ATTACHMENT- 0006

INCH-POUND
ATPD-2336E
12 August 2011
SUPERSEDING
ATPD-2336D
09 November 2010

PURCHASE DESCRIPTION

MODULAR FUEL SYSTEM (MFS)

This specification is approved for use by the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), Research, Development and Engineering Command (RDECOM), Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This performance specification covers the requirements for a Palletized Load System (PLS) and Heavy Expanded Mobility Tactical Truck-Load Handling System (HEMTT-LHS) compatible petroleum storage and distribution system called the Modular Fuel System (MFS). The MFS will be capable of receiving, storing, filtering, and issuing kerosene based fuels (i.e. Jet Propellant (JP) JP-5, JP-8, Jet-A, Jet-A1) and diesel fuel. The MFS is an ISO-compatible system that has the ability to be transported using the HEMTT-LHS truck, PLS truck, and PLS trailer as the prime mover, and can be rapidly emplaced, operated, maintained, and recovered by skilled personnel. A single MFS unit will be a 35,000-gallon capacity fuel farm consisting of fourteen tankrack modules (TRM) and two pumprack modules (PRM). The MFS consists of 2,500-gallon (threshold), 3,000-gallon (desired) TRMs, PRMs, a petroleum test kit, a fuel spill control kit, and accessories including hoses, valves, and fittings. The TRM will be capable of top and bottom fill and will be transportable at any level of fuel. The MFS will be capable of wholesale and retail distribution activities. The MFS is capable of evacuating all but residual

Comments, suggestions, or questions on this document should be addressed to U.S. Army RDECOM, Tank Automotive Research, Development and Engineering Center, ATTN: RDTA-EN/STND/TRANS MS #268, 6501 E. 11 Mile Road, Warren, MI 48397-5000 or emailed to DAMI_STANDARDIZATION@conus.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

fuel from the hoses and other system components prior to tear down. Mobility requirements of the HEMTT-LHS and PLS truck, and PLS trailer will not be affected while transporting MFS. The MFS will be compatible with other US and allied nations, military and commercial fuel systems. The MFS will meet ISO container requirements to allow stacking of TRMs and meet requirements of worldwide shipping by air, rail, marine, and highway without changes in configuration or special considerations.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this document. This section does not include documents cited in other sections of this document or recommended for additional information or as examples.

2.2. Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

FEDERAL STANDARDS

FED-STD-595/34094 - Green 383

COMERCIAL ITEM DESCRIPTION

A-A-393	-	Extinguisher, Fire, Dry Chemical (Hand Portable)
A-A-52030	-	Nozzles, Fuel and Oil Servicing, Nonautomatic Shutoff and Nozzles, Fuel Servicing, Automatic Shutoff
A-A-52557	-	Fuel Oil, Diesel; For Posts, Camps and Stations
A-A-52624	-	Antifreeze, Multi Engine Type
A-A-59326	-	Coupling Halves, Quick Disconnect, Cam Locking Type
A-A-59377	-	Coupling Assembly, Quick-disconnect, Sexless type

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-5624	-	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-53039	-	Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant
MIL-DTL-53072	-	Chemical Agent Resistant Coating (CARC) System Application Procedures and Quality Control Inspection
MIL-DTL-83133	-	Turbine Fuels, Aviation, Kerosene Types, JP-8 (NATO F-34), NATO F-35, and JP-8 +100 (NATO F-37)
MIL-PRF-370	-	Hose and Hose Assemblies, Nonmetallic: Elastomeric, Liquid Fuel

MIL-PRF-2104	-	Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service
MIL-PRF-10924	-	Grease, Automotive and Artillery
MIL-PRF-32143	-	Batteries, Storage: Automotive, Valve, Regulated, Lead Acid (VRLA)
MIL-PRF-46167	-	Lubricating Oil, Internal Combustion Engine, Arctic
MIL-PRF-52308	-	Filter-Coalescer Element, Fluid Pressure
MIL-PRF-52747	-	Nozzle Assembly, Closed-Circuit Refueling Standards and Arctic Service
MIL-PRF-52849	-	Test Kit: Aviation Fuel Contamination (Portable)

DEPARTMENT OF DEFENCE STANDARDS

MIL-STD-130	-	Identification Marking of U.S. Military Property
MIL-STD-209	-	Lifting and Tiedown Provisions
MIL-STD-461	-	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystem and Equipment
MIL-STD-464	-	Electromagnetic Environmental Effects Requirements for System
MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-814	-	Requirements for Tiedown, Suspension, and Extraction Provisions on Military Materiel for Airdrop
MIL-STD-913	-	Requirements for the certification of sling loaded military equipment external transportation by department of defense helicopters.
MIL-STD-1366	-	Transportation Criteria
MIL-STD-1472	-	Human Engineering
MIL-STD-3004	-	Quality Assurance/Surveillance for Fuels, lubricants, and related products

DEPARTMENT OF DEFENCE HANDBOOKS

MIL-HDBK-669	-	Loading Environment and Related Requirements for Platform Rigged Airdrop Materiel
MIL-HDBK-1791	-	Designing for Internal Aerial Delivery in Fixed Wing Aircraft
MIL-HDBK-138	-	Guide to Container Inspection for Commercial and Military Intermodal Containers

(Copies of these documents are available from https://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent

specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

US ARMY REGULATIONS & PAMPHLETS

AR 70-38	-	Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions
AR 750-1	-	Army Material Maintenance Policy and Retail Maintenance Operations
AR 750-43	-	Army Test, Measurement, and Diagnostic Equipment Program
DA PAM 611-21	-	Military Occupational Classification and Structure
DA PAM 750-8	-	Army Maintenance Management System (TAMMS) Users Manual
DA PAM 750-35	-	Guide for Motor Pool Operations

(Copies of pamphlets are available from the US Army Tank-automotive and Armaments Command, AMSTA-TR_D/210, Warren, MI 48397-5000. Some are also available on-line at – http://www.usapa.army.mil.)

CODE OF FEDERAL REGULATIONS (CFRs)

29 CFR 1910	-	Occupational Safety and Health Standards
49 CFR 172.504	-	General Placarding Requirements
49 CFR 178.345-346	-	Specifications for Packaging 49CFR 180.407- Requirements for test and inspection of specification cargo tanks
49 CFR 180.411,415	-	Acceptable Results of Tests and Inspections, Test and Inspection Markings
49 CFR 450-453	-	Regulation relating to Department of Transportation (DOT) (International Safe Container Act)
49 CFR 393.28	-	Wiring to be protected.

(Copies of these documents are available from www.gpoaccess.gov/cfr/index.html or U.S. Government Printing Office, P.O. Box 979050, St. Louis, MO 63197-9000.)

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

STANAG 2413	-	Demountable Load Carrying Platform (DLCP/Flatracks)
STANAG 4074	-	Auxiliary Power Unit Connection for Starting Tactical Land Vehicle
STANAG 1135	-	Interchangeability of fuels, lubricants and associated products used by the Armed Forces of the North Atlantic Treaty Nations (NATO)

STANAG 3756	-	Facilities and Equipment for Receipt and Delivery of Liquid Fuels
AVTP 03-160W	-	Dynamic Stability

(Application for copies should be addressed to the Ministry of Defense, Kentigern House, 65 Brown Street, Glasgow, G2 8EX, United Kingdom.)

US ARMY FIELD MANUALS

FM 3-11.5	-	Multiservice Tactics, Techniques, and Procedures For Chemical, Biological, Radiological, and Nuclear Decontamination
FM 3-100	-	Chemical Operations Principles and Fundamentals

(Copies are available from the US Army Tank-automotive and Armaments Command, AMSTA-TR-D/210, Warren, MI 48397-5000. Some are also available on-line at http://155.217.58.58.)

US ARMY DEVELOPMENTAL TEST COMMAND

TOP 2-2-608	-	Braking, Wheeled Vehicles

(Copies are available from http://www.dtc.army.mil/publications/topsindex.aspx or US ARMY Developmental Test Command, Headquarters, 314 Longs Corner Road, Aberdeen proving Ground, MD 21005.)

PURCHASE DESCRIPTIONS

PD 3930-0108	-	Truck, Lift, Fork, Variable reach, Rough terrain, 10,000-pound capacity
ATPD 2206	-	Batteries, Storage: Lead-Acid, Maintenance Free (Metric)
ATPD 2325	-	Truck, Lift, Fork, Variable Reach, Rough Terrain, 10,000 – Pound Capacity

(Copies of these purchase descriptions are available from the US Army Tank-automotive and Armaments Command, AMSTA-TR-D/210, Warren, MI 48397-5000.)

DRAWINGS

11674728	-	Vehicle Receptacle Assembly
11682336	-	Cable and Plug Assembly, Intervehicle Power
13222E8212	-	Coupling Set, NATO, Tank Truck Adapter
13222E8217	-	Coupling, Female, Tank Truck
13222E8218	-	Coupling, Male, Tank Truck
13222E8219	-	Coupling, Rail Tanker NATO
13219E0462	-	Ground Rod

12479550	-	Ground Combat Vehicle Welding Code – Steel
12472301	-	Ground Combat Vehicle Welding Code – Aluminum

(Copies of these drawings are available from the US Army Tank-automotive and Armaments command, AMSTA-TR-D/210, Warren, MI 48397-5000.)

AMERICAN PETROLEUM INSTITUTE

API/IP Specification 1581	-	Specification and Qualification Procedures for Aviation Jet Fuel Filter/Separators

(Copies of this document are available from API Publishing Services, 1220 L Street, N.W.,Washington, DC 20005.)

