selector position shall provide not less than four gear ratios without movement of the selector. The transmission shall be provided with a power takeoff opening.

3.4.5.4 Power takeoff. A power takeoff shall be provided, except on type V vehicles. The power takeoff shall be of a rated capacity to operate the product fuel pump. The power takeoff drive shaft shall be of the heavy duty type. Correct phasing and proper universal joint operating angles, relative to maximum engine/pump revolutions per minute (rpm) requirements, shall be incorporated into the installation design and assembly. All universal joints and drive shaft(s) shall be of the flanged type equipped with grease fittings. The power takeoff gear ratio shall be selected so that the intended maximum flow rate occurs at an engine speed of 700 to 1,000 rpm. Controls to operate the power takeoff shall be located in the truck cab accessible to the seated driver.

3.4.6 Driveline components. The driveline components shall be adequate to transmit the maximum delivered torque of the engine, as developed through the maximum gear train reduction. The drive shaft(s) shall be protected in a manner similar to that specified for buses by Federal Motor Carrier Safety Regulation 393.89.

3.4.7 Frame. The chassis frame shall be the manufacturer's heavy duty main frame or shall be a standard frame with frame reinforcements added. The heavy duty frame shall have frame rails of greater section modulus than the manufacturer's standard for the class vehicle furnished, and shall provide structural strength at least equivalent to the reinforced frame

specified herein. Reinforcements shall extend at least from the rear of the front suspension, rear hanger bracket to the front of the rear spring, front hanger bracket. The chassis frame rails shall not project beyond the rear end of the tank body or the rear bumper.

3.4.8 Suspension. The vehicle shall be equipped with a suspension system with components having a rated capacity at least equal to the load imposed on each member, measured at the ground, with the vehicle loaded to specified GVW. When the suspension capacity is rated at the spring pads, unsprung weight shall be deducted. The vehicle shall be equipped with hydraulic, double-acting shock absorbers at the front wheels.

* 3.4.9 Axles. Axle ratings shall be at least equal to the load imposed on each axle, measured at the ground, with the vehicle loaded to specified GVW. On classes 16 and 19, unless a two-speed axle is furnished, a single reduction rear axle shall be provided. When specified (see 6.2), the wheel bearings and axle spindles shall be oil lubricated. The hubcaps on non-drive axles shall have a window for visual determination of oil level. Provisions for venting or withstanding internal pressure buildup and for replenishing the oil supply shall be provided.

3.4.9.1 Two-speed axle. When specified for model 4x2 or 6x4 vehicles (see 6.2), a two-speed axle shall be furnished, equipped with electric vacuum or air shift and provided with ratios which will permit proper gear splitting. Gear ratios shall provide the performance specified in 3.3.1 through 3.3.1.3.

3.4.9.2 Traction control. When specified (see 6.2), a traction control shall be furnished on the rear axle of model 4x2 and 4x4 vehicles, and on either rear axle of the rear bogie on model 6x4 and 6x6 vehicles. The traction control shall actuate automatically to ensure that power is transmitted to the wheel having traction when the opposite wheel loses traction. Maximum traction capabilities shall be maintained at all times under each drive wheel for the life of the vehicle.

3.4.9.3 Rear bogie. Model 6x4 and 6x6 vehicles shall be equipped with a rear bogie. The rear bogie 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, and a manually or automatically controlled lockout assuring equal power to each rear axle. The manual lockout control shall be located in the truck cab. Axle gear ratios shall provide the performance specified in 3.3.1 through 3.3.1.3.

* 3.4.10 Wheels, rims, tires and tubes. Unless wide base tires are specified, the vehicle shall be equipped with single front and dual rear wheels. Except as specified herein, rims and tire ratings shall conform to The Tire and Rim Association or European Tyre and Rim Technical

Organisation recommendations for the type and size of tires furnished. Except when tube type tires are specified in the procurement documents, multi-piece rims shall not be furnished on front axles rated at 14,000 pounds or less and on single rear axles rated at 23,000 pounds or less or tandem axles rated at 46,000 pounds or less. Tire size, tire load range (ply rating), and rim size shall be the same for all tires on the vehicle except for class 50. When specified (see 6.2), wide base type tires and wheels on the front and rear axles shall be provided in lieu of conventional front and dual rear wheels and tires. When wide base tires are furnished, the wheels shall be interchangeable without the use of an adapter, except on class 50. When specified (see 6.2), the vehicle shall be furnished with disc type wheels.

* 3.4.10.1 Tires. Steel belted radial, or when specified (see 6.2) bias ply tires, shall be furnished. Tires shall be tube or tubeless type with highway tread for model 4x2 and 6x4 vehicles, and with nondirectional mud and snow tread for model 4x4 and 6x6 vehicles. Tires shall be of a rated capacity at least equal to the load imposed on each tire, measured at each wheel, at the ground, with the vehicle loaded to specified GVW. Tubes and tires and tire size designation system shall conform to Tire and Rim Association or to the European Tyre and Rim Technical Organisation recommendations.

3.4.10.2 Inner tubes. When tube type tires are specified in acquisition documents, inner tubes shall be of the heavy duty type, and shall be of the proper size for the tires furnished. Tire flaps shall be provided for tube type tires in accordance with Tire and Rim Association recommendations.

* 3.4.10.3 Carrier for spare tire assembly. When specified (see 6.2), a carrier for a spare wheel or rim and tire assembly shall be installed in a readily accessible location on the vehicle. The carrier design shall enable removal or mounting of the spare wheel assembly using only tools specified in 3.4.17.1. Threaded fasteners, when used to secure the spare tire in the carrier, shall be constructed of or plated with corrosion-resistant material. The carrier shall enable the safe removal and installation of the spare tire assembly from and to the vehicle and carrier without personnel positioning themselves or any part of their body under the spare tire assembly.

3.4.10.4 Spare wheel or rim. When specified (see 6.2), a spare wheel or rim shall be furnished. When a spare tire assembly is specified (see 3.4.10.5), a spare wheel or rim shall be furnished.

3.4.10.5 Spare tire assembly. When specified (see 6.2), a spare tire assembly shall be furnished. The spare tire assembly shall include an inflated spare tire mounted on the spare wheel or rim. The spare tire shall be of the same size, tread design and load range (ply rating) as the tires furnished on the front axle of the vehicle.

* 3.4.11 Brakes. Brakes shall conform to Federal Motor Carrier Safety Regulations 393.40 through 393.43 and 393.45 through 393.52. Parking brakes shall be furnished. Brake linings shall be of nonaebestos material.

3.4.11.1 Power-hydraulic type. Class 16 vehicles shall be equipped with power assisted, hydraulically actuated, four-wheel service brakes or with full air brakes on all wheels.

3.4.11.1.1 Split hydraulic brake system. The power-hydraulic brake system shall be so arranged as to provide separate systems for at least two wheels and so designed and constructed that rupture or leakage type failure of any single pressure component of the service brake system, except structural failures of the brake master cylinder body, effectiveness indicator body, or other housing common to the divided system, will not result in complete loss of function of the vehicle brakes when force on the brake pedal is continued. "Pressure component" means any internal component of the brake master cylinder or master control unit, wheel brake cylinder, brake line, brake hose, or equivalent, except power assist components.

3.4.11.1.2 Indicator light. The split hydraulic brake system shall be equipped with an electrically operated red light mounted on the instrument panel to indicate system effectiveness. The light shall have an area of not less than 0.196 square inch. It shall illuminate before or upon application of the brakes when an actuating-pressure component of the system has sustained a loss of pressure. The indicator light system shall include a means for testing by the vehicle operator to assure that the light bulb is operable.

* 3.4.11.2 Air brakes. Class 19, 28, 34.5, 36, 44 and 50 vehicles shall be equipped with full air brakes on all wheels. The braking system, complete with all necessary components, shall include:

(a) Air compressor, unloader-head type, engine driven and engine lubricated, air- or water-cooled, and having a capacity of not less than 7.25 cubic feet per minute (cfm) for class 16, 19 and 28 vehicles and 12 cfm for class 34.5, 36, 44 and 50 vehicles
(b) Air storage reservoir(s), each tank equipped with drain, and with safety and check valves between compressor and last reservoir tank. When a pneumatic fuel product tank control system is furnished, the air storage reservoir(s) shall be of sufficient capacity to supply air for both the air brake system and the complete tank pneumatic control system.
(c) Foot control, suspended or treadle type
(d) Air control valves
(e) Low air pressure warning, visible and audible
(f) Service brake stop lamp switch
(g) Automatic moisture ejector

(h) For model 4x2 and 6x4 vehicles only, automatic slack adjusters on cam type brakes or internal self-adjusting brakes on wedge and disc type brakes.

3.4.11.2.1 Air dryer. A replaceable cartridge desiccant type air dryer shall be installed in the air brake system. The dryer shall have the capability of removing a minimum of 95 percent of the moisture in the air being dried. The dryer shall have a pre-cooler and a filter to screen out oil and solid contaminants. The dryer shall have an automatic self-cleaning cycle and a thermostatically controlled heater to prevent icing of the purge valve.

3.4.11.3 Brake controls for use from a towing vehicle. When specified for vehicles with air brakes (see 6.2), the vehicle shall be furnished with a system for controlling the brakes from a towing vehicle (wrecker). The installation shall be complete with air brake couplers, relay emergency valve with no-bleed-back feature (except when spring applied emergency brake is furnished), and additional air lines and fittings. The service and emergency couplers shall be mounted on the front in a protected position providing for ready attachment of air hoses from a towing vehicle. The service and emergency couplers shall be identified and provided with dummy gladhand couplers with chains. The system shall not compromise conformance to any Federal Motor Carrier Safety Regulation referenced herein or to any Federal Motor Vehicle Safety Standard.

* 3.4.12 Cab. Unless otherwise specified, the chassis manufacturer shall furnish any type of his standard or optional full-width cab. When specified (see 6.2), a cab with a forward tilting hood and fender assembly, including tilting and locking mechanism, shall be furnished. When specified (see 6.2), a tilt type cab, with tilting and locking mechanism, shall be furnished. Tilt cab features shall be in accordance with the Employee Safety and Health Standards of Federal Motor Carrier Safety Regulation 399, including the first step height, which shall be not more than 24 inches. Cab doors shall be equipped with locks, operable from inside the cab through mechanical linkage, and with at least the curbside door equipped with external, key-operated lock. For vehicle types III and IV, the driver's door shall be equipped with a device to hold the door open when the vehicle is stationary and pumping product fuel, to enable the driver to enter the cab rapidly during emergency driveaway conditions. Drip rails shall be installed above the cab doors. Safety grips or grab handles shall be provided on each side of the cab to assist personnel in entering and leaving the cab. For tilt type cabs, provisions to facilitate cleaning the windshield shall be provided by means of a bumper step or bumper step cutouts, and a grab handle located under the windshield.

* 3.4.12.1 Cab interior. Unless otherwise specified, the cab shall have upholstered, full-width, adjustable seat and back or individual, adjustable driver's seat and individual passenger seat. When specified (see 6.2), an individual adjustable driver's seat and an individual

passenger seat shall be provided. The color of the upholstery and the interior finish shall be compatible with the exterior color (see 3.1.1.1). White upholstery shall not be furnished. Interior lighting shall be provided. Seat belts shall be installed.

3.4.13 Steering. Power steering shall be furnished.

3.4.14 Windshield wipers and washers. The vehicle shall be equipped with dual windshield wipers and windshield washers. The windshield wipers shall be of the multispeed type and operated by either air or electric motor(s).

3.4.15 Front bumper. Unless the front bumper is an integral part of the vehicle cab, a channel type front bumper shall be provided.

3.4.16 Rear bumper. A rear bumper shall be provided and shall conform to Federal Motor Carrier Safety Regulation 393.86 and 49 CFR, section 178.340, specification MC-306.

3.4.17 Tool stowage. Stowage space of sufficient size to accommodate a vehicle jack, hand tools, antiskid chains and emergency reflective triangles shall be furnished for retaining equipment during vehicle operation. Stowage space for these tools may be furnished in the cab. When stowage space is located outside the cab, it shall be weatherproof and shall provide for locking with a padlock.

3.4.17.1 Tools. When specified (see 6.2), the vehicle shall be furnished with tools required for exchanging a mounted tire assembly with the spare assembly, and shall include at least a hydraulic jack, jack handle and wheelnut wrench. The jack shall be of such closed height as to permit its location under an axle, or other satisfactory lift point, at any wheel with the tire flat. The jack, without blocking, shall be capable of raising any wheel of the loaded vehicle to a height adequate to permit removal and replacement of the wheel and tire assembly.

3.4.18 Heater and defroster. A hot water heater shall be provided. The heater shall have fresh air intakes. Discharge outlets shall be provided to direct heated air to the floor and to the defroster louvers. The heater shall be complete with a blower and mounted controls convenient to the driver.

3.4.19 Controls and operating mechanisms. All controls and operating mechanisms shall be located for left hand drive. Controls shall be complete and conveniently operable by the driver. Lever controls shall be designed and located to permit easy entrance and exit of the operator to and from the driver's compartment. Instruments and controls shall be identified as to their function and installed in a manner to facilitate removal and servicing. Instruments shall be visible to the driver when seated in driving position.