U.S. Army Corrosion Rating System

TACOM Design Guidelines for Prevention of Corrosion in Combat and Tactical Vehicles, Mar. 1988.

(Copies of USACTS and TACOM Guidelines are available from the US Army Tank-Automotive and Armaments Command, AMSRD-TR-E/267, Warren, MI 48397-5000.)

NBC Contamination Survivability Criteria for Army Materiel (NCSCAM)

(Copies of this document are available from the U.S. Army Nuclear and Chemical Agency, 7150 Heller Loop, Suite 101, Springfield, VA 22150-3198.)

2.3 Non-government publications. The following documents form part of this document to extent specified therein. Unless otherwise specified, the issues of the documents, which are DOD adopted, are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DODISS are the issues of the documents cited in the solicitation.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 228-1	-	Pipe Threads Where Pressure-Tight Joints Are Not Made on the Threads Part 1: Dimensions, Tolerances and Designation-Fourth Edition
ISO 668	-	Containers, Series 1 Freight, Classification, Dimensions and Ratings
ISO 1161	-	Containers, Series 1 Freight —Corner Fittings—Specification
ISO 1496-3	-	Containers, Series 1 Freight - Specification and Testing – Part 3: Tank Containers for Liquids, Gases and Pressurized Dry Bulk

ISO 1496-5	-	Containers, Series 1 Freight - Specification and Testing – Part 5: Platform and Platform Base Container
ISO 6346	-	Freight Containers – Coding, Identification and Marking

(Application for copies of ISO standards should be addressed to American National Standards Institute, 11 West 42nd Street, New York, N.Y. 10036.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 385	-	Tank Vehicle for Flammable and Combustible Liquids
NFPA 407	-	Aircraft Fuel Servicing

(Application for copies should be addressed to the National Fire Protection association, One Batterymarch Park, Quincy, MA 02269-9101.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 184	-	System, Acquisition, Qualifying a Sound Data
SAE J 534	-	Fittings, Lubrication
SAE J 2360	-	Oil, Lubricating, Gear Multipurpose (Metric) Military use
SAE-AS-5877	-	Nozzle, Aircraft Pressure Refueling

(Copies are available from Society of Automotive Engineers, Department 105, 400 Commonwealth Drive, Warrendale, PA 15096.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	-	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM D 522	-	Mandrel Bend Test of Attached Organic Coatings
ASTM D 610	-	Degree of Rusting on Evaluating Painted Steel Surfaces
ASTM B 633	-	Zinc on Iron and Steel, Electrodeposited Coatings of
ASTM D 975	-	Oils, Diesel Fuel
ASTM D 1171	-	Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1655	-	Aviation Turbine Fuels
ASTM D 3359	-	Adhesion by Tape Test, Measuring

(Copies are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME BPVC	-	Boiler and Pressure Vessel Code

(Copies are available from the American Society of Mechanical Engineers, 3 Park Avenue, New York, NY 10016.)

GERMAN INDUSTRIAL STANDARDS

DIN 30722	-	Pay-Off Dump Trucks up to 32T (Flatrack Critical Dimensions)
DIN 28450	-	Quick-acting Hose Couplings for Tank Trucks

(Copies are available from Global Engineering Documents, an IHS GROUP Company, 15 Inverness Way East, Englewood, Colorado 80112.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	-	Enclosures for Electrical Equipment (1000 Volts Maximum) (DOD Adopted)

(Application for copies should be addressed to the National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, VA 22209.)

GENERAL MOTORS CORPORATION (GM)

GM 9540P	-	Accelerated Corrosion Test

(Copies are available from Global Engineering Documents, an IHS GROUP company, 15 Inverness Way East, Englewood, Colorado 80112.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Description. As written in this purchase description, minimum acceptable performance threshold requirements are indicated with the word "shall" throughout the text. All requirements applicable to the MFS apply to both the TRM and the PRM. As applicable, objective capabilities that are not mandatory are indicated with the words "should", "desired", or "desirable". For the purpose of this purchase description, the MFS is described as an ISO compatible system that shall provide the ability to transport, store and distribute bulk fuel (both unit and supply point distribution) using the HEMTT-LHS truck (M1120); PLS truck (M1074, M1075); and PLS trailer (M1076) towed by the HEMMT-LHS truck, the HEMTT tanker, and the PLS truck (M1074, M1075) as the prime mover. The MFS shall be capable of storing fuel and performing both wholesale and retail operations. The tanks shall be connected to the PRM inlets and the retail hoses shall be connected to the outlet of the PRM. The wholesale capabilities of the MFS shall be utilized for distribution including the tank and pump unit (TPU) and 500-gallon collapsible containers and storage of bulk fuel, while the retail capabilities (see Appendix B) of the MFS shall allow supply of fuel to unit-level retail refueling operations.

3.2 First article. When required by contract (see 6.2), the MFS shall be subjected to First Article Testing (FAT) IAW 4.1.3.

3.3 Materials. The materials used in the MFS components shall be as identified and shall meet all of the physical, operational, and environmental requirements specified herein. The contractor shall verify that the components incorporated into the MFS are fabricated from recovered materials to the maximum extent practicable, provided the components meet all other requirements of this specification and subassembly specifications. The materials shall be of sufficient durability to meet all the requirements as specified herein. No material shall have an adverse effect on the health of personnel when used for its intended purposes. Toxic chemicals or ozone depleting chemicals (ODC) shall not be used.

3.3.1 Fuel compatibility. All materials in contact with fuel shall be compatible with the fuels listed in 3.5.9.

3.3.2 Service and storage life. The MFS shall have a service life of not less than 25 years when operated under the operational and environmental conditions specified in 3.8. Suction and discharge hoses shall have a minimum shelf life of at least 10 years (threshold) 20 years (objective) and a useful life of at least 5 years (threshold) and 10 years (objective) once wetted with fuel.

3.3.3 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion.

3.3.4 Hazardous materials usage. Asbestos, beryllium, radioactive materials, hexavalent chromium, cadmium, mercury, or other highly toxic or carcinogenic materials, as defined in 29 CFR 1910.1200, with the exception of the Chemical Agent Resistant Coating (CARC), shall not be used in the manufacture, assembly, operation or sustainment of this system without prior approval from the Government. Approval will only be granted when valid technical justification is provided. Class I and Class II Ozone Depleting Substances shall not be used. Lead shall not be used without prior approval of the Government. The use of lead solder may be approved for electrical components where a suitable alternative is not available. Lead-acid batteries may be used without approval from the Government. Hazardous materials requirements shall apply to any components/parts purchased through a subcontractor/vendor or OEM parts, as well as manufactured parts.

3.3.5 Deterioration, prevention, and control. The manufacturer shall select materials capable of meeting all the operational and environmental requirements specified herein. The system components shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide against corrosion and deterioration during storage and operational conditions experienced. Hoseline shall not be crimped or folded by any system components.

3.3.6 Recycled, recovered, and environmentally preferable materials. Recycled, recovered, and environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle cost.

3.3.7 Pipe threading connections. Threaded connections in contact with petroleum products shall have the threads treated with an antiseize compound or pipe thread sealant as appropriate.

3.3.8 Used, rebuilt, or remanufactured components. Used, rebuilt, or remanufactured components shall not be incorporated into the MFS.

3.4 Compatibility.

3.4.1 HEMTT LHS/PLS and PLS trailer compatibility. The MFS shall be compatible with the HEMTT-LHS, PLS, and PLS trailer as well as other military means as specified in 3.6.1 and commercial flatbed trailers. A HEMTT-LHS or PLS truck each coupled with a PLS trailer shall be capable of transporting two modules. These two modules shall be transported in two configurations: two TRMs at any fuel level and one TRM at any fuel level and a PRM, over the terrain specified in the Operational Mode Summary/Mission Profile (OMS/MP) without limitations. When transporting the MFS, the current level of HEMTT-LHS, PLS truck, and PLS trailer mobility (IAW Appendix A) and stability shall be maintained regardless of liquid level. The TRM shall meet the LHS interface requirements of DIN 30722 and STANAG 2413. It shall be capable of being loaded on and unloaded from the HEMTT-LHS, PLS truck, and PLS trailer using only the HEMTT-LHS and PLS load handling system. The TRM shall be able to couple with the M978 HEMTT Tanker to form a 5,000-gallon distribution platform. The TRM configuration shall allow operators to safely connect hoses and perform other steps necessary to bulk transfer fuel between the TRM and the HEMTT tanker when the TRM is towed by a HEMTT tanker. The TRM shall be able to perform retail operations using the TRM as the source without disconnecting the HEMTT Tanker from the PLS Trailer. The time to complete all required connects shall be five minutes or less.

3.4.2 ISO compatibility. The TRM and the PRM shall conform dimensionally to the requirements of Table 2 of ISO 668 as a 1CX twenty- (20) foot container. The MFS shall be capable of stacking empty loads on the ISO provisions up to nine units high. The container frame shall have corner fitting locations that conform to ISO 668 for a 1CX container. Upper and lower corner castings shall conform to ISO 1161. When stowed for transport the TRMs and the PRM including all accessories, components and add-on items as applicable shall fit within the ISO interface dimensions. The MFS shall be designed for and capable of being lifted from the four top corner fittings, being lifted from the four bottom corner fittings, meeting the stacking requirements, meeting external restraint (longitudinal), and meeting transverse and longitudinal rigidity requirements of ISO 1496-3. Contractor shall obtain ISO certification prior to government Acceptance Inspection and Test (AI&T).