3.4.20 Accessories and equipment. Chassis equipment shall be complete with all accessories furnished as standard equipment by the manufacturer. The following minimum equipment shall be furnished:

(a) Key-operated ignition switch
(b) Ammeter, charging indicator or voltmeter
(c) Fuel gage
* (d) Oil pressure gage or red indicator warning light
* (e) Engine coolant temperature gage or high coolant temperature or low coolant level red indicator light
* (f) High coolant temperature or low coolant level alarm buzzer
(g) Speedometer with recording odometer
(h) Dual sunvisors
(i) Front door mounted armrest on driver's side
(j) Driver's compartment ventilator other than window
(k) Tachometer
(l) No cigar lighter shall be furnished
(m) An ash tray, if furnished, shall be secured shut.

* 3.4.21 Rearview mirrors. Outside rearview mirrors shall be mounted on each side of the cab. The mirrors shall be of the combination type having flat and convex areas. The flat portion shall have not less than 50 square inches of reflective area. The convex portion shall have not less than 25 square inches of reflective area and a radius of curvature of not less than 20 inches. The mirrors shall have not less than two supports.

3.4.22 Horn. The manufacturer's standard electric horn shall be furnished. When specified (see 6.2), in addition, an air operated horn shall be furnished on vehicles equipped with air brakes.

3.4.23 Engine hour meter. Except for type V bulk haul vehicle, an engine hour meter having a totalizing mechanism of not less than 9,999 hours shall be furnished for the chassis engine to register accurately the number of hours of operating time. The meter shall be of rugged construction to ensure continuous trouble-free performance under severe operating conditions. The engine hour meter shall be mounted on the cab instrument panel, or in the engine compartment in a readable location.

* 3.5 Basic tank body and equipment. The vehicle shall be designed and constructed for the legal highway transportation of all types of gasoline, diesel fuel, and turbine fuel, including fuels conforming to MIL-T-5624, MIL-T-83133 and ASTM D-910. Accordingly, the vehicle shall conform in all respects to the Department of Transportation (DoT) Regulations Governing the Transportation of Dangerous Articles in Tank Motor Vehicles. The vehicle shall conform to 49 CFR, sections 178.340 and 178.341, specification MC-306, as published in the latest issues of the Code of Federal Regulations and as modified by all issues of the Federal Register published

and in effect prior to completion of the vehicle. Tank bodies and equipment for type III and IV vehicles shall conform to NFPA No. 407. In the event of conflict between referenced specification requirements for type III and IV vehicles, NFPA No. 407 shall take final precedence.

3.5.1 Tank capacity. The liquid capacity of the tank shall conform to 1.2.2 for the specified size of vehicle, plus not less than 3 percent extra capacity for expansion. In addition, the height from the top of the liquid cargo to the bottom of the automatic vent(s), with the tank fully loaded and the liquid then expanded 3 percent, shall be adequate to prevent any fluid from exiting from or being trapped in the automatic vent(s) with the vent(s) open and the vehicle parked on a 5 percent grade, headed first up and then down the grade.

3.5.2 Material and construction. The tank shall conform to 49 CFR, sections 178.340 and 178.341 of MC-306. The tank shall be fabricated of type 304 stainless steel in accordance with 49 CFR, section 178.340-3, except that mild steel, high strength low alloy steel, or combinations of these steels with austenitic stainless steel shall not be furnished. All tank filler openings and vents shall be protected against overturn damage by a rigid member or members firmly fixed to the tank in accordance with paragraph 4-6.3 of NFPA No. 407 and 49 CFR, section 178.340-8. Adequate hold-down devices shall be provided to anchor the product fuel tank in a suitable manner that will not introduce an undue concentration of stresses, and shall withstand loadings in any direction, of a magnitude not less than the weight of the tank and attachments when filled with product fuel. Except for the welding of mild steel to stainless steel as permitted elsewhere herein, effective means shall be taken to impede electrolytic action between all dissimilar metals used in the vehicle. Teflon packing and tape shall not be used on adjacent parts that are of aluminum content. The tank and all associated fittings, components and piping shall be free of all dirt, dust, loose scale and petroleum-soluble coating.

* 3.5.3 Tank shape. The length of the tank shall be such as to give a load distribution proportional to the GAWRs of the front and rear axles of the chassis supplied, based on a product density of 7.2 pounds per gallon. The tank shall have a low silhouette, elliptical, or modified rectangular cross-section, with the top edge of the roll-over rail within 6 inches of the height of the cab roof.

* 3.5.4 Baffles. Where the provisions of 49 CFR, section 178.340, would require circumferential reinforcements, baffles shall be used in lieu of ring stiffeners. Baffles shall be flanged and dished. A half round or full round opening of not less than 3-inch radius shall be provided at the bottom of the baffles. Openings of equivalent size shall be provided at the top of the baffles. Half round or full round openings of not less than 1 inch radius also shall be provided at the 3 o'clock and 9 o'clock positions of the baffles. Each baffle shall also be

provided with not less than an 18-inch diameter manway opening. The edges of the manway openings shall have a flange of approximately 1 inch. The cross-sectional area of each baffle shall be not less than 80 percent of the cross-sectional area of the tank.

3.5.5 Flanging and dishing. The heads and baffles, (and for two compartment tanks, the bulkhead) shall be uniformly flanged and uniformly dished. Flanges shall be formed by a multi-pass roller operation or by a one step, die press operation. Heads and baffles shall be dished by uniform hydraulic or uniform air pressure or by a one step, die press operation. Neither the flanging or dishing operations shall involve repeated hammer blows, either manually or automatically.

3.5.6 Sump. A sump shall be provided at the lowest point of the tank to allow the accumulation of solid contaminants and water. The tank shall be so designed that water will drain into the sump and will not be trapped by the baffles or stand in pockets. A sump drain valve not less than 1 inch in size, with remote control and extended drain line, shall be provided. The sump drain shall be protected against flying objects and shall be easily accessible for maintenance.

3.5.7 Static air pressure. The tank, without fuel, shall withstand an internal static air pressure of at least 5 pounds per square inch gage (psig) without evidence of leakage, in accordance with paragraph 4-10.1 of NFPA No. 407.

3.5.8 Tank support. Full length box type, V-type, or Z-type longitudinal subframe members shall be furnished. Full length welding pads of not less than 12 gage (0.1046 inch), type 304 stainless steel shall extend not less than 1 inch beyond the flanges on the longitudinal subframe members and shall be continuously welded to the tank proper. Box type longitudinal subframe members shall be fabricated with not less than a 7 gage (0.1793 inch) mild steel outer leg and bottom, with not less than a 12 gage (0.1046 inch) mild steel inner leg. A flange not less than 1 inch wide shall be provided at the top of both the outer and inner legs. Flanges shall be continuously welded to the pad over the full length of the tank. V-type longitudinal subframe members shall be fabricated with not less than 7 gage (0.1793 inch) mild steel inner and outer legs. A flange not less than 1 inch wide shall be provided at the top of both the inner and outer legs. Flanges shall be continuously welded to the pad over the full length of the tank. Z-type longitudinal subframe members shall be fabricated entirely of not less than 7 gage (0.1793 inch) mild steel. The width of the upper Z-member shall be not less than 2 inches and shall be continuously welded to the pad over the full length of the tank along both sides of the Z. With the Z-type construction, additional type 304 stainless steel pads shall be continuously welded to the tank proper at the front, rear, at each bulkhead and at each baffle. Bolsters of 3/16 inch mild steel shall be properly integrated with the Z-type longitudinals and continuously welded to the pads at the front, rear, at each bulkhead and at each baffle.

* 3.5.9 Manholes. Each compartment of the tank shall be equipped with a round manhole opening not less than 19 inches in diameter. A lightweight, liquid-tight, easy opening manhole cover or a bolted cover with a liquid-tight easy opening fill cover not less than 10 inches in diameter shall be supplied. The manhole shall be fully compatible with the use of a Parker-Hannifin Model F428A vapor-recovery adapter cover (to be in place only when top-loading). All materials used shall be resistant to corrosion and to deterioration from contact with the product fuel. Normal breathing venting may be incorporated into the manhole cover (see 3.5.11). If the cover is hinged, the hinge shall be forward-mounted and the cover shall have self-latching catches. The manhole cover shall have provisions for a padlock. When specified (see 6.2), a 2-inch National Pipe Thread (NPT) coupling and plug shall be provided in the tank, near the manhole cover, to permit future installation of a second fuel level-sensing device.

3.5.10 Capacity marker. A capacity marker or indicator disk of corrosion-resistant construction shall be installed at the side of each manhole. The marker shall be located so as not to interfere with the vapor recovery adapter cover specified in 3.5.9. The marker shall be set to indicate rated tank capacity ± 1 percent.

3.5.11 Vents. Each tank compartment shall be vented to comply with the requirements of 49 CFR, Section 178.341, Specification MC-306, and the additional requirements specified herein.

3.5.11.1 Normal venting pressure limits. The lower opening limits for normal venting (inbreathing, outbreathing) shall comply with the opening limits required by the California Air Resources Board for vapor recovery, as summarized herein:

(a) The entire tank and venting system shall be sufficiently vaportight, such that a pressure change of not more than 1 inch of water shall occur within 5 minutes when the tank is pressurized to 18 inches of water (gage) or evacuated to 6 inches of water (gage);
(b) The outbreathing pressure vents shall remain closed as tank compartment pressure is increased above 18 inches of water (gage), but shall open before compartment pressure reaches 27.7 inches of water (1 psig);
(c) The inbreathing vacuum vents shall remain closed until tank compartment vacuum drops below 6 inches of water (gage), but shall open before a vacuum of 10.4 inches of water (gage) is reached (6 ounces per square inch gage).

3.5.11.2 Normal venting capacity. The normal vents shall have sufficient vapor flow capacity to permit bottom loading at a rate of 600 gpm, and for types I through IV to permit loading and unloading through the plumbing system at not less than 200 gpm, all with the manhole and fill covers closed, without damage and without exceeding the vacuum and pressure limitations of 49 CFR, section 178.341, specification MC-306 (maximum pressure of 3 psig; maximum vacuum of 1 psig).

3.5.11.3 Emergency venting capacity. The vapor flow capacity of the emergency venting system, whether through pressure-actuated or fusible venting, shall be not less than that required by 49 CFR, section 178.341-4, for compartment pressures of not more than 5 psig differential.

3.5.11.4 Automatic vent(s). Vent(s) shall be equipped for hydraulic or pneumatic automatic operationl except class 16 vehicle may be mechanically operated. The automatic vent(s) shall be spring-loaded shut to prevent the spillage of fuel and vapors. The vent(s) shall be mounted in the top of the tank near the longitudinal center. The actuation system shall be capable of exerting a force of at least 150 pounds in order to break the vent(s) loose under icing conditions. The vent(s) shall be interlocked with the automatic flow control valve (see 3.5.13.2) to assure that the vent is open during loading and off-loading operations.

3.5.11.5 Vent construction. The vent(s) shall be of aluminum with a corrosion-resistant steel weld ring with the aluminum isolated from contact with steel, or shall be of corrosion-resistant steel.

3.5.12 Vapor recovery system. The vehicle shall be equipped for vapor recovery in general conformance to the recommended practice of the American Petroleum Institute (API) in RP 1004, and the California Air Resources Board in executive order G70-10-A. The automatic vent(s) (see 3.5.11.4) shall be furnished with a vapor recovery hood or collecting chamber and shall be manifolded to an overturn rail or other suitable manifold piping. Connections between the tank vapor space vents and the header tube(s) shall be not less than 3 inches in diameter (7 square inches in open cross-sectional area). The header tube shall be not less than 4 inches in diameter (12 square inches in open cross-sectional area). The manifold piping, overturn rail, connections and header tube shall be of stainless steel or aluminum.

3.5.12.1 Vapor recovery flange. A standard pipe flange, suitable for future installation of a vapor recovery adapter, shall be furnished. The flange shall be suitable for installation, at the user's option, of either a 4-inch cam and groove quick-coupling conforming to API RP 1004 or a 3-inch cam and groove quick-coupling conforming to MIL-C-27487. The flange shall be of stainless steel or aluminum.

3.5.12.2 Vapor recovery flange location. The vapor recovery flange shall be located on the side of the vehicle opposite the driving controls, between 2.5 and 5 feet above ground level.

3.5.12.3 Vapor recovery system protection. Any portion of the vapor recovery system installed on the top of the tank which could damage the tank in the event of overturn shall be protected by a rollover device. Any portion of the vapor recovery system installed at the rear of the tank shall not extend beyond the rear bumper. The rollover device shall be of stainless steel.

3.5.12.4 Vapor discharge outlet. Provision shall be made for discharging to atmosphere vapors from the vapor recovery system when vapor collection facilities are not available. The location of the outlet shall be on the top of the tank, remote from the driver's loading area, and isolated from the engine exhaust.

3.5.13 Bottom loading system. The tank shall be capable of being bottom loaded at a rate of not less than 600 gpm. To provide bottom loading capability, the tank shall be furnished with an automatic vent valve (see 3.5.11.4), a level-sensor controlled automatic flow control valve, and a bottom loading adapter with check valve. The system, including the automatic vent, shall be designed failsafe to prevent damage to the truck or any of its components if the bottom loading system malfunctions or is operated incorrectly. The system shall comply with paragraph 4-14.3 of NFPA No. 407.