3.4.3 Forklift compatibility. Each TRM, PRM, and any loads to be handled by a forklift, shall have forklift pockets, for lifting, conforming to ISO 1496-5. TRMs shall be empty prior to handling by a forklift. Forklift pockets shall be shielded to prevent the TRM from accidental piercing by the forklift tines. Each TRM, PRM, and any loads to be handled by a forklift shall be capable of being entirely lifted and secured IAW MIL-STD-1366 onto the HEMTT-LHS truck, PLS truck, PLS trailer, and conventional flatbed trailers, by the following standard U.S. Army forklifts: 10,000 Lb. All Terrain Lifter Army System (ATLAS) IAW ATPD 2325 and the M10A

(ref. TM 10-3930-643-10). The TRM and the PRM components shall be within the physical envelope of the ISO frame to avoid contact with the forklift carriage.

3.5 Design and operating requirements.

3.5.1 Operation. The operator shall be capable of performing all MFS loading, unloading, and dispensing operations while the TRM is mounted on the palletized load system (PLS) trailer, while on the HEMTT-LHS/PLS truck, and while the MFS is sitting on the ground, flat and on slopes up to 5 degrees. Once the MFS modules have been emplaced at the operational location, a MFS shall be fully operational and ready to dispense fuel in a maximum of 1 hour using four MOS 92F soldiers without the need for material handling equipment. The MFS shall be recovered as specified in 3.5.9.4. The MFS shall be designed to minimize or eliminate environmental quality impact and shall comply with all environmental policy and procedures.

3.5.2 Starting, operation, and stopping.

a. Starting. The MFS shall be capable of starting within 5 minutes under any environmental conditions or combination of conditions as specified in 3.8. The MFS shall start and operate on inclines up to +/- 5 degrees from horizontal.

b. Operation. The MFS shall be capable of operating under any environmental condition or combination of conditions as specified in 3.8. No leakage, contamination, or damage to the MFS shall result from operation.

c. Stopping. As required, MFS shall be equipped with a manual stop to stop the flow of fuel within 5 seconds after activation.

3.5.3 Failsafe structure. Failure of the TRM bailbar or loading bar shall not result in a rupture of the tank. The head of the tank shall be protected from accidental puncture by the LHS hook when engaging the bailbar or loading bar. The TRM/PRM base and frame shall protect components of the TRM/PRM from damage caused by loading and unloading onto its prime mover, transport, and normal use and abuse in the military environment. Components mounted to the TRM/PRM base and frame shall be protected from accidental contact and damage by foreign objects on the ground.

3.5.4 Weight. The maximum gross weight of the TRM, fully loaded with fuel, and the maximum gross weight of the PRM and all associated components including the container frame, shall not exceed the loading, unloading, and lifting capabilities of the HEMTT-LHS of 26,000 pounds. The center-of-gravity limit for the 26,000 pound flatrack for transport by the HEMTT 1120 is 110.3 inches from the front of the flatrack and 39.9 inches from the bottom of the flatrack.

3.5.5 Component housings and storage boxes. All housings and boxes shall protect a component from damage, reduce noise signature, store equipment, etc. and shall exclude wind driven rain, snow and sand from the interior of the box or housing. All components contained in

housings and boxes shall be easily identified and accessible to allow fast and expedient removal and inventory. All housing and box doors shall be self-supporting in the open position, and shall be labeled to indicate items accessible through them. Housings and boxes shall not allow either the buildup of air pressure or the retention of fluid. All component housings shall be removable or allow sufficient interior access to permit performance of all inspection and unscheduled and scheduled maintenance actions including the removal of all major components contained within. The housings shall have permanently mounted doors allowing access to perform preventive, scheduled and unscheduled maintenance service actions.

3.5.5.1 Equipment box (es). Each TRM and PRM shall be equipped with equipment storage boxes. The storage boxes shall be compartmented, contain a lockable hasp, and have provisions for holding the lid in an open position. Unless specified elsewhere, the box (es) shall provide enough space to organize and protect from corrosion and other damage all tools, accessories, publications, and any other Basic Issue Items (BII) supplied with the MFS. Equipment boxes shall be accessible by personnel standing at ground level when the MFS is sitting on the ground.

3.5.5.2 Hose storage. The MFS shall have lockable storage tubes capable of storing all non-collapsible hoses as specified in 3.5.7.1. In addition, the PRM shall provide storage capacity for all collapsible hoses as specified in 3.5.7.1. Each TRM shall have storage tubes located where they can be accessible by personnel standing at ground level when the system is truck or trailer mounted. The storage tubes shall have a permanently attached cover at both ends and shall prevent damage to the hoses.

3.5.6 Major Components.

3.5.6.1 Tankrack Module (TRM).

3.5.6.1.1 Capacity. The tank shall have a capacity of 2,500 gallons with a desired capacity of 3,000 gallons (plus 5 percent (%) capacity providing for expansion of the fuel) of bulk petroleum product as specified in 3.5.9. The TRM shall contain secure storage for hoses and nozzles as specified in 3.5.9.2 and 3.5.7.1, and other equipment necessary for maintenance and refueling operations.

3.5.6.1.2 Pressure relief. Relief valves used to relieve over or under pressure in the tank shall not allow flow of liquids, dust, and dirt into or out of the tank and shall be automatic in operation. Relief valves shall prevent deformation of the tank structure and conditions of reduced flow from vacuum or pressure build-ups, through equalization of tank pressure under all loading, unloading, and operating conditions specified herein. Tank vents shall restrict evaporative loss. Tank pressure relief system shall meet the requirements of DOT 49CFR178.346-3. The tank and associated components shall present a closed system that shall not vent externally when in the air transport configuration. Fluids and vapors within the tanks and associated components shall not be permitted to mix with cabin air inside the aircraft cargo compartment under any normal or emergency flight conditions. Aircraft overboard venting shall not be used.

3.5.6.1.3 Load stabilization. The tank shall be equipped with permanent tank baffling, surge plates, or other provisions to minimize longitudinal, lateral, and vertical sloshing of fluid during transport of partial loads to the extent required to meet the requirements of this PD.

3.5.6.1.4 Cleaning. The design shall provide ease of cleaning the complete tank compartment of sediment and contaminants. Provisions to allow the tank to drain to the maximum extent possible as specified in 3.5.9.8 and unassisted when sitting level shall be provided. All inside surfaces of the tank shall be smooth, allow no trapped or freestanding pocketing of fuel when drained, and shall not provide an environment that favors microbial growth. Internal baffles or load stabilization provisions shall not restrict access by personnel to any part of the tank.

3.5.6.1.5 Manhole. The tank shall be equipped with a hinged manhole cover. The manhole shall be designed so that no fuel spillage occurs when loading or unloading the TRM, with fuel at any level, from or to the LHS or PLS truck or trailer. The manhole assembly shall meet the requirements of DOT 49CFR178.345-5. The opening for the manhole shall be raised above the level of the top of the tank a minimum of 2 inches, to prevent debris from falling into the tank when opening the manhole. The manhole shall be lockable with a hasp. Access to the inside of the tank shall allow 5^{th} percentile female to 95^{th} percentile male soldier equipped with proper safety equipment to ingress and egress the inside of the tank. Soldier safety shall be considered when designing method of access.

3.5.6.1.6 Fuel level gauges. Each TRM shall be equipped with a fuel level indicator, viewable by a soldier standing on the ground. The level indicator shall not be of a sight-glass type, and shall be accurate within ± 5 percent with the TRM sitting level. Each TRM shall be provided with a fuel level gauge stick to physically measure the amount of fuel in the tank through the manhole. A storage location shall be provided on the top of the TRM for the gauge stick.

3.5.6.1.8 TRM interconnection. The TRM shall be capable of being interconnected to another TRM positioned 30 feet apart using non-collapsible hose as specified in 3.5.7.1. The TRM shall have the ability to interconnect, within the terrain features that might be encountered, to allow for filling and dispensing from more than one TRM at a time. Each TRM shall have provisions that allow the MFS to add TRMs, up to the maximum number of TRMs as specified herein, once the MFS is set up and the suction manifold is full of fuel, without spilling fuel. Provisions shall minimize pressure drop at the maximum extent.

3.5.6.1.8 Structural durability. Throughout the range of fuel payloads, the MFS shall be capable of withstanding loading and unloading operations to and from the HEMTT-LHS, PLS truck, PLS trailers, and capable of being transported as defined in this document without spilling fuel, developing leaks, or incurring damage, deformation or degradation of the TRM or components. All external TRM dimensions shall be maintained within the allowable tolerances of ISO 668. All TRMs shall meet the applicable requirements of DOT 49 CFR 178.345-3(a), DOT 49 CFR 178.345-4(a), DOT 49 CFR 178.345-6, DOT 49 CFR 178.345-8(b)(2), DOT 49 CFR 178.345-8(c)(1), DOT 49 CFR 178.345-8(c)(2), DOT 49 CFR 178.346-1(b) and DOT 49 CFR 180.411(b). Structural requirements for the tank and all associated hardware and the fluid

areas filled to the shipping configuration, shall withstand minimum deceleration forces of 3G longitudinally, 2G vertically up, 1.5 laterally, and 4.5 G vertically down. The tank and associated components shall withstand external loss of pressure up to 13psi.

3.5.6.1.9 Detachable ladder. A ladder shall be provided to safely perform operator-level Preventive Maintenance Checks and Services (PMCS) and to get access to the stowage cabinet. The ladder shall be one-person portable and securely stowed on each TRM within the exterior dimensions of the ISO envelope. The ladder shall comply with paragraphs 3.7.1.1 and 3.7.1.2 herein and 29CFR1910.26. The ladder interface points shall be located where PMCS shall be conducted and compatible with the TRM ladder, the PLS ladder, and the HEMTT ladder.