3.5.13.1 Inlet manifold. The bottom loading inlet manifold shall extend from the bottom loading adapter to the automatic flow control valve in the bottom of the tank. The complete inlet manifold system shall be sized to meet the required system filling rates and pressures.

3.5.13.2 Automatic flow control valve. An automatic flow control valve which serves as a combination bottom loading and emergency valve shall control the flow of fuel into the tank during bottom loading. The control valve shall be level-sensor controlled to shut off intake flow when the tank has reached its rated fluid capacity. A remotely operated manual control shall also be provided to open or close the valve. The automatic flow control valve operation shall be in simultaneous actuation with the automatic vent (see 3.5.11.4). The design of the control valve shall be in accordance with the emergency flow control type valve described in 49 CFR, section 178.341-5 of MC-306, for assurance against accidental escape of contents. A deflector, in accordance with paragraph 4-14.3.8 of NFPA No. 407, shall be mounted in the tank over the flow control valve in order to prevent the fuel from spraying unrestrictedly into the tank.

3.5.13.2.1 Tank level-sensor control. The level control shall automatically shut off the automatic flow control valve when the tank is filled to its rated capacity. The level control unit shall be a hydraulic jet type sensing device utilizing line fuel pressure with a jet stream directed to a receiver. The level control shall have no moving parts but shall be adjustable to various heights from the manhole(s). A means shall be provided to precheck the level control system to determine if it is functioning properly. The level-sensing device shall be failsafe in case of line breakage or leakage. The level control system shall operate properly within the designed system pressure range and shall operate with the type of fuel specified without causing undue corrosion or deterioration of the equipment. The level sensor and any associated valves shall be free of all liquids with a freezing point above minus 50 °F.

3.5.14 Bottom loading adapter. Unless otherwise specified (see 6.2), the bottom loading adapter shall be of the Y-type or of the elbow and tee type, capable of connection to both a four-inch coupler conforming to API RP 1004 and to a 2.5 inch type D-1 nozzle conforming to MIL-N-5877. The adapter shall have a dry break feature and shall be on the side of the vehicle opposite the driving controls. The adapter shall be furnished with a bonded nose seal. The adapter shall be provided with a poppet type, spring loaded check valve. The valve shall be full swiveling and free floating, forming a fuel-resistant seal to prevent leakage. Dust caps, complete with security cables or chains, shall be provided for the adapters. All parts of the adapters, valves, caps, cables and chains shall be corrosion-resistant. Non-electrical interference type interlocks shall be provided on air brake trucks to prevent movement of the vehicle when either leg of the bottom loading adapter is engaged for loading or, on hydraulic brake trucks, to prevent the engagement of either leg unless the parking brakes are set.

3.5.15 Emergency controls. The automatic flow control valve shall be operable by cable linked controls. An opening and a quick acting closing control for each compartment shall be located in the underslung cabinet. Controls shall be mounted to provide interference with one of the doors of the underslung cabinet to ensure that the valve is closed when the cabinet door is closed. In accordance with paragraph 4-14.4 of NFPA No. 407, remote, emergency, quick-acting controls for closing the valve (but inoperable for opening) shall also be provided, one set near the door on the driver's side outside the driver's cab, one set at the rear of the body on the side opposite the driver's side and one set operable from the catwalk. The controls, except the catwalk controls, shall be operable from a ground level standing position. Each control shall be outlined by a contrasting color panel at least 12 inches square, identified with the words "EMERGENCY SHUTOFF," and provided with indicator arrows or instructions such as "PUSH," "PULL," or other appropriate wording. Identification and instruction wording shall be in letters not less than 2 inches high. In addition, the controls shall have fusible links to ensure automatic closing of the valves in case of fire. One set of fusible links shall be located near the emergency valves and another set near the plumbing system in the underslung cabinet.

* 3.5.16 Catwalk. A flat catwalk of type 304 stainless steel, covered with a special abrasive type of paint (ship's grip), shall be furnished over the full length of the top of the tank. The catwalk walking surface shall be above the tank shell and shall not follow the curvature of the top of the tank shell. Type 304 stainless steel liquid-tight flashing shall be installed around the catwalk. The catwalk shall be provided with front and rear drains and stainless steel drain lines on opposite sides of the vehicle and in such other locations as are necessary to prevent liquids from standing on the catwalk and on top of the tank. Catwalks, flashing and drains shall prevent the possibility of spilled fuel coming into contact with the exhaust system and exhaust shields and shall prevent water from entering the tank. Drain lines shall be external to the tank and shall be of not less than 1.5 inch stainless steel tubing. Drain outlets shall be located not less than 3 feet away from the exhaust system.

3.5.16.1 Access ladder. An access ladder or equivalent access steps, grabhandles and grabrails shall be furnished, providing easy access to and from the catwalk. Ladders, steps, handles and rails shall be functionally spaced and arranged for maximum safety of personnel climbing up onto and down from the catwalk. All components shall be of stainless steel.

* 3.5.17 Skirting and hose tubes. Skirting down to the bottom of the underslung cabinets shall be provided the full length of the body on both sides, across the rear of the vehicle to the outside of the chassis frame rails, and across the front to the outside of the chassis frame rails. At the rear, skirting shall be provided from the bottom contour of the tank down to the top of the chassis frame rails. Cutouts for the wheels shall be rounded at the top on both ends. The radius portion of the cutout shall be approximately 1.25 times the tire radius. When the width over the tires exceeds the body width, rubber fenders around the wheelwells, extending to the outside of the tires, shall be provided. The skirting shall house hose tubes for four 2.5 inch by 10-foot suction hoses (see 3.5.23). The hose tubes shall be constructed of stainless steel. The hose tubes may be incorporated into the tank subframe structure. The hose tubes shall be totally enclosed, dustproof, and shall be equipped with hinged access doors with provisions for padlocking. If the top surface of the skirting (cabinets) is relatively flat so it can be stepped on, the top surface of the skirting shall be reinforced and covered with a special abrasive type of paint (ship's grip) for use as a walkway. If the top surface of the skirting (cabinets) is relatively flat so it can be stepped on, the top shall be free of hose tubes, piping, brackets, and other tripping hazards. The skirting shall be constructed of not less than 16 gage (0.0598 inch) hot rolled mild steel. Type 304 stainless steel pads shall be provided at points of attachment of the skirting or skirting reinforcements to the tank shell or heads and shall be continuously welded.

3.5.18 Fire extinguisher brackets. In conformance with paragraph 4-3.10 of NFPA No. 407, brackets for two 20B fire extinguishers shall be furnished. The fire extinguishers, to be installed upon receipt of the vehicle by the Government, will conform to NFPA No. 10. Each mounting/carrying bracket shall be capable of easy and quick operation. One fire extinguisher bracket shall be mounted vertically on each side of the truck. Protection shall be provided from splashing of mud and water. A contrasting background color shall be furnished behind the normal location of the fire extinguisher. The fire extinguishers, when installed by the Government on the brackets furnished, shall be readily accessible to personnel standing on the ground.

3.5.19 Underslung cabinets. Underslung cabinets shall be provided on both sides of the vehicle extending from the front end of the tank to at least the rear wheelhousing. Cabinets shall be constructed of not less than 16 gage (0.0598 inch) hot rolled mild steel. If the cabinets are attached to the tank shell or heads, continuously welded type 304 stainless steel pads shall be provided at all points of attachment. Each cabinet shall be of a full-flanged, flush type

construction to carry the required load and shall be of a size to house the plumbing system, meter and except for type V, the delivery hose reel. Doors shall be side-hung and equipped with hinges. Hinges shall have stainless steel hinge pins and stainless steel, bronze, nylon or nylon insert sockets. Doors shall have countersunk locking handles and a two-point locking mechanism keyed alike. Nozzle shall have rubber door bumpers, except the cabinet doors on type III and IV aircraft refuelers shall have devices to hold the forwardmost doors open in a position that does not restrict the operator's entry into the cab.

* 3.5.19.1 Cabinet floor. The cabinet floor shall be constructed of flattened expanded metal grating, weighing not less than 3 pounds per square foot or metal bar grating, type W-19-4, conforming to Metal Bar Grating Manual ANSI/NAAMM MBG 531. Flooring shall be in accordance with paragraph 4-3.9 of NFPA No. 401. Floors shall be designed to accept the loads imposed by all installed equipment and shall be securely supported by appropriate structural members. All fasteners and support structures shall be corrosion-resistant. The grating shall be free of exposed sharp edges.

3.5.19.2 Lights. In addition to the lighting specified in 3.4.2.4, the following lighting and wiring requirements shall be furnished:

(a) The body electrical system shall comply with paragraphs 4-3.8.1 through 4.-3.8.4 and 4-3.8.6 of NFPA No. 407;
(b) A light shall be provided in each underslung cabinet;
(c) All wiring shall be in conduit with threaded joints, having waterproof and vaporproof connections at the lamps and junction boxes, but not to include boxes around the lights;
(d) When specified (see 6.2), the vehicle cab shall be provided with an automotive type, 6-inch sealed beam, roof or side mounted type spotlight. The spotlight shall be located near the front corner of the cab roof on the side opposite the driver on types I, II and V and on the driver's side on types III and IV. The spotlight shall swivel to allow the light to illuminate the ground area to the rear and adjacent to the fuel servicing compartments. The spotlight shall be removable for shipping purposes.

3.5.20 Piping and couplings. All piping between the tank compartment, pump (except type V), and the plumbing system shall be not less than 2.5 inch inside diameter (id) tubing with long sweep bends or 2.5 inch diameter (nominal) pipe with long radius elbows. All piping between the tank compartment and the bottom loading adapter(s) shall be not less than 4-inch id tubing with long sweep bends or 4-inch nominal diameter pipe with long radius elbows. Piping shall be of stainless steel or aluminum. The pumping system piping layout shall be designed to facilitate maintenance of the pumping system and removal of components with minimum disassembly of piping. Piping sections shall be easily removable for maintenance and repair. Where required, piping connections shall be of the grooved (Victaulic or equal) type.

Tank inlet and discharge piping shall comply with 49 CFR, section 178.340-8 of MC-306 for accident damage protection against escape of contents. Piping shall be isolated from direct contact with dissimilar metals at the point of connection with the tank body or the automatic flow control valve. Tubing, pipe, galvanized coatings, gaskets and fittings shall not contaminate the fuel or decompose from contact with fuels. The piping installation shall be designed to withstand expansion and vibration without failure, and shall conform to the strength and other requirements of 49 CFR, section 178.340 of MC-306.

3.5.20.1 Grooved-end pipe clamp couplings or flanges. Clamp couplings or flanges, in accordance with MIL-C-10387 (Victaulic or equal), shall be provided on the inlet and outlet sides of the pump, meter, valves, and all other locations where flexible couplings are required.

3.5.20.1.1 Pipe grooves for couplings. Pipe grooves for couplings shall be in accordance with dimensions specified by MIL-P-10388, or by the coupling manufacturer. The groove and outside diameters shall be concentric to each other. The groove and the ends of the pipe shall be deburred to 0.003 to 0.020 inch chamfer or radius. The outside diameter of the pipe between the groove and the end of the pipe shall be smooth without evidence of scale, seams, weld splatter, digs, or scratches.

3.5.21 Suction stub. For types I through IV, the tank-to-pump suction line shall incorporate a suction stub. The stub shall be a 2.5 inch size and shall be provided with a manually operated shutoff valve, a 2.5 inch camlock quick-coupling, and a dust cap, in accordance with MIL-C-27487. The suction stub and shutoff valve shall terminate in the cabinet housing control panel, and shall be easily accessible to an operator standing on the ground.

3.5.21.1 Suction stub strainer. The suction stub line shall incorporate a nonferrous type 40-mesh strainer. The strainer shall be rigidly constructed and adequately sized to allow the rated flow at minimum pressure drop. The strainer screen shall be easily removable for cleaning and inspection.

3.5.22 Drains. All sections of the fuel discharge system, including the pump and the meter, shall be equipped with marked drain plugs. Drain plugs shall be located to assure complete drainage and security from pilferage. Drains that can be opened from outside the pumping compartments shall have provisions for locking the drain valves with a padlock.

3.5.23 Suction and gravity discharge hoses. The fuel servicing system shall be furnished with four 10-foot lengths of 2.5 inch noncollapsible, wire-reinforced hose. The hoses shall be provided with camlock quick-couplers and shall be stowed as specified in 3.5.16. The hoses shall be in accordance with the requirements of 49 CFR, section 178.340-8.

3.5.23.1 Speed ends. Each fuel servicing system shall be furnished with two speed ends equipped with 2.5 inch, camlock, quick couplings and elbows, and each shall be 36 inches long. One speed end shall have a tubing size of 2.375 inch outside diameter (od) and one shall have a tubing size of 1.875 inch od. In addition, each fuel servicing system for type III and IV vehicles shall include a speed end with a tubing size of one inch. All tubing shall be nonsparking.

3.5.24 Electrostatic discharge protection. Electrostatic discharge protection, equivalent to paragraph 4-3.2 of NFPA No. 407, shall be provided. Bonding straps shall be provided between the tank, all plumbing, and the vehicle chassis (see 3.1.1.5). Brass static lugs shall be provided at the side of the manhole. When a filler/separator is furnished, provisions shall be made to dissipate electrostatic electrical charges generated in the product fuel during filtration. A charge relaxation chamber providing a charge relaxation time (fuel-to-metal contact) of not less than 30 seconds shall be provided, downstream of the filter/separator and upstream of the hose reel. (See API RP 2003).

3.5.24.1 Ground cable reel. A ground cable reel shall be installed in a location that will permit easy withdrawal and recovery of the grounding wire. The cable reel shall contain a ratchet for retaining the ground cable in any extended position so that tension is not maintained on the ground cable. The reel shall have an outlet guide. The reel shall be furnished with a grounding cable approximately 80 feet long, plus "Y" ends 20 feet long. The "Y" ends shall be equipped with clamp connectors for electrically connecting the truck to ground and the truck to the unit being serviced. The clamp connectors shall conform to MIL-C-83413, part number M83413. The cable shall be No. 12 stranded copper, or 0.094 inch diameter 7x7 stainless or galvanized steel. The cable shall be covered with petroleum-resistant rubber or nylon. The free end of the cable shall be provided with an elastomeric bumper (ball). The ground cable reel shall be located in the underslung cabinet. Ground cable reel mounting surfaces shall be free of paint and contamination, and shall be securely mounted to the cabinet so as to prevent the cable reel assembly from being pulled away from its mountings. A warning plate shall be attached to the cable reel, stating: "WALK BACK GROUNDING CABLE TO REEL."

3.5.25 Identification and instruction plates. Identification, instruction, schematic diagram and chart-type plates shall be permanently attached and located so as to be accessible and visible to the operator. All plates shall conform to composition A (class 1 or 2) or composition C of MIL-P-514. The plates shall be securely installed with corrosion-resistant metal fasteners. Plates shall be masked prior to painting. All valves, switches, levers, controls and other devices used in the operation of the fuel servicing system shall be properly identified by identification plates. The identification and instruction plates shall incorporate a numerical or

alphabetical system of identification keyed to the schematic and an indication of the relative position of the lever or control handle, such as "ON" or "OFF."

3.5.25.1 Operating instructions. Operating instructions shall be clearly and concisely stated. All designations used in the operating instructions shall be the same as shown on the schematic diagrams. Operations which affect safety of the pumping system shall be listed under the title "CAUTION" at the top of the plate. Operations which affect safety of the operator shall be listed under the title "WARNING" at the top of the plate. The words "CAUTION" and "WARNING" shall be larger than the operational instructions. Specific instructions shall be listed separately for each pumping system operating mode, with the pumping system mode as the title for the various sections on the plate. For types I through IV, at least the following notices shall be included: "WARNING: AUTOMATIC FLOW CONTROL VALVE CONTROL MUST BE IN CLOSED POSITION WHEN BOTTOM LOADING," and "WARNING: DO NOT LOAD AT RATES IN EXCESS OF 600 GPM WITHOUT OPENING MANHOLE."

3.5.25.2 Schematic diagrams. Schematic diagrams of the piping, including the bottom loading system, pneumatic control system (if required), and electrical system shall be provided. Each valve, switch, and other pertinent component on the diagram shall be properly identified to correspond to the markings on like parts of the truck. Valves that are normally closed or normally open shall be identified as to their normal mode.

3.5.25.3 Fuel load chart. A chart in the form of a plate shall be provided for converting inches of fuel depth in the tank to gallons of fuel. The chart shall include tabulated data for compensating the depth measured at various temperatures to gallons of various fuels at a standard temperature of 60 °F.

* 3.6 Type I tank body (fuel servicing). Type I tank body shall be a single compartment type with both forced discharge and gravity discharge capability. Top and bottom loading systems, single hose reel dispensing system, and metered delivery shall be provided. In addition to the requirements of 3.5 through 3.5.25.3, type I tank body shall be furnished with the additional equipment specified in 3.6.1 through 3.6.5. When specified for type I (see 6.2), a filter/separator package shall be installed conforming to 3.8.6 through 3.8.6.6, 3.8.10 and 3.8.10.1. Filter/separator check valves in accordance with 3.8.5.3 and a relaxation chamber in accordance with 3.5.24 shall be provided when a filter/separator package is furnished.

3.6.1 Type I dispensing hose reel. A manual hose reel shall be provided. A crank shall be provided for hand rewind of the winding mechanism. Rollers shall be provided to prevent damage to the hose when a bottom winding type reel is furnished. The hose reel shall be of

commercial quality, with internal components compatible with gasoline, diesel fuel, and turbine fuel. The hose reel shall be mounted in an underslung cabinet on the side of the vehicle opposite of the driving controls. Provisions shall be made for a properly stowed and secured hose nozzle after the hose has been wound on the reel.

3.6.1.1 Dispensing hose. The hose reel shall be equipped with 100 feet of 1.5 inch id noncollapsible commercial hose, compatible with the fuels listed in 3.6.1.

* 3.6.1.2 Type I delivery nozzle. The delivery end of the hose shall be equipped with an aluminum-copper, sparkproof metal nozzle having a 1-1/2 inch inlet. The nozzle shall be trigger-action operated, and shall have a rigid nozzle tube. Unless otherwise specified, the nozzle shall be furnished without notches, with a 100 mesh strainer, and shall be rated for not less than 100 gpm. When specified (see 6.2), the nozzle shall be of the automatic shutoff type with notches, without strainer, rated at not less than 75 gpm, OPW Model 1290 or equal.

* 3.6.1.3 Dust caps. Each faucet and nozzle shall be provided with a dust cap, complete with corrosion resistant security chain or cable.

* 3.6.2 Pump and strainer. A positive displacement rotary pump shall be furnished. The pump shall provide a flow of not less than 100 gpm at a hose nozzle rated at 100 gpm at a power takeoff output shaft speed of not more than 1,000 rpm. The pump shall have 2.5 inch minimum suction and 2-inch minimum discharge openings. The pump shall have replaceable, lapped, carbon ring, mechanical seals to protect externally lubricated bearings from fuel. The pump shall incorporate a bypass pressure regulator with a pressure control adjustable from 50 to 75 psi. The bypass pressure regulator shall be capable of limiting the pressure rise to 25 percent of the desired discharge pressure. A 2.5 inch line strainer with brass screen shall be installed upstream of the pump. The pump shall be provided with a drain.

3.6.2.1 Pump installation. The product fuel pump shall be installed under the cargo tank and shall be driven from the power takeoff (see 3.4.5.4). An engine hand throttle, operable from the cab, shall be furnished and permanently set to limit the engine speed to the speed required for rated flow capacity of the tank product fuel pump. Mechanical or air-operated nonelectrical interlocks shall be provided to prevent movement of the vehicle when the power takeoff is engaged.

3.6.3 Measuring meter. A 100 gpm positive displacement meter shall be provided, having a built in strainer and air release, and shall be calibrated for handling diesel fuel, turbine fuel, or gasoline. When specified (see 6.2), the meter shall be calibrated for the specified fuel. The meter shall have a 2-inch inlet and outlet and shall be accurate within 1 percent at 50 gpm flow rate and accurate within 2 percent at other flow rates between 25 gpm and 100 gpm. The

meter shall have a seven figure totalizer to record the total gallons pumped and a four figure set-back counter with figures not less than 0.75 inch high. The meter shall be located to facilitate reading of numerals, and shall conform to the applicable requirements of the National Bureau of Standards Handbook 44 covering Specification and Regulations for Commercial Weighing and Measuring Devices.

* 3.6.4 Type I pumping system operation. The pumping system shall provide for any servicing rate between zero and the maximum rated flow capability for the specified hose and a 100 gpm nozzle. The flow rate shall be controllable between zero and 100 gpm by the trigger control of the 1.5 inch nozzle, when flow is through the meter and 100 feet of 1.5 inch hose.

3.6.4.1 Self-loading operation. The truck shall be capable of self-loading (loading by use of the on-board pumping system) at a rate of not less than 100 gpm. Self-loading shall be accomplished through use of the suction stub specified in 3.5.21 and the 10-foot, 2.5 inch hoses specified in 3.5.23. The speed ends of 3.5.22.1 may be attached to the 2.5 inch hoses for use when drawing from drums.

3.6.4.2 Gravity discharge. The truck shall be capable of off-loading by gravity discharge through the 10-foot, 2.5 inch hoses of 3.5.23 and the gravity discharge faucets of 3.6.5.

3.6.5 Type I plumbing system. A plumbing system shall be installed in the underslung cabinet on the side of the vehicle opposite the driving controls. The plumbing system shall incorporate at least the following valves and equipment, functionally arranged:

(a) Nonmetered gravity discharge faucet, 2.5 inch, with camlock coupler for gravity discharge and for use with the suction stub in filling the tank from drums by use of a 2.5 inch diameter hose and speed end
(b) Automatic flow control (bottom loading) valve, 4-inch
(c) Pump suction valve, 2.5 inch.
(d) Sectionalizing valve, 3-inch across the manifold, to be closed when pumping and open for gravity discharge through the meter
(e) Pump discharge valve, 2-inch
(f) Meter, 2-inch (see 3.6.3)
(g) Metered gravity discharge faucet, 2-inch, with 2.5 inch camlock adapter
(h) Hose reel valve, 1.5 inch.

3.7 Type II tank body (dual fuel servicing). The type II tank body shall be a two-compartment type with dual loading and dispensing systems. The tank body shall conform to the basic body requirements specified in 3.5 through 3.5.25.3 and to the dual fuel servicing requirements specified in 3.7 through 3.7.6.

3.7.1 Type II two-compartment tank. Type II vehicles shall be furnished with a two-compartment tank. Each compartment of the tank shall have a capacity equal to 50 percent of the specified tank capacity plus 3 percent extra capacity for expansion. The compartments shall be separated by bulkheads providing an air space between the two compartments. The air space shall be vented. A drain shall also be provided. The drain opening shall be not less than 0.5 inch in diameter. Venting and drainage shall be in accordance with 49 CFR, section 178.340. The bulkheads between the compartments shall be uniformly dished and uniformly flanged to provide structural strength for hydraulic pressure and surge and shall conform to 3.5.5. When specified (see 6.2), two filter/separator packages shall be installed conforming to 3.8.6 through 3.8.6.6, 3.8.10 and 3.8.10.1. Filter/separator valves in accordance with 3.8.5.3 and two relaxation chambers in accordance with 3.5.24 shall be provided when filter/separator packages are specified.

3.7.2 Type II dual suction stubs. Two suction stubs shall be provided, each in accordance with 3.5.21 and 3.5.21.1.

3.7.3 Type II speed ends. Two sets of speed ends, identical to those specified in 3.5.23.1, shall be furnished.

3.7.4 Type II dual ground cable reels. In addition to the ground cable reel specified in 3.5.24.1, a second ground cable reel (conforming to 3.5.24.1) shall be provided in the underslung cabinet on the opposite side of the vehicle.

3.7.5 Type II dual fueling. Type II vehicles shall be furnished with a dual fueling system. The dual fueling system shall consist of a complete and separate fuel servicing and loading system for each tank compartment. Each fuel servicing and loading system shall be capable of operating independently but not simultaneously.

3.7.5.1 Type II dual hose reels. Two hose reels, hoses and nozzles shall be furnished and mounted on opposite sides of the vehicle in the underslung cabinets. Each reel, hose and nozzle shall conform to 3.6.1 through 3.6.1.3.

3.7.5.2 Type II dual pump and strainer. Two power takeoff driven fuel pumps shall be provided (one for each compartment), each conforming to 3.6.2 and 3.6.2.1.

3.7.5.3 Type II dual meters. Two meters shall be provided, each conforming to 3.6.3.

3.7.5.4 Type II dual pumping system operation. Pumping system operation shall be as specified for type I in 3.6.4 through 3.6.4.1 for each pumping system, except that only one system is required to operate at a time.

3.7.5.5 Type II dual gravity discharge provisions. Each compartment shall be equipped for gravity discharge in accordance with 3.6.4.2.

3.7.6 Type II plumbing system. Two separate plumbing systems shall be installed. The one for the forward tank compartment shall be in the right underslung cabinet, with the system for the rear tank compartment in the left underslung cabinet. Each system shall conform to the type I system of 3.6.5.

3.8 Type III tank body (aircraft fuel servicing). The type III tank body shall conform to the basic tank body requirements as specified in 3.5 through 3.5.25.3. A single compartment body shall be furnished. The additional aircraft fuel servicing requirements specified in 3.8.1 through 3.8.10.2 shall also apply. Where the requirements herein conflict with NFPA No. 407, the NFPA No. 407 requirements shall take precedence.