3.5.6.1.10 Pumping assembly. The TRM shall be equipped with pumping capability to dispense filtered fuel at a rate of 20 gpm (threshold) with a desired rate of 50 gpm (Objective). The rated capacity of the pump shall apply to the designated primary fuel as specified in paragraph 3.5.9 herein. The pump shall be self priming within two minutes of start and shall not require fuel to be poured into the casing for an initial prime. The system shall have the capability to operate at no flow conditions for up to five minutes without harm. The pump shall be continuous-duty for a minimum of two hours and comply with all requirements herein. The TRM shall be capable of dispensing fuel by gravity flow, while mounted on HEMTT-LHS, PLS truck, and PLS trailer, a minimum of 99 percent of the tank volume. The system shall be capable of evacuating/draining all lines, hoses, and components downstream of the pump. The pumping assembly shall include an adequate number of hose(s) equipped with quick disconnect fittings to allow refueling of vehicles and equipment positioned a minimum of 25 feet away from the TRM. All pump intake openings should have a removable, cleanable screen to prevent foreign objects from entering the pump. The pumping assembly shall be protected against severe environmental conditions as specified in paragraph 3.8 herein. The pumping assembly shall be capable of withstanding vibration stresses induced by the various modes of transportation without permanent damage, deformation, or performance degradation such as, but not limited to, leaks. The pump shall be easily removable for maintenance and be capable of being carried by two MOS 92 soldiers. If the pump is driven by an electric motor, the TRM shall have a remote control on a cable for switching the pump ON/OFF from a location up to 40-feet from the pump. The remote ON/OFF power switching device shall not interfere with the operation of any other electrical equipment. The cable for the remote power switch shall connect to the pump using a standard connector so the cable and control can be replaced if it is damaged. The pumping assembly shall have an three-position toggle switch mounted on the TRM, to control the pump without the remote power switch. The three-position toggle switch shall be hermetically sealed, and shall be marked for positions to control whether pump is "OFF", "MANUAL ON" (with or without the remote power switch connected), and "REMOTE" selections. The pumping assembly shall include means to prevent unauthorized use.

3.5.6.1.11 Filtration and Water Separation System. The filtration and water separation system shall be capable of removing sediment and undissolved water from bulk fuel at the maximum rated flow of the pumping assembly. The performance of the filtration and water separation system shall be IAW API/IP Specification 1581 Fifth edition, Category M, Type S. Mandatory filter/separator accessories are required and as specified herein. The filtration and water separation system shall be capable of providing direct reading of differential pressure

across the filtration and water separation system without the manipulation of valves. The differential pressure gauge shall have an accuracy of +/- 0.5 psi and shall not require periodic calibration. A means to prevent sediment from obstructing proper operation of the filtration and water system shall be provided. The gauge or device shall be color-coded to indicate 'normal operating conditions', 'marginal operating condition', and 'immediate service required' ranges according to filter-coalescer element manufacturer's recommendation. The filtration and water separation system shall be provided with a device to manually or automatically vent trapped air from the top of the filtration and water separation system while minimizing release of fuel during venting. The filtration and water separation system shall be provided with a device to manually drain the water from the sump under operating conditions. The filtration and water separation system shall be provided with a sight gauge that shall clearly show the level of collected water within the sump. A mark on this sight gauge shall be provided to indicate when the water should be discharged before it reaches the bottom of the elements. The discharge outlet shall be equipped to control the discharge flow and direct it safely into an appropriate size and type receptacle. A means to draw fuel samples from the center of fuel flow shall be provided at both the inlet and outlet of the filtration and water separation system. A quick disconnect coupler with dust plug shall be provided at each sampling point. The quick disconnect coupler shall interface with Gammon Actuator Nipple, model GTP-772 (or equivalent) without binding or leaking during sampling. The filtration and water separation system shall be capable of withstanding a hydrostatic test pressure of 60 pounds per square inch (psi) for 10 minutes without leaks or degradation of performance. To insure proper interface and interchangeability with existing US Army filter/separator vessels, the filtration and water separation system shall incorporate filter-coalescer elements fabricated and assembled to the form and dimensions IAW DESC-X-P-2, Category 2 or 3 (API 6 by 22 inch, or MIL-PRF-52308).

3.5.6.2 Pump Rack Module (PRM). The MFS shall include a PRM capable of refueling both ground vehicles and aircraft. The PRM shall be capable of being transported by the HEMTT-LHS, PLS, and PLS trailer. All necessary fittings shall be provided to connect the Hammonds fuel additive injector, part number 4TP-4A-800MIL to the outlet of the pumping assembly IAW 3.5.6.3. The PRM shall contain secure storage as specified in paragraph 3.5.5 and 3.5.5.1 for all hoses, fittings, nozzles, fire extinguishers, petroleum test kit, fuel spill control kit, and other equipment necessary to perform refueling operation.

3.5.6.2.1 Pumping assembly. The pumping assembly shall consist of a self-priming pump and a power source. The pumping assembly shall be easily removable from its module for maintenance purposes.

3.5.6.2.1.1 Pump capacity. The PRM, when connected to the fuel additive injector as specified in paragraph 3.5.6.2, shall be capable of providing filtered fuel according to the following scenarios: bulk refueling at a rate of 400 gallons per minute (GPM) (threshold) and 600 GPM (objective), retail-refueling at a rate of 50 GPM to eight nozzles simultaneously. Spacing between the dispensing points and PRM shall be a minimum of 100 feet. The system shall have the capability to operate at no flow conditions for up to 5 minutes without harm. The pumping assembly shall operate continually for four hours at maximum performance without being refueled or serviced.

3.5.6.2.1.2 Filtration and Water Separation System. The filtration and water separation system shall be capable of removing sediment and undissolved water from bulk fuel at the maximum rated flow of the pumping assembly. The filtration and water separation system shall be IAW API/IP Specification 1581 Fifth edition, Category M, Type S. Mandatory filter/separator accessories are required and as specified herein. The filtration and water separation system shall be capable of providing direct reading of differential pressure across the filtration and water separation system without the manipulation of valves. The differential pressure gauge shall have an accuracy of +/- .5 psi and shall not require periodic calibration. A means to prevent sediment from obstructing proper operation shall be provided. The gauge or device shall be color-coded to indicate normal operating conditions, marginal operating condition, and immediate service required ranges according to filter-coalescer element manufacturer's recommendation. The filtration and water separation system shall be provided with a device to manually or automatically vent trapped air from the top of the filtration and water separation system while minimizing release of fuel during venting. The filtration and water separation system shall be provided with a device to manually drain the water from the sump under operating conditions. The filtration and water separation system shall be provided with a sight gauge that shall clearly show the level of collected water within the sump. A mark on this sight gauge shall be provided to indicate when the water should be discharged before it reaches the bottom of the elements. The drain shall maximize water removal and inhibit discharge of fuel with the water. The discharge outlet shall be equipped to control the discharge flow and direct it safely into an appropriate size and type receptacle. A means to draw fuel samples from the center of fuel flow shall be provided at both the inlet and outlet of the filtration and water separation system. A quick disconnect coupler with dust plug shall be provided at each sampling point. The quick disconnect coupler shall interface with Gammon Actuator Nipple, model GTP-772 (or equivalent) without binding or leaking during sampling. The filtration and water separation system shall be capable of withstanding a hydrostatic test pressure IAW ASME BPVC, Sec. VIII, Div. 1. The filtration and water separation system shall incorporate filter-coalescer elements fabricated and assembled to the form and dimensions shown in MIL-PRF-52308 Figure 1 and Figure 2 to insure proper interface and interchangeability with existing US Army filter/separator vessels.

3.5.6.2.2 Power source. The power source shall be capable of meeting all performance requirements specified herein. The power source shall be compliant with EPA Tier II non-road exhaust emission standards. Pollution control technologies that are impacted by the sulfur level of the JP-8 fuel either in maintenance or life expectancy shall not be used, e.g., externally cooled Exhaust Gas Recirculation (EGR), NOX traps, catalytic converters, etc. In addition, lubricity canisters/filters should not be required for proper power source operations. The power source shall be capable of starting and operating in all environmental conditions referenced in section 3.8, and shall be capable of operating on all fuels for extended periods (over 1 year) specified in section 3.5.9 at rated system capacity without damage. The power source shall be equipped with a device to prevent the engine from pumping over the hose maximum pressure, or any other components of the MFS. It shall also be equipped with an integral recharging capability to maintain sufficient battery charge during all modes of operation as specified herein. All lines including fuel lines and fuel line fittings shall be protected from any accidental contact and damage by foreign objects and components of the PRM including the pumping assembly. The exhaust system shall prevent any interference and/or cumulative damage to any part of the PRM

such as, but not limited to, the emergency shut off line, and shall be physically safe so as not to be a hazard to operating personnel. The fuel cap shall not leak during any mode of operation, including loading and unloading the PRM.

3.5.6.2.3 Starting system. The PRM power source shall be equipped with electric start capability.

3.5.6.2.4 Control panel. Each PRM shall be equipped with an integrated control panel containing all necessary controls required to operate the pump assembly including an engine-hour meter. Sufficient indicators shall be provided to inform the user of operating status at all times, under both conditions of normal operation and activation of system shut-offs. The control panel shall include an indicator for monitoring system voltage. The control panel shall meet the requirements for NEMA 250 Type 4X enclosures to protect against severe environmental conditions. All switching components shall be hermetically sealed. The control panel shall have the capability of displaying at least volumetric flow rate and the differential pressure across the filtration system to an accuracy of ± two percent (2%). All control panel components including circuit boards, switches, and light-emitting diodes (LEDs) shall be replaceable within ten minutes without special tools (see 3.7.4.2). The control panel shall include the power source's diagnostic connector. The diagnostic connector shall be attached to the panel for connecting to the test, measurement, and diagnostic equipment (TMDE) without damaging the connector or wiring. The control panel shall be easily operable by soldiers wearing MOPP IV as specified in 3.7.2. Controls, gauges, and indicators shall be readable in direct sunlight. A space of 25"(L) x 28"(W) x 11"(D) underneath the control panel shall be provided to enable the installation of a tactical display control unit.