3.8.1 Type III dispensing hose and reel. One manually driven dispensing hose reel shall be provided. The hose reel shall be of commercial aviation refueler quality. The hose reel shall be provided with 50 feet of 2-inch noncollapsible hose. The hose shall be of commercial aviation refueler quality conforming to paragraph 3-1 of NFPA No. 407, suitable for auction defueling at 80 gpm. The hose reel shall be mounted in the underslung cabinet on the same side of the truck as the driver's controls. The reel shall be of multiwrap or grooved design. The hose reel inlet connections shall be grooved. Hose reel components coming into contact with fuel shall be of nonferrous materials. A nozzle holder with an air-operated brake interlock shall be provided to prevent truck movement when the underwing hose nozzle is not stowed in place, in accordance with paragraph 4-9.10 of NFPA No. 407. A guarded toggle switch shall be provided on the truck cab instrument panel within reach of the driver to override the nozzle brake interlock. The switch shall be identified as to function and switch position.

3.8.1.1 Emergency dry brake connector. An emergency dry break connector of the frangible or shear pin type shall be provided between the hose end dry break coupling in 3.8.1.2 and the fuel nozzles specified in 3.8.2.2 and 3.8.2.3, to permit the truck to drive away in the event of fire, leaving the sealed off nozzle connected to the aircraft. Both halves of the connector shall seal instantly on breakaway, eliminating fuel spillage from either the nozzle or the delivery hose. The connector shall separate when subjected to an emergency load of not less than 150 pounds and not more than 250 pounds. It shall be possible for the separated connector halves to then be manually removed from the nozzle and hose, and the hose reconnected to the nozzle using the dry break coupling specified in 3.8.1.2. Normal fueling operations shall be possible without the emergency breakaway provision. Replacement of the shear pin shall permit re-use of the emergency dry break connector. The emergency dry break connector shall be similar or equal to Aeroquip Corporation part number AE82129R.

3.8.1.2 Dry break coupling. A dry break coupling shall be provided for the hose connection to the fuel nozzles specified in 3.8.2.1, 3.8.2.2 and 3.8.2.3. The coupling shall permit full flow during fueling operations and shall seal the dispensing hose assembly prior to connection or disconnection of any of the fuel nozzles. The nozzles shall be incapable of connection or disconnection to the hose assembly unless the coupling is in the closed and locked position. The coupling shall incorporate a positive lock mechanism to prevent disconnection from the nozzles through mishandling or through dragging the delivery hoses in either direction during fueling operations. The coupling shall be compatible with the emergency dry break connector of 3.8.1.1. The coupling shall be similar or equal to Aeroquip Corporation Part number AE82096R.

3.8.2 Nozzles.

3.8.2.1 Overwing nozzle. A 1.5 inch overwing nozzle conforming to MIL-N-87963, Type MD-3, shall be provided for the 2-inch servicing hose. The overwing nozzle assembly shall permit interchange with the nozzles specified in 3.8.2.2 and 3.8.2.3 by connection to the dry break coupling specified in 3.8.1.2. The overwing nozzle assembly shall be similar or equal to Aeroquip Corporation part number AE83956R. A screw-in nozzle extension of noncollapsible teflon hose shall be provided with the nozzle to provide defueling capability for helicopter fuel tanks with depths of up to 30 inches. The nozzle extension shall be similar or equal to Aeroquip Corporation part number AE706517-1

3.8.2.2 Closed-circuit nozzle. A 1.5 inch closed-circuit nozzle meeting the performance requirements and the 15 psig pressure regulating requirements of MIL-N-52747 shall be provided for the 2-inch servicing hose. The outlet end of the nozzle shall be capable of connection to the fuel inlet receptacle specified in MIL-N-52747 as the helicopter mounted closed-circuit fuel servicing connection. The closed-circuit nozzle shall permit inter-change with the nozzles specified in 3.8.2.1 and 3.8.2.3 by connection to the dry break coupling specified in 3.8.1.2 and the emergency dry break connector specified in 3.8.1.1. The nozzle shall be similar or equal to Aeroquip part number AE83501R.

3.8.2.3 Underwing single point pressure servicing nozzle. An underwing single point pressure servicing nozzle conforming to the functional and performance requirements of MIL-N-5877 (designated type D-l), or a commercial aviation refueling nozzle capable of connection to the International Standard bayonet adapter, shall be furnished for the 2-inch servicing hose. The underwing nozzle assembly shall permit interchange with the nozzles specified in 3.8.2.1 and 3.8.2.2 by utilizing a dry break coupling as specified in 3.8.1.2.

3.8.2.3 Underwing single point pressure servicing nozzle. An underwing single point pressure servicing nozzle conforming to the functional and performance requirements of MIL-N-5877 (designated type D-l), or a commercial aviation refueling nozzle capable of connection to the International Standard bayonet adapter, shall be furnished for the 2-inch servicing hose. The underwing nozzle assembly shall permit interchange with the nozzles specified in 3.8.2.1 and 3.8.2.2 by utilizing a dry break coupling as specified in 3.8.1.2.

* 3.8.3 Pump. A power takeoff driven, self-priming, centrifugal, aircraft fuel dispensing type pump shall be provided. The pump internal components shall be of nonferrous materials. The pump shall be capable of producing a vacuum of not less than 18 inches of mercury (Hg) when loading the tank from an outside source. The pump shall be so constructed and positioned that fuel will not enter into any gearbox or transmission. A drain plug or valve shall be provided for completely draining the pump.

3.8.3.1 Power takeoff interlock. A brake interlock shall be provided to prevent truck movement while the power takeoff is engaged. The interlock shall be air operated.

3.8.4 Pumping system operation. The pumping system shall provide the pressure control and flow rates specified herein. For overwing (open port) refueling, the flow rate shall be controllable between zero and 100 gpm by the trigger control of the 1.5 inch overwing nozzle. For pressure (underwing and closed-circuit) refueling, the pumping system shall provide for any servicing rate between zero and the required nominal flow capability for the specified hose and nozzle (as indicated in 3.8.4.2 and 3.8.4.3) based on the aircraft demand. The pumping system shall exhibit no instability in pressure or flow rate under any operating condition. The vacuum of the pump suction at the maximum refueling rate shall be not more than 7 inches Hg as the tank approaches empty.

3.8.4.1 Overwing (open port) fuel servicing operations. The pumping system shall function as follows:

(a) Refuel from the tank through the filter/separator, the contamination monitor, the meter, the 2-inch servicing hose, and the 1.5 inch overwing nozzle at flow rates from zero to 100 gpm. The flow rate shall be regulated on demand by control of the trigger of the 1.5 inch overwing nozzle;
(b) Defuel from the aircraft through the 1.5 inch overwing nozzle, the 2-inch hose, the meter, the filter/separator, the contamination monitor, and into the tank at flow rates of not less than 60 gpm. (See 3.8.2.1 for nozzle extension required for deep tanks);
(c) Defuel from the aircraft through the speed ends (see 3.5.23.1), the 2.5 inch suction, hoses (see 3.5.23), the suction stub (see 3.5.21), the filter/separator, the contamination monitor and into the tank at flow rates up to 100 gpm.

3.8.4.2 Underwing (single point) fuel servicing operations. The pumping system shall function as follows:

(a) Refuel from the tank through the filter/separator, the contamination monitor, the meter, the 2-inch pressure servicing hose, and the 2.5 inch underwing nozzle at any flow rate from zero to 200 gpm, while automatically maintaining 50 ± 5 psig nozzle pressure at the inlet side of the nozzle. Once the pumping system pressure controls have been adjusted, the flow rate shall be regulated on demand ahead of the underwing nozzle. The system shall automatically recover from an externally induced no-low condition to full flow within 15 seconds after the full flow demand condition has been re-established. During pressure (underwing) refueling operation, the pumping system shall limit the total pressure at the inlet to the underwing nozzle to 120 psig at any initial flow rate from 0 to 200 gpm when the flow is shut off in 0.5 second;
(b) Defuel from the aircraft through the 2.5 inch underwing nozzle, the 2-inch hose, the filter/separator, the contamination monitor, and into the tank at flow rates up to 80 gpm.

3.8.4.3 Closed-circuit fuel servicing operations. The pumping system shall refuel from the tank through the filter/separator, the contamination monitor, the meter, the 2-inch hose, and the 1.5 inch closed-circuit nozzle at any flow rate from zero to 100 gpm, while automatically maintaining 15 ± 2 psig nozzle pressure at the nozzle outlet.

3.8.4.4 Self-loading operation. The truck shall be capable of self-loading (loading by use of the on-board pumping system) at a rate of not less than 200 gpm. Self-loading shall be accomplished through use of the suction stub specified in 3.5.21 and the 10-foot hoses specified in 3.5.23.

3.8.4.5 Recirculation operations. The truck shall have the capability of recirculating contaminated fuel through the filter/separator, the contamination monitor, and back into the tank. The 2.5 inch underwing nozzle on the 2-inch hose shall be connected to a fitting with a check valve on the driver's side of the tank to perform fuel recirculation.

3.8.5 Type III fuel system components.

3.8.5.1 Pump bypass valve and line. An automatic pump bypass valve and line shall be an integral part of the flow control system. The pump bypass valve shall serve to divert excess fuel flow to the inlet side of the pump to control fuel pressure. The bypass line shall be located upstream of the filter/separator and contamination monitor. The bypass system shall prevent engine speed changes of more than 300 rpm between the full-flow and no-flow for any pumping mode, except defuel.

3.8.5.2 System tank return line. In addition to the pump bypass, a tank return line shall be provided. The return line shall allow return of fuel to the tank during defuel and during use of

the suction stub. The return line shall be tied in with the bottom loading emergency valve for tank fill shutoff control during defuel operation. The tank return line shall be located downstream of the filter/separator and the contamination monitor.

3.8.5.3 Check valves. The tank return line, as well as any other piping or tubing between the tank and pumping system except the tank-to-pump suction line, shall incorporate check valves to prevent backflow from the tank. The check valves shall comply with 49 CFR, section 178.340-8 of MC-306. Check valves or manually controlled valves shall also be located at the inlet and outlet sides of the filter/separator and the contamination monitor to allow routine servicing and replacement of filter/separator elements and fuel quality monitor elements without draining adjacent piping.

3.8.5.4 Tank-to-pump suction line. The tank-to-pump suction line shall provide for adequate flow and smooth operation of the pump under all conditions. The suction line shall incorporate a line strainer and a tank shutoff valve. A flexible coupling may be provided. The suction line shall terminate in the bottom of the tank (not in the sump area) and shall not have a raised seat that will allow sediment and water to collect in the low point area. The product discharge opening shall be of the emergency flow control type designed in accordance with 49 CFR, section 178.341-5 of MC-306, to assure against the accidental escape of the contents. A readily accessible tank drain shall be provided in the low point area.

3.8.5.5 Deadman pressure control valve. A deadman pressure control valve shall be furnished as an integral portion of the flow control system to operate in conjunction with the pump bypass valve and line to control flow rate and pressure (see 3.8.9.3.2).

* 3.8.6 Filter/separator. A filter/separator shall be mounted in one of the underslung cabinets in such a manner that water removal and filter/coalescer elements are readily accessible for replacement. The filter/separator unit shall be of aluminum or stainless steel construction and designed for a rated flow capacity of not less than 200 gpm (100 gpm for type I and II vehicles) for fuels as specified in 3.5. The filter/separator unit shall utilize not less than 10 filter/coalescer elements (5 for type I and II vehicles) conforming to MIL-F-52308 at a rating of not more than 20 gpm each. Performance requirements of the filter/separator unit shall be certified by the filter/separator manufacturer to be in accordance with MIL-F-8901. All aluminum parts shall be anodized in accordance with MIL-A-8625 or coated in accordance with MIL-C-5541, class lA. Inlet and outlet connections shall be not less than 3-inch grooved couplings (Victaulic or equal). The filter/separator shall be so installed in the system that all fuel during fueling and defueling operations will pass through the filter/separator. Fuel shall pass through the filter/separator in one direction only, under all conditions. The filter/separator unit and components shall be mounted to minimize vibration, oscillation or swing of the various components. The air bleed line to the tank shall be compatible with the product fuel.

3.8.6.1 Pressure vessel. The filter/separator pressure vessel shall be in accordance with MIL-F-890l and ASME Boiler and Pressure Vessel Code, section VIII. The pressure vessel shall be designed for a working pressure equal to or greater than the maximum pressure encountered during operation of the pumping system. The pressure vessel shall be hydrostatically tested at 1.5 times the maximum working pressure. The pressure vessel flange gasket shall be of the O-ring type. The main vessel shall be provided with lifting devices capable of lifting the entire filter/separator assembly.

3.8.6.2 Air eliminator. An air eliminator shall be provided to allow automatic purging of air from the filter/separator. The air eliminator shall be vented into the bottom of the cargo tank. A check valve shall be provided in the air eliminator line to prohibit the back flow of product fuel. The air eliminator shall be of the manufacturer's recommended size to allow proper air elimination, but shall be not less than 0.75 inch in diameter.

3.8.6.3 Water slug control. A water slug control shall be provided. The water slug control shall stop the fuel flow when a predetermined water level is reached in the pressure vessel and shall then permit fuel flow when the water level is lowered to a predetermined level. The water slug detector shall be capable of being positively tested by exposing the detector probe to water, without contaminating existing fuel in the tank, and without removing the detector probe from the vehicle. The water slug detector system shall be a Parker Hannifin part number F716 or equal.

3.8.6.4 Automatic and manual water sump drain. An automatic water sump drain shall be furnished and shall be either an aluminum or stainless steel vessel or an integral part of the filter/separator. The sump drain shall be provided with an automatic water discharge and a manually operated drain. The automatic water sump drain shall discharge accumulated water from the filter/separator. Provisions shall be made to discharge accumulated water to the ground. The water sump shall be structurally supported to prevent vibration on any fitting.

3.8.6.5 Liquid level indicator. A transparent liquid level indicator having a travel of approximately 2 inches and containing a 0.25 inch diameter red or black polypropylene float, and suitable for observing the water accumulation, shall be provided and attached directly to the vessel. The midpoint of the indicator shall be located at a level at least 1 inch below the bottom of the filter/coalescer elements.

3.8.6.6 Differential pressure gage. The filter/separator shall be connected to a differential pressure gage. The gage shall indicate the pressure drop across the first and second stages of the filter/separator. The gage shall be located such that it is visible to the operator during refueling. The gage shall range from 0 to 25 psi, with a green background below 20 psi and a red background above 20 psi.

3.8.6.7 Fuel sampling fitting. A fuel sampling fitting shall be installed in a readily accessible location, in the piping and not in any pipe fitting, downstream of the filter/separator and upstream of the hose reel. The fitting shall be an Aeroquip part number AE96920E or equal. The fitting shall be of anodized aluminum or stainless steel, complete with valve core, probe, wire retaining rope and 7/16-14UNC-2A plug. The fitting shall mate and properly function with Aeroquip part number AE96924E.

3.8.7 Contamination (fuel quality) monitor. A contamination monitor, meeting the requirements of MIL-M-81380, shall be furnished and installed downstream of the filter/separator. The monitor shall contain a built-in surge suppressor that will provide maximum protection to the filter/separator in the event of a pressure surge in the system. One set of monitor elements shall be provided. The monitor shall shut down fuel delivery when excessive contaminant levels are reached in the fuel. The monitor shall be provided with a differential pressure gage. The monitor differential pressure gage is not required if the contamination monitor is incorporated into the filter/separator. The contamination monitor shall be certified by the component manufacturer to be of adequate capacity for the maximum flow rates and pressures possible for the pump and piping system furnished on the vehicle.

* 3.8.8 Meter. A positive displacement reversible meter with a maximum rating of not less than 200 gpm shall be housed in the pumping system compartment. The meter shall be capable of momentary overspeeding to 125 percent of maximum rated capacity without mechanical damage or impairment of accuracy. The meter shall be designed for not less than 75 psig working pressure and 125 psig hydrostatic test pressure. The meter shall have an accuracy in accordance with the requirements of the National Bureau of Standards Handbook 44. The meter shall be capable of being adjusted while under pressure without leakage or loss of the product. The adjustment sensitivity shall be sufficiently fine to permit calibration changes in conformance to the accuracy requirements set forth above and shall be capable of an adjustment range so that the meter will be suitable for aviation gasoline, JP-4, JP-5 and JP-8 fuel, and adjustment shall be accomplished without the use of external change gears. A vertical meter counter shall have a seven figure totalizer and a four or five figure setback indicating full gallons. The numerals in the setback shall be coated with light reflecting material. All components of the meter in contact with the fuel shall be fabricated from aluminum material. Stainless steel may be used in conjunction with aluminum for moving components of the meter having metal-to-metal contact.

3.8.9 Product flow control system. The control system shall automatically provide the pressure control and flow relief functions to accomplish the performance requirements specified in 3.8.4. The control system shall prevent pump speed surges, pressure surges, and any other type of pumping system instability. The system shall automatically regulate to the required flow conditions, as determined by the overwing nozzle and the aircraft fuel system ahead of the

pressure servicing and closed-circuit fuel servicing nozzles. The control system shall include a pump bypass valve, a pressure sensing venturi, dispensing hose reel shutoff valves, a filter/separator water slug discharge control, and operating controls. The pressure sensing venturi shall be located downstream of the filter/separator.

3.8.9.1 Pneumatic operation. The control system shall be pneumatically operated from the truck air brake system. Safety provisions shall be incorporated that will prevent loss of air in the air brake system in the event of failure of any portion of the control system. Components which operate with fuel and vehicle air under pressure shall be so designed that leakage of fuel into the air system or leakage of air into the fuel system cannot occur. Where possible, components or valves which operate with only one medium (either fluid or pneumatic) shall be used. The pneumatic power system shall be essentially a static system which releases air only when the controls are operated and only to the extent necessary to purge the components. Under no condition shall air be vented into the tank. The bottom loading system pneumatic and fuel components shall be protected with screens, filters, or other devices to prevent contaminants from entering critical components. All pneumatic controls shall be compatible and designed to provide reliable operation in the available air pressure range.

3.8.9.1.1 Pneumatic lines. All pneumatic lines shall be of corrosion-resistant metal and shall be secured to the tank or frame and protected from damage. All lines exposed to possible ground or brush contact shall be protected with skid plates. All pneumatic lines that pass through holes shall be grommeted against chafing.

3.8.9.2 Control panel. The pumping system shall incorporate a control panel on the driver's side of the truck in the underslung compartment. The control panel shall be located within easy reach and shall be clearly visible to an operator standing on the ground. The control panel shall be easily removable or accessible from the rear for maintenance purposes. The control panel shall contain the throttle speed selector control, selector valve control, dispensing hose reel shutoff valve controls, underwing or pressure servicing nozzle pressure gage, filter/separator differential pressure gage, contamination monitor differential pressure gage, pump discharge pressure gage, and pumping compartment light switch. The controls shall be arranged for the maximum convenience of the operator. All controls shall be protected from damage and inadvertent operation.

3.8.9.3 Operating controls. The operating controls shall include a selector valve, a throttle control, a deadman control, dispensing hose reel shutoff controls, and operating and emergency controls for the automatic flow control valve.

3.8.9.3.1 Selector valve. A selector valve shall be the primary operating control of the pumping system. The selector valve shall have positions for overwing, pressure servicing, and defuel. The selector valve shall provide for automatic adjustment of the pumping system

controls to accomplish the corresponding pumping mode. The control for the automatic flow control valve shall automatically revert to the closed position when the selector valve is placed in the defuel position.

3.8.9.3.2 Deadman control. A deadman control shall be provided and shall be of the air-operated type. The deadman control shall consist of not less than a 50-foot hose with a deadman control at the free end. The hose shall be stored on a spring loaded reel. The deadman control shall provide control of a pressure control valve (see 3.8.5.5) and shall prevent operation of the pressure control valve unless the deadman control is operated. The deadman control reel shall be located in the driver's side underslung cabinet and shall be so designed as to prevent overrunning at end of rewind. Means shall be provided to deactivate the deadman control for overwing refueling, and to reactivate the deadman automatically for pressure refueling. The means shall be keyed as to which nozzle is out of its holder, such that while the underwing pressure servicing nozzle is lifted, the deadman system is operative. When the overwing nozzle is lifted and the selector valve is in the "OVERWING" position, flow control shall be provided through the trigger control on the overwing nozzle.

3.8.9.3.3 Throttle. A deadman operated throttle control shall be furnished and shall be governor regulated. The control shall be of reliable design to provide repeated positive and smooth operation on demand. The throttle speed selector control shall have two speeds and shall be marked to indicate the dispensing rate applicable: "THROTTLE: OVERWING, CLOSED-CIRCUIT AND DEFUEL--PRESSURE UNDERWING (50 psi)."

3.8.9.3.4 Emergency controls. Remote, emergency, quick acting controls for closing (but inoperable for opening) the automatic flow control valve shall be provided in accordance with paragraph 4-8.2 of NFPA No. 407. Three emergency controls shall be provided: One near the front of the tank on the driver's side; one near the rear of the tank on the side opposite the driving controls; and one accessible from the catwalk. The controls shall have fusible devices to insure automatic closing of the valve in case of fire, in accordance with paragraph 4-8.4 of NFPA No. 407. Placarding for each emergency control shall comply with paragraph 4-8.3 of NFPA No. 407.

3.8.9.4 Pressure servicing nozzle pressure gage. The nozzle pressure gage shall continuously monitor pressure at the venturi throat. The gage shall read a corrected pressure which simulates the actual pressure at the nozzle. The pressure gage shall be shock mounted and marked "UNDERWING NOZZLE PRESSURE." The gage shall be of adequate size and located so as to be readily visible during refueling. The gage shall have a compound scale with a range from minus 30 psig to plus 160 psig, and shall be accurate to within one percent of the full-scale range.

3.8.9.5 Hose reel shutoff valve. A shutoff valve shall be located immediately upstream of the hose reel. The shutoff valve shall be pneumatically controlled from the pumping system control panel. The valve shall open when the control is placed in the "ON" position and shall remain closed (pressure-tight) at all other times.

3.8.10 Type III data plates. In addition to the basic plates required in 3.5.25 through 3.5.25.3, type III truck shall have filter element and contamination monitor change criteria data plates. The plates shall conform to 3.5.25.

3.8.10.1 Filter/separator element change criteria data plate. An element change criteria data plate shall be mounted adjacent to the filter/separator pressure gage specified in 3.8.6.6. The data plate shall be entitled "FILTER/SEPARATOR ELEMENT CHANGE CRITERIA." The plate shall indicate that the elements shall be changed at 20 psi pressure differential, every 2 years, or when the contamination monitor triggers (shuts off the flow), whichever occurs first.

3.8.10.2 Contamination monitor element change criteria data plate. A data plate, similar to the plate described in 3.8.10.1, shall be provided. The data plate shall be entitled "CONTAMINATION MONITOR ELEMENT CHANGE CRITERIA" and shall describe the criteria for changing of the contamination monitor elements. The plate shall be located in close proximity to the filter/separator pressure gage specified in 3.8.6.6.

3.9 Type IV tank body (aircraft dual fuel servicing). The type IV tank body shall be a two-compartment type with dual loading and dispensing systems. The tank and each tank compartment shall conform to the basic body requirements specified in 3.5 through 3.5.25.3 and to the aircraft dual fuel servicing requirements specified in 3.9.1 through 3.9.11. Where the requirements herein conflict with NFPA No. 407, the NFPA No. 407 requirements shall take precedence.

3.9.1 Type IV two-compartment tank. Type IV vehicles shall be furnished with a two-compartment tank. Each compartment of the tank shall have a capacity equal to 50 percent of the specified tank capacity plus 3 percent for expansion. The compartments shall be separated by bulkheads providing an air space between the two compartments. The air space shall be vented. A drain shall also be provided. The drain opening shall be not less than 0.5 inch in diameter. Venting and drainage shall be in accordance with 49 CFR, section 178.340. The bulkheads between the compartments shall be uniformly dished and uniformly flanged to provide structural strength for hydraulic pressure and surge and shall conform to 3.5.5.

3.9.2 Type IV dual suction stubs. Two suction stubs shall be provided, each in accordance with 3.5.21 and 3.5.21.1.

3.9.3 Type IV speed ends. Two sets of speed ends, identical to those specified in 3.5.23.1, shall be furnished.

3.9.4 Type IV dual ground cable reels. Dual ground cable reels, each conforming to 3.5.24.1, shall be installed in the underslung cabinets near the dispensing hose reels on the driver's side of the truck.

3.9.5 Type IV dual fueling. Type IV vehicles shall be furnished with a dual fueling system. The dual fueling system shall consist of a complete and separate fuel servicing and loading system for each tank compartment. Each fuel servicing and loading system shall be capable of operating independently but not simultaneously.

3.9.5.1 Type IV dual hose reel. Two hose reels, hoses and sets of nozzles shall be furnished and mounted on the driver's side of the vehicle in the underslung cabinets. Each reel, hose and nozzle shall conform to the requirements of 3.8.1 through 3.8.2.3.

3.9.5.2 Type IV dual pump installations. Two power takeoff driven fuel pump installations shall be provided (one for each tank compartment), each conforming to 3.8.3 through 3.8.3.2.

3.9.5.3 Type IV pumping system operation. Pumping system operation shall be as specified in 3.8.4 through 3.8.4.5 for each pumping system, except that only one system is required to operate at a time.

3.9.6 Type IV product fuel system components. Two sets of fuel system components shall be provided, each set conforming to the requirements of 3.8.5 through 3.8.5.5.

3.9.7 Type IV dual filter/separators. A separate filter/separator shall be provided for each fuel system. Each filter/separator and its accessories shall conform to 3.8.6 through 3.8.6.6. Both filter/separators shall be mounted on the side of the vehicle opposite the driver's controls in the underslung cabinet.

3.9.8 Type IV dual contamination monitors. A separate contamination (fuel quality) monitor shall be provided for each product fuel system and shall conform to the requirements of 3.8.7. Both monitors shall be mounted on the side of the vehicle opposite the driver's controls in the underslung cabinet.

3.9.9 Type IV meters. A meter shall be furnished for each fuel system. Both meters shall be mounted on the driver's side in an underslung cabinet and shall conform to 3.8.8.

3.9.10 Type IV product flow control system. Separate product flow control systems for each tank compartment shall be furnished. Each system shall conform to 3.8.9 through 3.8.9.5. The control panel and throttle may be common to both systems.