3.5.6.2.4.1 Operational fault controls. In addition to the emergency manual stop, as a minimum operational automatic fault shut-offs shall be incorporated into the PRM to prevent system damage or minimize hazard to personnel as a result of:

a. Engine overspeed, low operating pressure, high product temperature, and high engine temperature;

b. Low fuel level/run-dry operation;

c. Excessive electrical currents and voltages (if system is equipped with an on-board electrical power generator)

d. High or low pumping assembly suction and discharge pressure.

When a shut-off is activated, sufficient indication of the condition(s) shall be provided to the operator via the control panel. After the condition that caused activation of the shut-off is resolved, the system shall be capable of resetting to normal operating status. Manual override of shut-off shall be provided. A toggle switch shall be provided on manual overrides. Each toggle switch shall include a red toggle switch safety cover in order to prevent any accidental manipulation of the override.

3.5.6.2.4.2 Lighting. The control panel shall be backlit to allow operation in reduced daylight visibility, nighttime, and blackout conditions.

3.5.6.2.4.2.1 Non-tactical conditions. Permanent backlighting shall be provided to ensure safe operation of the control panel in darkness and periods of reduced visibility. Lighting shall allow the reading of dials and gages, the reading of item identifications, instructions, and warnings, and the operation of switches and controls. Control panel illumination shall not require dark adaptation by the user.

3.5.6.2.4.2.2 Tactical/blackout operations. The control panel shall provide tactical/blackout lighting that meets the following requirements:

a. Ninety-five percent of the light energy emitted by each light source shall be at wavelengths below 700 nanometers.

b. All lighting shall be dimmable to 0.05 foot-Lamberts (fL) or less.

c. All light sources shall be controlled by a single on-off blackout switch, labeled "LIGHTS."

3.5.6.2.5 Emergency shutoff. The MFS shall be equipped with a manual shutoff capability located at the operator's position that stops the flow of fuel within 5 seconds after activation in the event of an emergency. In addition to the manual shut-off, the PRM shall include a reel-mounted "dead-man" switch that, when released, stops the flow of fuel from the filtration unit.

3.5.6.2.6 Fuel supply. The PRM shall have an integral fuel supply capacity sufficient to allow no less than 4 hours of operation under full load. Fuel re-supply shall be supplied to the PRM from the pumpage.

3.5.6.3 Piping system. The piping system shall be designed to allow easy access to all components for maintenance, repair and operation. The piping system shall be designed to prevent contact between the bulk fuel and other operating fluids. All discharge hoses and connections specified herein shall be equipped with sexless dry disconnect fittings IAW A-A-59377, with captive dust caps. All ports, with the exception of top loading, shall be equipped with shut-off valves. All ports shall be located within the TRM/PRM ISO structure and shall not overlap with the TRM/PRM ISO frame. A shut-off valve shall be provided at all tank/piping system interfaces to allow flow stoppage from the tank. All valves or valve controls shall be easily accessible and identifiable to the operator and shall have provisions that inform the user of operating status (open or closed). Retaining lanyards are not an acceptable solution to securely attach label/tags to the valves. The piping system shall meet the requirements of DOT 49CFR178.345-11(d) as applicable.

3.5.6.3.1 Emergency valve**.** Each TRM shall be equipped with a self-closing shut-off valve IAW NFPA 385 (paragraph 2-4) to allow flow stoppage from the tank. The emergency valve shall prevent any unintended opening through impact or other inadvertent act. The shut-off valves shall be equipped with a control system that includes a mechanism that permits automatic valve closure of valves in case of emergencies. The setting of the valve (open or closed) shall be easily identifiable from the ground. The operator shall be able to manually and remotely open or close the emergency valve from a control assembly. The valve shall continue to be effective in the event of damage to the external device for controlling the operation of the

valve. The controls for manual emergency valve closure shall be located on both sides of the TRM. Each control location shall be stenciled with the words “EMERGENCY SHUT-OFF”.

3.5.6.3.2 Inspection and clean-out. The design of the MFS piping system shall provide ease of cleaning of the manifold(s) without contamination of the system. Valves shall be located such that the piping system can be completely drained.

3.5.6.3.3 Vapor Recovery Pipe. The TRMs shall be capable of capturing the vapors displaced from the tank during refueling operation. The connection shall be a 4-inch camlock.

3.5.6.3.4 Bottom fill and discharge ports. The TRM shall be provided with two bottom port(s) equipped with 4-inch female cam-lock fitting, IAW A-A-59326. The 4-inch bottom discharge/suction ports shall be capable of providing gravity and forced discharge, recirculation of filtered fuel, and bottom loading from an external pumped source rated up to 400GPM and shall be capable of transferring fuel from and to a HEMTT tanker without requiring the trailer to be unhooked and repositioned. In addition, all TRMs shall be capable of being bottom loaded using a single point-refueling nozzle, IAW SAE-AS-5877.

3.5.6.3.5 Retail dispensing ports. The TRM shall include a minimum of two ports, one on each side, with 2-inch unisex fittings. These ports shall be capable of discharging fuel either by gravity or utilizing the pumping assembly specified in 3.5.6.1.10.

3.5.6.3.6 Top loading port. The TRM shall be capable of top loading through a port equipped with a 2-inch unisex fitting and tethered cap. The port shall be raised a minimum of two inches to prevent debris from entering the tank. Easy and safe access to the top loading port shall be possible from the catwalk specified in 3.5.7.3 without requiring stepping or walking on the tank. The top loading port shall include a drop tube to aid in emergency top loading of the tank when bottom loading is not possible. The drop tube shall extend to the bottom of the tank.

3.5.6.3.7 Line strainer. The piping system shall include an in-line strainer before the pump to prevent damage to the pump by debris. The strainer shall be corrosion resistant. The strainer shall be accessible for inspection and cleaning at the operator level, without special tools.

3.5.6.3.8 Bleed reservoir. The PRM shall be provided with a common tank where all lines on the PRM that may release fuel are consolidated and all potential fuel releases are captured and contained. The bleed reservoir shall be easily accessible and removable for maintenance and cleaning purposes. The bleed reservoir shall be provided with a device that shall clearly show the level of collected fuel within the tank. A mark on this device shall be provided to indicate when the fuel shall be discharged. Mounting to securely attach the bleed reservoir to the PRM shall be provided. The reservoir shall allow for venting of pressure and prevent dirt and contamination from entering the bleed reservoir.

3.5.7 Non major components.

3.5.7.1 Hose. Two segments of 4-inch non-collapsible hose, 15 feet in length, one segment of 4-inch non-collapsible hose, 8 feet in length, and one segment of 4-inch non-

collapsible hose, 6 feet in length shall be supplied with each TRM. Four segments of 4-inch non-collapsible hose, 15 feet in length equipped with 4 inch camlock fittings, one male and one female, shall be supplied with each PRM. Each of these 4 segments shall be equipped with one 4-inch male cam-lock fitting with tethered cap on one end and one 4-inch female cam-lock fitting with tethered plug on the other end IAW A-A-59326. In addition, an adequate number of 50ft segments of collapsible hose shall be supplied with each PRM and shall be capable of supplying fuel to eight refueling points IAW 3.5.9.1 and 3.5.6.2.1.1. All hoses used on or supplied with the MFS shall be IAW MIL-PRF-370. All hose lengths specified herein are nominal lengths for the overall hose assembly.

3.5.7.2 Adapters.

3.5.7.2.1 Army Adapters. The MFS shall be provided with the adapters and reducers as specified in 3.5.7.2.1.1 though 3.5.7.2.1.2 to allow interfacing with existing Army bulk storage and distribution equipment.

3.5.7.2.1.1 PRM Adapters/Reducers.

(2) 2-inch unisex to 2-inch female cam-lock adapter
(2) 2-inch unisex to 2-inch male cam-lock adapter
(2) 4-inch female to 2-inch male cam-lock reducer
(1) 4-inch female to 3-inch male cam-lock reducer
(1) 6-inch male to 4-inch female cam-lock reducer

3.5.7.2.1.2 TRM Reducer.

(1) 4-inch male to 3-inch female cam-lock reducer

3.5.7.2.2 NATO Fittings for PRM. Each PRM shall be provided with fittings as specified in 3.5.7.2.2.1 through 3.5.7.2.2.2.7.

3.5.7.2.2.1 Coupling, rail tanker, NATO. One fitting shall be provided for attachment to (non-US) railroad fuel tank cars, with an angular orientation approximately as shown in U.S. Army drawing # 13222E8219. It shall be provided with an inlet capable of clamping and locking onto 80 mm to 140 mm size outside diameter, male, tank car outlets. The clamping mechanism shall incorporate a tension-adjusting, quick release feature, and the coupling shall have a captivated, fuel resistant gasket. The coupling outlet shall have ISO 228/1 G3A external thread (80mm British Standard Pipe (BSP)) conforming to ISO 228-1.

3.5.7.2.2.2 Coupling-set, tank truck, NATO. The fittings defined in these subordinate paragraphs delineate specific interface requirements, governed by international standardization agreements and comprise the NATO tank truck coupling set. One NATO tank truck coupling set as referenced in U.S Army drawing # 13222E8212 shall be provided for each PRM.

3.5.7.2.2.2.1 Coupling half, female, NATO. The fitting shall be a cam-locking, quick disconnect, 3-inch female coupling half in accordance with A-A-59326, except with an ISO 228/1 G3A internal thread (80mm BSP) conforming to ISO 228-1.

3.5.7.2.2.2.2 Coupling half, male, NATO. The fitting shall be a cam-locking, quick disconnect, 3-inch male coupling half in accordance with A-A-59326, except with an ISO 228/1 G3A internal thread (80mm BSP) conforming to ISO 228-1.

3.5.7.2.2.2.3 Adapter, hose coupling, NATO. The fitting shall be a coupling with ISO 228/1 G3A external threads (80mm BSP) conforming to ISO 228-1 at both ends. The fitting shall not be greater than 3.00 inches long, and shall be provided with spanner wrenching lugs, approximately 90° apart.

3.5.7.2.2.2.4 Coupling half, female, tank truck, NATO. One NATO tank truck female coupling, size NW80, set as referenced in U.S Army drawing # 13222E8217 shall be provided for each PRM.

3.5.7.2.2.2.5 Coupling half, male, tank truck, NATO. One NATO tank truck male coupling, size NW80, set as referenced in U.S Army drawing # 13222E8218 shall be provided for each PRM.

3.5.7.2.2.2.6 Adapter, NATO (NPSH). The fitting shall be an adaptor with an ISO 228/1 G3A external thread (80mm BSP) conforming to ISO 228-1 at one end, and a 3-8 NPSH external thread conforming to ASME B1.20.7 at the other. The fitting shall not be greater than 3.25 inches long, and shall be provided with hammer-type lugs approximately 180° apart.

3.5.7.2.2.2.7 Adapter, NATO (NPT). The fitting shall be an adapter with an ISO 228/1 G3A external thread (80mm BSP) conforming to ISO 228-1 at one end, and a 3-8 NPT external thread conforming to ASME B1.20.1 at the other. The fitting shall not be greater than 3.25 inches long, and shall be provided with hammer-type lugs approximately 180° apart.

3.5.7.2.2.3 Reducers.
(1) 4-inch male cam-lock to 3-inch male cam-lock
(1) 2-inch unisex to 3-inch female cam-lock
(1) 2-inch unisex to 3-inch male cam-lock

3.5.7.2.3 NATO fittings for the TRM. Each TRM shall be provided with a 3-inch NATO Standard Connector as defined 3.5.7.2.3.1 through 3.5.7.2.3.2.

3.5.7.2.3.1 NATO Standard Adapter or Tank Unit. One male coupling adapter also known as Tank Unit shall be provided with a tethered dust cap and designed to permit connection via a bayonet style adapter without spillage when pressurized. The dimensions are considered interface dimensions and shall conform to Annex E of STANAG 3756 (PHE). The size (nominal 80 mm) and all other design requirements such as pressure rating, spillage, materials of construction, electrical continuity, clearance access, etc. are covered by the Annex E

of STANAG 3756 (PHE). The attachment end of the tank unit shall be a nominal 3-inch, male cam-locking style coupling per A-A-59326.

3.5.7.2.3.2 NATO Standard Connector or Hose Unit. One female coupling half also known as the Hose Unit shall be provided with a tethered dust plug and shall be designed to couple with the adapter or the Tank Unit of the coupling in any of the three lug positions. The dimensions are considered interface dimensions and shall conform to Annex E of STANAG 3756 (PHE). The female half shall be interlocked in such a way that the product cannot flow until a seal is achieved between the adapter and this hose unit. The interlock shall ensure that flow will cease before the seal between the adapter and hose unit is broken. The attachment end of the hose unit shall be a 3-inch, male cam-locking style coupling per A-A-59326.

3.5.7.3 Catwalk. Each TRM shall be equipped with a catwalk on the top of the tank to allow access to the manhole and top filling port. Provisions shall be provided for each TRM to drain (rain) water from the top of the tank including the catwalk. Access to the manhole or fill port shall not require personnel to step onto the tank. Handrails shall be provided to access the catwalk from the ground, allow safe operator access and departure, and to minimize the likelihood of accidental falls. The handrails shall be foldable or collapsible in place to facilitate stacking and transport of the TRM, however the stowed handrails shall be within the ISO envelope. Ease of deployment of the handrails and strength requirements to access the top of the TRM shall be considered when designing the deployment mechanism and methods for the handrail. The catwalk shall be capable of supporting a minimum of 450lbs/ft^2.

3.5.7.4 Fire extinguisher. A minimum of two fire extinguishers shall be provided for each TRM and each PRM, mounted in quick release brackets. The brackets shall hold the fire extinguisher securely during transport but shall be capable of being quickly released. Extinguishers shall be accessible to personnel standing on the ground. In addition, a minimum of one fire extinguisher shall be provided for each refueling point. The PRM shall provide adequate and secure storage for a minimum of eight fire extinguishers. The MFS shall be equipped with BC fire, Type I, Class 2, and size 20 extinguishers per A-A-393, IAW NFPA 385, and 407.

3.5.7.5 Grounding and bonding. The MFS shall have complete electrical continuity (bonding) throughout the system when in operational service configuration. This includes all electrically conductive components of the MFS that the fluid and the operator may come in contact with. All bonding and/or grounding connections shall be mechanically secure and shall measure 1 (one) ohm or less. Two manual reels each with one 15-ft grounding wire and plier-type clamps shall be provided for each TRM and each PRM.

3.5.7.5.1 Grounding rods. One grounding rod shall be provided for each TRM, each PRM, and each refueling point. The grounding rods shall include an integral rod insertion device to drive the rods into compacted soil. Each grounding rod shall be of sufficient length to provide a minimum of 36 inches of ground penetration. A storage location shall be provided for grounding rods within the TRM and PRM envelopes. A storage location shall be provided for the refueling point grounding rods on the PRM. (Reference: U.S. Army drawing 13219E0462 Ground Rod).

3.5.8 Electrical system. All electrical systems shall be 24 volt (nominal). All electrical systems shall be capable of sustained operation when any voltage between 22 and 30VDC is provided.

3.5.8.1 Battery. All batteries supplied with the PRM shall be IAW MIL-PRF-32143. Batteries shall be connected in 24-volt configuration and be readily accessible for service, inspection, and removal. Insulated boots shall be installed over the battery terminals. Batteries shall be of sufficient quantity and type to comply with the starting, lighting, normal and surge electrical loads, reserve electrical power capacity, and maintenance requirements. The batteries shall have sufficient capacity to start the system at -25 °F three times within a 1-hour period with a minimum of 15 minutes between starts after a 5 minute run period.

3.5.8.2 Battery cables. The positive cable(s) shall have a non-conductive red sleeve at both ends. The negative cable shall have a black non-conductive sleeve on both ends. Battery terminal non-conductive protective cover shall be provided on each battery terminal connector (red for positive and black for negative). The battery cables shall be marked to indicate polarity.

3.5.8.3 Battery box. A non-metallic, vented, battery box with cover shall be provided to retain/protect the batteries during operation and transport. The box shall allow for easy installation and removal of the battery. The box shall protect the batteries from external environmental conditions and shall provide for venting of battery gases. The box shall be resistant to battery electrolyte and shall allow drainage out of the box.

3.5.8.4 NATO intervehicle receptacle. A receptacle conforming to NATO STANAG 4074 Type 1 (reference: US Army TACOM drawing 11674728) with cover shall be provided in a protected position to each module. This shall allow the PRM and the TRM to accept electrical power from another 28 VDC military vehicle through a NATO Intervehicle Connector and Cable Assembly as specified in 3.5.8.5 for starting the power source, and as applicable, operating under emergency conditions. The receptacle shall be labeled “28 VOLTS”.

3.5.8.5 NATO intervehicle cable and plug assembly. A 20-ft. intervehicle cable and plug assembly, NSN 6150-01-022-6004 (Reference: drawing 11682336-1), IAW NATO STANAG 4074 shall be provided with each PRM to provide emergency electrical power and emergency starting capability to the PRM.

3.5.8.6 Auxiliary intervehicle cable and plug assembly. A 40-ft auxiliary intervehicle cable and plug assembly shall be provided on the TRM, if the TRM pumping assembly uses an electric motor. The assembly shall terminate with a type I plug (male) IAW NATO STANAG 4074. The auxiliary cable shall have provisions to restrict its use to the TRM. Hard wiring the cable to the pump is an acceptable solution. The auxiliary cable shall allow the pump assembly to accept electrical power from other nominal 24 VDC military systems including tactical vehicles and two-(2) kilowatt (kW) direct-current Military Tactical Generator (MTG) sets.

3.5.9 Fuel. The MFS shall be capable of operating on all military and commercial kerosene-based and diesel fuels conforming to, as a minimum, those listed below without restrictions or kits. JP-8 shall be the designated primary fuel for the MFS.

a. MIL-DTL-83133 (JP-8) (NATO F-34)
b. ASTM D 975 (Diesel-US commercial)
c. MIL-DTL-5624 (JP-5) (NATO F-44)
d. A-A-52557 (diesel–military, including NATO F-54)
e. ASTM D 1655 (Jet A-1/Jet A) (NATO F-35 – Jet A-1)
f. MIL-F-46162 Fuel, Diesel, Referee Grade

3.5.9.1 Fuel dispensing points. The PRM shall be capable of refueling a minimum of eight vehicles or aircrafts simultaneously. This shall include the capability to perform retail refueling using eight 1-1/2-inch automatic shut-off open port nozzles or eight 1-inch automatic shut-off open port nozzles IAW A-A-52030, type 2, class A, style 2. The MFS shall be capable of bulk bottom loading a minimum of four HEMTT tankers, tank and pump units (TPUs), or 5000-gallon tankers, and be capable of filling two 500-gallon collapsible drums simultaneously. All nozzles, fittings, and valves required to refuel, bottom load, and fill drums shall be equipped with sexless dry break couplings. Each dispensing point shall be a minimum of 100 feet from the PRM. Spacing between the dispensing points shall be a minimum of 100 feet. A military 5-gallon water can shall be provided at each refueling point and stored on each PRM.