3.9.11 Type IV data plates. Data plates shall be furnished in accordance with 3.8.10 through 3.8.10.2.

3.10 Type V tank body (bulk haul). The type V tank body shall be a single compartment gravity discharge type conforming to 3.5.1 through 3.5.10, 3.5.12 through 3.5.20.1.1, 3.5.22, 3.5.23 (not 3.5.23.1), 3.5.24 through 3.5.25.3 and 3.10.1 through 3.10.2.

3.10.1 Type V vents. The vents shall be as specified in 3.5.11 through 3.5.11.5, except normal venting vapor flow capacity to permit unloading at 200 gpm is not required.

3.10.2 Type V plumbing system. A plumbing system shall be installed on the side of the vehicle opposite the driving controls in the underslung cabinet. The plumbing system shall incorporate at least the following valves and equipment, functionally arranged:

(a) Nonmetered gravity discharge faucet, 2.5 inch, with 2.5 inch camlock coupler
(b) Automatic flow control (bottom loading) valve, 4-inch
(c) Meter, 2-inch, conforming to 3.6.3
(d) Metered gravity discharge faucet, 2-inch, with 2.5 inch cam lock adapter.

3.11 Body mounting. The body shall be secured with U-bolts, twin studs, or brackets, and shall include a wood breaker strip. For classes 16 and 19 all but the rearmost, and for classes 28, 34.5, 36, 44 and 50 at least the forwardmost pair of U-bolts, twin studs, or brackets shall be spring loaded to permit vertical movement between the chassis and body.

3.11.1 U-bolts or twin studs. When U-bolts or twin studs are used, there shall be not less than three U-bolts or twin studs per side, for classes 16 and 19 and not less than four per side for classes 28, 34.5, 36, 44 and 50. Each U-bolt or twin stud shall have a 0.563 inch minimum body diameter with 0.625 inch minimum thread diameter. Tie-plates shall be at least 0.5 inch thick. The vehicle chassis frame shall be braced, using wood blocks at each mounting point. Blocks shall incorporate a keeper strap or groove for mounting bolt, and shall be of a width and thickness to assure retention. Two tie backs shall be provided, one on each side of the rear portion of the body subframe to maintain body alignment on the vehicle chassis. Forward body mounting bolts shall be located to the rear of the tapered portion of the breaker strips (see 3.11.3).

3.11.2 Brackets. When brackets are used, they shall be bolted to the web of the chassis frame rails. The body mounting brackets shall provide means for drawing down the body on the chassis rails. Provisions shall be made to prevent lateral shifting of the breaker strips. When additional holes are required to secure mounting brackets to chassis frame rails, they must be

located within the area of the rail which is designated as being safe for drilling in accordance with the chassis manufacturer's body builder's layouts. Attachments shall not interfere with nor obstruct existing chassis components.

3.11.3 Breaker strips. A hardwood or dense southern yellow pine breaker strip not less than 1.063 inches finished thickness shall be installed between longitudinal sills and vehicle chassis frame. Breaker strips shall have a taper of not less than 0.5 inch in 16 to 18 inches at the forward end.

* 3.12 Welding. Adequate preparation of metal prior to welding of the tank shell, appurtenances, components and accessories shall be provided. Surface of parts to be welded shall be free of dust, scale, paint, grease, and other foreign matter. Stainless steel electrodes or filler rods used in the welding process shall be for use with the grade of stainless steel specified herein and according to the recommendations of the manufacturer or producer of the stainless steel electrodes or filler rods. When welding the cabinet support members to any stainless steel pads or saddles, the ferritic particles shall not penetrate through the pads or saddles. The body shall be free of the following:

(a) Slug or plug welding
(b) Undersize of fillet welds, overlaps, inadequate fusion and penetration and undercutting of weldments
(c) Unremoved slag and spatter
(d) Cracks
(e) Spot, tack, or intermittent welds for strength.

Weld penetration shall be such as to provide transference of maximum design stress through the base metal juncture. Intermittent welding shall be permissible when in accordance with 3.12.1 and 3.12.2.

3.12.1 Workmanship specimens. Workmanship specimens shall be prepared by the manufacturer for the body and components to simulate all welding conditions. The specimens shall be cross-sectioned and etched. The specimens shall represent the minimum acceptable weld quality and cleaning procedure to be used in production. The specimens shall be prepared using the welding procedures to be employed in production. Specimens prepared to represent multiple pass welds shall be made in such a manner as to leave at least two inches of each layer of weld metal exposed. Upon submittal of these specimens by the contractor, the quality level and identification shall be subject to approval by the Government.

3.12.2 Welded members. All members to be joined by welding shall be brought into contact or close proximity before welding. For fillet, butt and flare groove welds; including those for the heads, baffles and shell; the gap between members before welding shall be such as

to ensure complete fusion with minimum distortion of the shell and in all cases, in all areas, the gap shall be no greater than 0.063 inch or the thickness of the thinner member, whichever is less.

3.12.3 Welding procedures. The contract will require welding procedures to be recorded prior to production of any weldment, but no procedure qualification other than workmanship specimens will normally be required.

3.12.4 Factors. The factors listed below shall be included in the recorded welding procedures:

(a) Joint sketch
(b) Joint type and preparation
(c) Base metal type and thickness
(d) Filler metal, size and type
(e) Position of welding
(f) Arc-voltage, current range, and polarity
(g) Manual or machine weld
(h) Travel speed, machine only
(i) Pre-heat and post-heat.

3.13 Servicing and adjusting. Prior to acceptance of the vehicle by the Government inspector, the contractor shall service and adjust each vehicle for operational use including at least the following: alignment of lights, adjustment of the engine and brake systems, filling and charging of battery, alignment of front wheels, inflation of all tires, complete lubrication of chassis, engine, and running gear with grades of lubricants recommended for the ambient air temperature at the delivery point, servicing of the cooling system with a solution of ethylene glycol type antifreeze and water in equal parts by volume, and servicing of the windshield washer reservoir with water and appropriate additives.

3.14 Workmanship. Defective components or parts and assemblies which have been repaired or modified to overcome deficiencies shall not be furnished. Welded, bolted and riveted construction utilized shall be in accordance with the highest standards of the metal fabrication industry. The entire vehicle shall be designed and constructed in accordance with the best known and available practices (see 49 CFR, Paragraph 178.340-2). Surfaces shall be free of visible grinder marks, rough cut edges, hand hammered edges, and dents. The body shall be free of body filler materials. The tank shell shall be free of ripples except in those immediate weld areas where the heads and baffles are attached to the shell. Permissible ripples in these areas shall be limited to the following:

* (a) Ripples shall deviate from the surrounding true shape of the shell (see 3.5.3) not more than 0.125 inch, protruding outward from the true shell shape or depressed inward from the true shell shape, but not both immediately adjacent to each other on the same tank shell.

(b) Ripples shall transition smoothly and gradually into the surrounding true shape of the shell.
(c) All ripples shall be confined to an area included within a 6-inch band, centered over the weld area and encircling the tank shell.
(d) In addition to the above, ripples shall be confined to those clearly unavoidable by use of first quality manufacturing techniques, careful handling of materials, closely held tolerances and pride of workmanship.

4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements (examination and tests) as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

* 4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility for ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Government verification. Quality assurance operations performed by the contractor will be subject to Government verification at unscheduled intervals. Verification will consist of observation of the operations to determine that practices, methods, and procedures of the contractor's inspection are being properly applied. Failure of the contractor to promptly correct product deficiencies discovered shall be cause for suspension of acceptance until correction has been made or until conformance of product to specification criteria has been demonstrated.

4.3 First production vehicle inspection. The first vehicle produced under the contract shall be inspected by the contractor at his plant under the direction and in the presence of Government representatives. The purpose of the inspection shall be to determine vehicle conformance to the contract. Acceptance of the first production vehicle shall not constitute a waiver by the Government of its rights under the provisions of the contract.

4.3.1 In-process inspection. The first production tank truck being produced under the contract shall receive an in-process inspection prior to prime painting and prior to mounting on the vehicle chassis. The inspection shall be conducted to evaluate manufacturing procedures, workmanship, welding specimens and welding procedures.

4.3.1.1 Workmanship. The truck body and manufacturing procedures shall be visually inspected for conformance to 3.5.5, 3.12 and 3.14. All welds on stainless steel body materials shall be inspected with a magnet to verify that they have been made with stainless steel electrodes or filler rods.

4.3.1.2 Joint specimens. The contractor shall present for Government inspection and approval the joint test specimens subjected to the tensile test required by 49 CFR, section 178.340, together with the certification regarding their date of preparation and testing. The test specimens shall be current in accordance with 178.340. The contractor shall present for Government inspection the workmanship specimens required by 3.12.1. All approved specimens shall be identified, the Government representative's approval recorded thereon, and retained at the manufacturing facility for the duration of the contract.

4.3.1.3 Welding procedure. The contractor shall present to the Government the recorded welding procedures prepared in accordance with the contract and 3.12.3 and 3.12.4. Approved procedures shall be identified, the Government representative's approval recorded thereon, and retained at the manufacturing facility for the duration of the contract.

4.3.2 Vehicle weight. The first production vehicle shall be weighed to determine the curb weight and distribution of the curb weight on the front and rear axles. The total imposed loading on the front and rear axles shall be computed by the contractor and verified by the Government, using the curb weight, the operator weight at 175 pounds and the payload required to provide the specified GVW. The calculated imposed loads on the front and rear axles shall be compared to the suspension, axle and tire load capacity ratings to determine if these components are of adequate capacity to meet contractual requirements.

* 4.3.3 Road test. The vehicle, for rear wheel drive models and models built to all wheel drive while on the chassis manufacturer's production line shall be road tested by the contractor with payload. The road test shall be for not less than 10 miles at speeds up to 55 mph. The vehicle, for all wheel drive models qualifying under 3.1.1.10, shall be road tested with and without payload. The road test for both conditions shall be for not less than 50 miles at speeds up to 50 mph over highways and gravel roads and for not less than 5 miles at speeds up to 15 mph over cross country terrain with ground and grade requiring all wheel drive. During the loaded and empty portions of the road test, the brakes shall be applied firmly, bringing the vehicle to a sudden stop not less than 5 times during each portion of the road test. During the

road test, the front and rear suspension and the drivetrain shall be periodically inspected for interference and contact with other vehicle components. Abnormal contact of the drivetrain or suspension components with other components shall be cause for rejection. Front spring bumpers shall not make contact with frame stops except under the most extreme cross country conditions. Operational or mechanical failures of vehicle components during the road test shall be cause for rejection. Failure includes permanent deformation as well as breakage.

4.3.4 Cleaning. Prior to the beginning of air pressure or fluid flow tests, the vehicle shall be cleaned. The vehicle shall be carefully inspected for evidence of contaminants in the tank and fuel system, such as loose, spattered or excess solder, metal chips, grinding dust, or other debris. Test fluid, as specified in 4.3.10, shall be pumped through the system for a minimum of 10 minutes at not less than 80 gpm. Filter/separator and contamination monitor filter elements shall not be in place. At the end of the 10 minutes, strainers and low point drains shall be examined for evidence of contaminants. If any trace of contaminants is found, the recirculation of test fluid at 80 gpm shall continue for 10-minute periods until all trace of contaminants has been removed. Strainers and low point drains shall be examined at the end of each 10-minute period. When all trace of contaminants has been removed, testing may proceed. Filter/separator and contamination monitor filter elements shall be reinstalled before flow testing.

4.3.5 Tank leakage test. To determine conformance to 3.5.4, after the road test the cargo tank shall be subjected to a static air pressure test at 5 psig for a period of not less than 5 minutes. A soap solution shall be applied on the exterior of the tank at all welds and joints as an aid in the visual detection of leaks. Vents and other normal pressure relief systems shall be sealed closed during the test.

4.3.6 Hydrostatic test pressure. The entire fuel dispensing system of types III and IV vehicles shall be tested for conformance to paragraph 4-10.2 of NFPA No. 407.

4.3.7 Vent operation and pressure/vacuum holding tests. The contractor may use pressure transducers or other industry accepted methods to measure normal venting pressure limits for conformance to 3.5.11.1. A suggested test method suitable for the low pressures involved is as follows:

(a) Position the first production truck such that a test fluid hose can be connected between the bottom loading adapter and a pressurized source for filling the tank and a hose can be connected to a receptacle for discharging test fluid from the tanks. Partially fill the tank (required for steps (f), (g) and (h) below).
(b) Attach the vapor recovery flange to a U-tube water manometer (mercury unacceptable). (The U-tube manometer can be fabricated from clear plastic tubing mounted on a ruled board.)