3.5.9.2 Fuel dispensing nozzle. Each TRM shall be equipped with one 1-inch fuel nozzle IAW A-A 52030 type I, class A, style 2 to refuel vehicles. The nozzle shall be provided with a caution tag to prevent confusion with other nozzles in the system. Each PRM shall be equipped with eight single point refueling, D-1 type nozzles, equipped with a 100 mesh screen, IAW SAE-AS-5877, two closed circuit refueling (CCR) nozzles for aircraft refueling IAW MIL-PRF-52747, eight 1.5-inch automatic shut-off open port nozzles, and four 1-inch automatic shut-off open port nozzles IAW A-A-52030 type 2, class A, style 2. All nozzles shall be equipped with a bonding and grounding cable assembly.

3.5.9.3 Filtered fuel recirculation. The MFS shall have the ability to recirculate fuel and fuel filtered within the same storage tank or any other storage tank within the system. The MFS shall include the capability to bypass any component/assembly that may be removed as not required due to mission requirements (e.g. Fuel Additive Injector Assembly).

3.5.9.4 Fuel evacuation. The MFS shall be capable of evacuating all but residual fuel from the suction and discharge hoses and other system components prior to teardown. Evacuation, teardown, and recovery shall not require more than 1 hour using four MOS 92F soldiers and shall not require material handling equipment.

3.5.9.5 Test kit, petroleum: Aviation fuel contamination (portable). Each PRM shall include a portable petroleum test kit IAW MIL-PRF-52849.

3.5.9.6 Fuel flow rate measurement. The PRM shall be capable of determining the fuel flow rate and total amount of fuel passed into and out of the PRM at any given time within ± one percent (1%) of true flow rate. The electronic flow meter assembly shall have a minimum range of 0 to 630 gpm at 150 psi with a resettable counter and a totalizer and shall be capable of providing an electronic signal to a data acquisition system to be added at a later date. The indicator, counter, and totalizer shall be sealed for protection from moisture and dust. The flow

meter shall not be damaged by sudden flow rate surges or “gas slugs” pumped along with the liquid. The TRM shall have a flow meter, or totalizer, to measure the quantity of fuel pumped, in gallons. All displays of the flow meters shall be sealed for protection from moisture and dust. The TRM and components shall not be damaged by sudden flow rate surges or “gas slugs” pumped along with the liquid. The flow meter shall have an accuracy of 2% or better within at least 80% of the operational flow range. One meter display that allows the operator to reset before each dispensing operation shall be provided with a range from zero to a minimum of 9,999 gallons. The TRM shall have provisions to prevent either air or vapor from entering the flow meter.

3.5.9.7 Fill and discharge. Utilizing the PRM, the MFS shall be capable of self-loading and unloading fuel at the rate of 400 GPM (threshold), 600gpm (objective). The TRM shall be capable of bottom loading through its 4-inch port at a minimum rate of 400 gpm from any external source. Using a single point refueling, nozzle IAW SAE-AS-5877, and a 4-inch cam lock coupling connection provides a back-up method when a single point nozzle is not available. The TRM shall be provided with an automatic shutoff control device to prevent over filling the TRM under all bottom loading operations to include recirculating. The fuel overfill control system shall have the capability to signal the TRM to shut off the flow of fuel into the tank when the fuel volume reaches 2,500 gallons. The emergency valve arrangement shall be such as to minimize the splashing or spraying inside the tank for minimum vapor loss and best control of static electricity.

3.6 Interface requirements.

3.6.1 Transportability. The MFS shall be capable of being transported at any level of fuel by highway, rail, and marine. The transportability criteria shall be as specified in MIL-STD-1366. All slinging/tie-down provisions shall be labeled "LIFT", “TIEDOWN", or "LIFT TIEDOWN", as appropriate, in 1-in. (2.54 cm) high letters.

3.6.1.1 Transportation configurations.

a. Fixed wing
b. Rotary wing
c. Rail
d. Road- tactical and commercial
e. Water

3.6.1.2 Tie-down provisions. The MFS tie-down provisions shall be IAW MIL-STD-209 and MIL-STD-814, as appropriate.

3.6.1.3 Slinging provisions. The MFS shall be equipped with slinging provisions. Sling provisions shall be designed to allow lifting of the MFS IAW MIL-STD-913 and MIL-STD-209 without resulting in damage or permanent deformation to the components. Slinging provisions may also be used as tie-down provisions when such provisions meet the requirements of 3.6.1.2. The PRM and the TRM shall have provisions to allow four (4) soldiers to stand simultaneously on the top of the module during dual point lift hook-up with the helicopter. The design used

shall take into account ease of accessing the top of the module to include consideration of operator safety in the need for handholds, footholds, and handrails.

3.6.1.4 Air transport. The MFS shall have a compatible interface for removal from the prime mover and shipment as a separate unit. The MFS shall have features to permit loading and airlift on the C-130 463L cargo handling system while complying with all structural limitations and design requirements as given in MIL-HDBK-1791. The MFS shall not require aircraft power and shall have no EMI/EMF emissions during flight.

3.6.1.4.1 Air transport, fixed-wing (cargo aircraft). The TRM shall be airlifted only when empty or when the tank contains 2,500 gallons of fuel. The MFS shall be capable of being transported without restriction on C-130 and larger aircraft. MIL-HDBK-1791 may be used for guidance.

3.6.1.4.2 Air transport, rotary-wing. The MFS shall be capable of being transported externally by CH47D helicopters (below 2000 ft, 70 degrees F or lower, for 30 nautical miles IAW MIL-STD-1366) at any level of fuel from empty to the maximum payload IAW MIL-STD-1366. Provisions for Helicopter Sling Lift (HSL) shall be IAW MIL-STD-913.

3.6.1.4.3 Low Velocity Air Drop (LVAD). The TRMs as defined in CLIN 0021AA, full, should be capable of being airdropped and withstanding the impact forces encountered in LVAD from a C-130, C-141, C-5, and C-17 aircraft without damage or permanent deformation. Parachute suspensions and tiedown provisions should be provided IAW MIL-STD-814. MIL-HDBK-669 and MIL-HDBK-1791 may be used for guidance.

3.6.1.5 Rail transport. The MFS, when not mounted on prime mover shall be rail transportable in the U.S. and North Atlantic Treaty Organization (NATO) countries as a Container on Flat Car (COFC) without restriction, and shall have a dimensional profile within the Gabarit International de Chargement (GIC) outline diagram (see MIL-STD-1366). The MFS shall not sustain physical damage or reduction in performance or service life as the result of rail shipment, or railroad car impacts as specified in MIL-STD-810. The MFS, when mounted on a rail car, shall be capable of unrestricted transport by rail when full. The MFS, at any level of fuel, shall be rail transportable when mounted on its prime movers as specified in 3.1, when rail dimensional clearances allow.

3.6.1.6 Highway transport. The MFS when mounted on the HEMTT-LHS truck, PLS truck, PLS trailer, and conventional flatbed trailers, shall be capable of unrestricted highway transport IAW MIL-STD-1366 in the Continental United States (CONUS) and North Atlantic Treaty Organization (NATO) member countries.

3.6.1.7 Water transport. The MFS shall be transportable by commercial ships and barges, Army landing craft and barges, the Logistics Support Vessel (LSV) and Landing Craft Utility (LCU).

3.6.1.8 Safety approval. The MFS design shall be certified IAW 49 CFR 450-453 (safety approval for cargo containers used in international transport).

3.6.2 Lubricants. The lubricating oil requirements shall be satisfied by using one or more of the following depending on the ambient temperature: MIL-PRF-2104 and MIL-PRF-46167. Gear oil, if required, shall conform to SAE J 2360 and grease to MIL-PRF-10924. Means of lubrication shall be provided for all MFS components requiring routine lubrication. Lubrication fittings shall conform to SAE J 534. Antifreeze, if required, shall conform to A-A-52624, type I and II (Arctic).

3.7 Ownership and support requirements.

3.7.1 Safety. All electrical wiring, rotating, and reciprocating parts shall be electrically and physically safe, and shall be guarded so as not to be a hazard to operating personnel and to minimize the hazard of fire in the event of a fuel spillage or leakage from hoses and connections. All electrical terminals and wiring shall be completely enclosed or insulated IAW 49 CFR 393.28 to prevent inadvertent contact by personnel or equipment that may cause arcing to occur. Danger or caution signs, labels and markings shall be used to warn of potential or specific hazards.

3.7.1.1 TRM top access. Provisions shall be provided to allow safe and easy access to the catwalk on top of the TRM, when the TRM is both mounted and demounted from its prime carrier. The design used shall take into account ease of accessing the top of the TRM to include consideration of operator safety in the need for handholds, footholds, and handrails.

3.7.1.2 Non-skid surfaces. All walking and climbing areas, accessible for operation and/or maintenance, shall have a non-skid surface, either applied as a coating or inherent to the material itself. The non-skid surface shall provide proper drainage (rain water). An adhesive tape type surface is not acceptable. Ladder rungs and catwalk surface shall have an inherent, grate-type non-skid surface.