(c) Bottom load test fluid into the tank until a positive air pressure differential of 18 inches of water is reached. (Opening the bottom loading valve will open the automatic vents specified in 3.5.11.4 thus pressurizing the vapor recovery line and the manometer.) Leave the bottom loading valve open. Close all other valves. Insure that test fluid is not draining back through the bottom loading check valve.
(d) The pressure decay over a 5-minute period shall be observed for conformance to the 1 inch of water requirement of 3.5.11.1(a).
(e) Bottom load additional test fluid into the tank observing the manometer and the vents to insure that the vents do not open before 18 inches of water is reached and that the vents do open before 27.7 inches of water is reached (see 3.5.11.1(b)).
(f) Drain test fluid from the tank until a negative pressure differential of 6 inches of water is reached and hold at that level.
(g) The pressure increase over a 5-minute period shall be observed for conformance to the 1 inch of water requirements of 3.5.11.1(a).
(h) Drain additional test fluid from the tank observing the manometer and the vents to insure that the vents open before a vacuum of 10.4 inches is reached (see 3.5.11.1(c)).
(i) Similar tests conducted by pressurizing the tank through an air hose connected to the bottom loading flange are not acceptable since vacuum tests on the entire tank cannot be performed using this method.

4.3.8 Emergency venting. The exposed surface area of each tank compartment shall be measured and the capacity of each vent determined by its required stamping and certification (see MC-306). The total venting capacity shall be calculated and compared to the surface area to determine conformance to the requirements of 49 CFR, section 178.341, specification MC-306.

4.3.9 Parking brake check. On the first production vehicle, for vehicles with air brakes, the parking brake control in the truck cab shall be set in the "OFF" position. A 4-inch API coupler shall be connected to the bottom loading adapter. The brakes shall be observed to insure that they apply. The brakes shall be released and the test repeated with a 2.5 inch D-I type underwing nozzle connected to the bottom loading adapter. On type III and type IV trucks, the brakes shall be released and the underwing nozzle removed from its stowage bracket. The brakes shall be observed to insure that they apply. The override toggle switch on the truck cab instrument panel shall be checked to insure it overrides the brake interlock only of the underwing nozzle stowage bracket. For vehicles with hydraulic brakes, the parking brake control in the cab shall be placed in the "OFF" position and attempts made to connect the 4-inch API coupler and then the 2.5 inch D-I type underwing nozzle to the bottom loading adapter. The ability to make either connection with the parking brake off shall constitute failure of the test. The test shall be repeated with the parking brake set and connection(s) shall then be possible.

4.3.10 Fluid flow tests. Test fluid shall be a clean commercial solvent with viscosity equal to gasoline or turbine fuel, but having a higher flash point and lower vapor pressure.

4.3.10.1 Bottom loading system and calibration test. Using either leg of the bottom loading adapter, at the manufacturer's option, the tank of the first production vehicle shall be loaded from empty at a rate of not less than 600 gpm through a calibrated meter. Failure of the tank to accept 600 gpm, failure of the tank compartment to accept less than its required capacity before closing of the bottom loading valve, acceptance by the tank compartment of more than its required capacity (in excess of 1 percent) or liquid contact with or liquid flow from the vents shall constitute failure of the test. The capacity marker of 3.5.10 shall be checked against the meter reading for proper setting. Upon any failure, corrections shall be made and the entire test repeated until successful.

* 4.3.10.2 Fuel servicing tests. The tank of the first production truck shall be completely discharged through the onboard meter and fuel servicing system(s) (gravity discharge for type V). The recorded flow out through the onboard meter shall be compared to the amount of fluid pumped into the truck to insure proper calibration of the onboard meter. During discharge, the flow rate (except on type V) shall be rapidly varied from 0 to 100 gpm for overwing refueling and closed-circuit fuel servicing and from 0 to 200 gpm for underwing fuel servicing. On type III and IV trucks, the nozzle pressure shall be observed and the time from no-flow to full-flow measured for conformance to 3.8.4.2.(b). For type I and III vehicles with the optional 75 gpm automatic nozzle (see 3.6.1.2), the automatic nozzle shall be replaced with a 100 gpm nozzle for the purpose of these tests.

4.3.10.3 Self-load test. To determine conformance to 3.6.4.1, the four 10-foot lengths of hose shall be connected from the suction stub of the first production truck to a storage tank or other typical fuel source below ground level. A flow rate of not less than 100 gpm shall be maintained for a minimum of 3 minutes.

4.3.10.4 Defuel tests. The first production truck of type III and IV shall be tested to simulate defueling through the overwing and the underwing nozzles. The rate of flow during defueling shall be measured for conformance to 3.8.4.1(b), 3.8.4.1(c) and 3.8.4.2(b). The tank shall be filled to capacity during defueling to check automatic closing of the bottom loading valve during defueling.

4.3.10.5 Recirculation test. The recirculation system shall be tested for conformance to 3.8.4.5.

4.3.10.6 Deadman control. The deadman control shall be tested to insure immediate fuel flow stoppage when the control is released.

4.3.11 Exhaust gas test. The vehicle shall be tested to determine the concentration of NO_x, CO and SO_2 in the cab after 8 hours of engine operation. The tests shall be in accordance with TOP 2-2-614. The tests shall be conducted with the vehicle stationary, with all cab windows and doors closed, with cab air intakes open, with all cab heaters operating at highest output, and with the chassis engine operating at the manufacturer's recommended speed for the power takeoff driven pump operation, 700 to 1000 rpm (see 3.4.5.4). The test shall be repeated, except with the heater off.

4.3.12 Two-compartment trucks. Each compartment of type II and IV first production trucks shall be tested in accordance with 4.3.5 through 4.3.10.6.

4.3.13 Element change. Filter/separator elements and contamination monitor elements used during testing shall be replaced prior to shipment to the receiving activity.

4.3.14 Body treatment and painting. The certification regarding the body cleaning, treating, prime painting and salt spray resistance testing, as required by MIL-STD-1223, shall be made to Government representatives at the first vehicle inspection.

4.3.15 Catwalks and flashing. The catwalks and flashing on top of the vehicle and the catwalk drain outlets shall be carefully inspected to ensure that spilled fuel cannot run toward the exhaust and that water cannot enter the tank.

4.4 Test records. Contractor's records of all first production and production vehicle tests and inspections, giving the results of the tests and inspections will be required in the contract. The records shall be kept complete and available to the Government representatives. Test and inspection records shall be signed and approved by a person specifically assigned by the contractor. Contractors not having testing facilities satisfactory to the Government shall engage the services of a commercial testing laboratory satisfactory to the Government.

4.5 Certification. The manufacturer's certificate of compliance to MC-306, as required in 49 CFR, sections 178.340 and 178.341, shall be furnished, endorsed by the vehicle contractor if different, and securely stowed and shipped with each truck together with instructions for the recipient regarding the certificate's retention and use. The certificate shall bear, in addition to the signatures specified above, the typed and signed name of the Government official accepting the vehicle.

4.6 Availability of regulations. The contractor shall make available to the Government at the point of final acceptance current copies of 49 CFR, sections 178.340 and 178.341, of Specification MC-306; of NFPA No. 407; and of TOP 2-2-614. The documents shall be surrendered to the Government for the personal use of the Government representatives in conjunction with the contract for the duration of the contract.

4.7 Production sample. Upon acceptance of the first production vehicle, it shall remain at the manufacturing facility as a production sample, and shall be the last vehicle shipped on the contract. The contractor shall maintain the vehicle in a serviceable condition for the duration of the contract.

4.8 Failure. Failure of the first production vehicle to meet requirements of the contract shall be cause for the Government to refuse acceptance of all vehicles under contract until corrective action has been taken. Following corrective action, the vehicle shall be reinspected and any previously performed tests, at the Government's option, shall be repeated.

4.9 Inspection of production vehicles. The contractor's inspection system shall, as a minimum, assure that the vehicle conforms to the physical and dimensional requirements and is capable of meeting performance requirements contained herein. All tank trucks under contract shall be cleaned in accordance with 4.3.4, tested for leaks as specified in 4.3.5 and calibrated in accordance with 4.3.10.1. All type III and IV tank trucks under contract shall be tested hydrostatically in accordance with 4.3.6. For each vehicle under contract, the contractor shall make available to the Government, at the point of final acceptance, records acceptable to the Government indicating that the servicing and adjusting required by 3.13 have been accomplished.

5. PREPARATION FOR DELIVERY

5.1 Vehicle processing. The vehicle shall be processed for shipment, from the manufacturer a plant to the initial receiving activity, in accordance with the manufacturer's standard commercial practice.

6. NOTES

6.1 Intended use. Type I and II vehicles are intended for nontactical use as fuel servicing vehicles. Type III and IV vehicles are intended for pressure refueling and defueling, closed-circuit type refueling, and overwing type refueling and defueling of all Army helicopters and aircraft. The type V vehicle is intended for bulk hauling of gasoline and fuel oil. All vehicle types are intended for both on-road and limited off-road usage.

6.2 Ordering data. Acquisition documents should specify the following:

(a) Title, number and date of this specification.
(b) Type, class, size, and model of vehicle required (see 1.2).
* (c) Issue of DoDISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
(d) Identification of appropriate service for painting and marking (see 3.1.1.1 and 3.1.1.2).
(e) Concealed markings, if required (see 3.1.1.2).

(f) Rustproofing, if required (see 3.1.1.3).
(g) Tropical rustproofing, if required (see 3.1.1.3).
(h) Silicone brake fluid, if required for class A vehicles (see 3.1.1.8).
* (i) Satisfactory operation on JP-4, JP-5 and JP-8 fuel, if required (see 3.4.1.1).
(j) Gasoline engine, if required for classes 16, 19 and 28 (see 3.4.1.2).
(k) Power plant heaters and fuel warmer, if required (see 3.4.1.8).
(i) If a battery heater is not required with the power plant heaters (see 3.4.1.8).
* (m) Alternator capacitor, if other than as specified (see 3.4.2.3).
(n) Two-speed transfer case, if required (see 3.4.5.1).
(o) Automatic transmission for type I, III and V vehicles, if required (see 3.4.5.3).
(p) Oil lubricated wheel bearings and axle spindles, if required (see 3.4.9).
(q) Two-speed axle for model 4x2 vehicle, if required (see 3.4.9.1).
(r) Traction control, if required (see 3.4.9.2).
(s) Wide base tires, if required (see 3.4.10).
(t) Disc type wheels, if required (see 3.4.10).
(u) Bias ply or other type tires, if required (see 3.4.10.1).
(v) A carrier for a spare tire assembly, if required (see 3.4.10.3).
(w) Spare wheel or rim, if required (see 3.4.10.4).
(x) Spare tire, if required (see 3.4.10.5).
(y) Brake controls for use from a towing vehicle, for vehicle with air brakes, if required (see 3.4.11.3).
(z) Tilting hood and fender assembly, if required (see 3.4.12).
(aa) Tilt cab, if required (see 3.4.12).
(ab) Individual seats, if required (see 3.4.12).
(ac) Tools, if required (see 3.4.17.1).
(ad) Air horn, in addition, if required (see 3.4.22).
(ae) 2-inch NPT couplings and plug, if required (see 3.5.9).
(af) Type of bottom loading adapter required, if not Y-type (see 3.5.14).
(ag) Spotlight, if required (see 3.5.19.2(d)).
(ah) Filter/separator for type I vehicle, if required (see 3.6).
(ai) Automatic shut-off nozzle, if required (see 3.6.1.2).
(aj) The specific fuel the meter is to be calibrated for, if required (see 3.6.3).
(ak) Filter/separators for type II vehicle, if required (see 3.7.1).

6.3 Performance prediction. SAE Truck Ability Prediction Procedure computations and computations for low speed and maximum geared speed will be required by the contract. The SAE Work Sheet Item 1 should include vehicle model number, engine model number, and vehicle type, class and model. Unless other conditions are cited in the contract, computations should be made for normal atmospheric pressure, normal ambient air temperature, and still dry

air. The factors to be used in predicting truck ability (see 3.3.1.1) are established as follows for the corresponding SAE Truck Ability Prediction Procedure Tables:

Table 1	- Tire Factor. This factor must relate to the size of tires furnished by the contractor in accordance with this specification.
Table 2	- Altitude Factor. 1.00
Table 3	- Rolling Factor. 1.613
Table 4	- Area Factor. 0.173
Table 5	- Velocity Factor. 250.0
Table 6	- Altitude Factor. 1.00
Table 7	- Chassis Friction Horsepower. Use applicable power unit GVW (to nearest, higher, 1,000 pounds) and the engine rpm (to nearest 100 revolutions) which is required for 50 mph geared speed. For GVW and engine speed beyond the range of this table, factors shall be extrapolated.
Table 8	- Grade Factor. 0.75
Table 8A	- Correction Factor. Not required.
Table 9	- Road Factor. 0.0.

6.4 Subject term (key word) listing.

Bottom loading
Closed circuit
Contamination monitor
Electrostatic discharge protection
Emergency dry break connection
Exhaust system safety
Filter/separator
Fuel emission control
Level sensor
MC-306
NFPA No. 407
Nozzles
Overwing fuel servicing
Pneumatic controls
Single point fuel servicing
Truck, tank
Truck, tank, aircraft fuel servicing
Truck, tank, bulk haul
Truck, tank, dual fuel servicing
Truck, tank, fuel servicing
Underwing fuel servicing
Vapor recovery.

6.5 Changes from previous issue. The margins of this specification are marked with asterisks (*) to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content regardless of the marginal notations and relationship to the last previous issue.

Custodians:

Army - AT
Navy - YD
Air Force - 99

Preparing Activity:
Army - AT

Review Activities:
Army - AV
Air Force - 84

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