3.7.1.3 Workmanship. The MFS shall be constructed with the safety of the operator and maintainer in mind. Sharp edges, sharp points, “head bangers”, “shin bangers” and pinch points shall be avoided.

3.7.2 Reliability. The mean time between hardware essential function failures (MTBHEFF) shall be not less than 350 hours - for the PRM and not less than 125 hours for the TRM.

3.7.3 Maintainability. All lubrication fittings shall be accessible without removal of major components. Electrical fittings shall be waterproof, corrosion resistant, and resistant to disconnection due to vibration. Engine oil shall be drainable without flowing onto other components. The total maintenance ratio (see 6.5.7) shall not exceed 0.07 maintenance man-hours/operating hours.

3.7.3.1 Time to repair. The median time to repair (MedTTR) shall not exceed one hour. The maximum time to repair (MAXTTR) for 90% of all Essential Unscheduled Maintenance Demands (EUMD) shall not exceed 1.5 hours.

3.7.4 Servicing, operation, and maintenance. The MFS support concept shall use two-level organic maintenance, and shall conform to the requirements and guidance according to AR 750-1, DA PAM 750-35, and DA PAM 750-8. The MFS shall be designed to reduce or eliminate as many tools, special tools, and test equipment as possible. If required to support the MFS, all tools, special tools, and test equipment shall be designed and provided by the contractor as part of each MFS to assemble, disassemble, maintain, and repair by the designated MFS operators and maintainers as required below. Maximum utilization of existing DOD and US Army tools and support equipment is required (see 6.5.3). If test, measurement, and diagnostic equipment (TMDE) is required, it shall be selected IAW the criteria set forth in AR 750-43 and subject to Government approval.

3.7.4.1 Operator. All tools, special tools, and test equipment required to perform Operator-level Preventive Maintenance Checks and Services (PMCS) which includes assemble, disassemble, adjust, maintain, diagnose, and repair or report the condition of the MFS during the required MFS service life shall be provided with each MFS along with the required stowage space.

3.7.4.2 Field and Sustainment Maintenance. All tools, special tools, and test equipment required to adjust, maintain, and repair the MFS that are not already available to the upper level echelon repair organization that would normally provide these services to the using unit during the required MFS service life requirement shall be provided in the quantities specified in Section 6.2. Examples of tools already available include, but are not limited to, the Army's General Mechanics Tool Kit (NSN 5180-01-548-7634), Organizational Maintenance Common No. 1 Tool Kit (NSN 4910-00-754-0654), Common No. 2 Tool Kit (NSN 4910-00-754-0650, and Tool Kit Supplement No. 1 (NSN 4910-00-754-0653), and U.S. Army Supply Catalogs 4910-95-A73 and 4910-95-A74. The Contractor shall select the equipment in the following order of preference:

a. Tools available in specified tool kits
b. Test, Measurement and Diagnostic Equipment (TMDE), which is currently part of the Department of Defense
c. Commercially available items not previously identified.

3.7.5 Camouflage. The PRM modules shall include provisions to aid in the tiedown of camouflage netting while in transport. Provisions shall be positioned within the ISO envelope.

3.8 Environmental requirements. The MFS shall have full mission capability in all environments in which it is intended to operate. Design of the MFS shall preclude contamination of the fuel by environmental effects. The MFS shall not require any specific weather, oceanographic, or geophysical support. The MFS shall be capable of being stored, transported, and operated under the environmental conditions specified below. AR 70-38 may be used for guidance regarding consideration of hot, basic, and basic-cold climatic conditions. In addition, exposure to wind, either naturally occurring, resulting from exposure during transport, or a combination of both, shall be considered, along with their combined effect with other environmental conditions, such as cold temperature.

3.8.1 Temperature. The MFS shall be capable of being operated, transported, and stored as defined herein within the following minimum ambient temperature ranges:

a. Operating – General, to include required freeze prevention both during intra-theater transport (see 6.5.9) and operation IAW the MFS OMS/MP: -25ºF to 120ºF.

b. Storage temperature. The MFS, when stored for two (2) years in an open environment or four (4) years in a warehouse environment, shall not be damaged by any ambient temperature from - 50°F to +160°F.

c. Inter-Theater Transport (ref. para. 6.5.8): -28°F to +160°F

The MFS, when filled, shall be capable of withstanding thermal expansion of the fuel without leaking or venting.

3.8.2 Sand. The MFS shall be capable of performing in a blowing sand environment when subjected to a minimum sand concentration of 0.0623 ± 0.015 g/ft^3 at a minimum wind velocity of 3540 feet per minute (ft/min).

3.8.3 Dust. The MFS shall be capable of performing in a blowing dust environment when subjected to a minimum dust concentration of 0.3 ± 0.2 grams per ft^3 (g/ft^3) at a minimum wind velocity of 1750 ft/min.

3.8.4 Humidity. The MFS shall perform as specified under relative humidity of up to 95% in saturation.

3.8.5 Solar radiation. The MFS shall perform as specified with up to 355 British thermal units (BTUs) per square foot per hour of solar radiation.

3.8.6 Rain. The MFS shall perform as specified herein with blowing rain of up to 4 inches per hour impinging on the system at 40mph.

3.8.7 Salt fog. The MFS shall withstand damage from salt fog.

3.8.8 Noise limits. Steady-state noise produced by the MFS shall not exceed 85 dB (A) at the operator's position and at occasionally occupied positions.

3.8.9 Electromagnetic Interference (EMI). The electromagnetic radiated interference and susceptibility characteristics of the MFS shall not exceed the limits specified in MIL-STD-461 for Army ground equipment or systems. The MFS shall meet ESD and inter-system EMC requirements as specified in MIL-STD-464.

3.8.10 High Altitude Electromagnetic Pulse (HEMP). The MFS shall not exhibit any malfunction or degradation of performance when subjected to the default free-field electromagnetic pulse (EMP) environment IAW MIL-STD-464.

3.8.11 Altitude. The MFS shall withstand the low-pressure environment in its storage configuration at maximum altitudes of 40,000 ft and perform as specified at altitudes up to and including 10,000 ft above sea level.

3.8.12 Ozone. All rubber components used on the MFS shall be ozone resistant as tested IAW ASTM D 1171.

3.8.13 Environmental hazard prevention. The MFS shall be designed to prevent inadvertent product discharge or leakage during operation, storage, and maintenance.

3.8.14 Fuel Spill Control Kit. Each TRM shall include supplies and equipment to allow the containment and clean-up to 10-gallon fuel spill minimum. Each TRM shall be equipped with a minimum of four portable drip pans. Each PRM shall include supplies and equipment to allow the containment and cleanup of up to 50-gallon fuel spill. In addition, each PRM shall be equipped with a minimum of 10 portable drip pans for use at hose connection points to capture any residual fuel remaining in the system. Each drip pan shall have a capacity of a minimum of five gallons and shall not impede the ability of the operator to install, operate, and recover the modules. Each module shall have provisions to securely store and transport the drip pans and the fuel spill control kit. The drip pans and the fuel spill control kit shall be easily accessible to personnel. In addition, the drip pans shall have non-collapsible walls and shall be capable of capturing and retaining residual fuel remaining in the system while supporting the hose assemblies at hose connection points. A method shall be provided to drain any fuel captured in the pan.

3.8.15 EPA compliant power source. The power source provided with the MFS shall have an EPA emission certification as specified in section 3.5.6.2.2.

3.9 Manpower and Personnel Integration (MANPRINT). As designated by DA PAM 611-21, the MFS shall be operable by MOS 92F (Petroleum Supply Specialist) ranging from the 5^{th} percentile female to the 95^{th} percentile male soldier and shall be maintainable by MOS 91J (Quartermaster and Chemical Equipment Repairman). The system shall be capable of being supported using the Army's current and emerging maintenance and logistics systems and be interoperable with other standard Army systems. PRMs components shall be designed and mounted for ease of removal and replacement. Electrical components shall not be soldered. Terminal boards, switches, light-emitting diodes (LEDs), and E-stops shall be a plug-and-play type part/component and shall be able to be removed and replaced in field conditions by the 91J without the use of special tools or equipment (see 3.7.4.2).

3.9.1 Human Factors Engineering (HFE). Maximum accessibility to the MFS components shall be maintained such that system operation, pre-operative checks, and routine operator maintenance can be accomplished as safely and efficiently as possible. MIL-STD 1472, or commercial equivalent standards, may be used for guidance regarding HFE consideration. All system controls and equipment shall be easily accessible and operable per specified requirements in all climatic conditions. The MFS shall contain controls and indicators that are easy to read, understand and use during day/night operations, and which are readable and operable by personnel standing on the ground. All equipment storage boxes and hardware requiring set-up

for the conduct of water/fuel dispensing operations shall be accessible by personnel standing on the ground. All features and controls of the MFS shall be operable by soldiers wearing cold/wet weather protective clothing, and ensemble for Mission Orientated Protective Posture (MOPP) Level IV. Operation of one control while wearing protective clothing hall not result in the accidental activation of another control. All individual MFS components requiring set up by personnel shall not exceed the combined lifting capability of 37 lbs per individual.

3.10 Identification, marking, and information. Unless specified otherwise, all identification, markings and operating/data plates applied to the MFS shall be IAW MIL-STD-130.

3.10.1 Data plates. Data plates shall be permanently attached to the MFS. All data plates shall be located in positions that are visible and accessible, but protected from damage during operation, movement, and handling, and any environmental conditions IAW paragraph 3.8 herein. Operating instruction, identification, and shipping data plates shall contain all necessary information for safe operation of the MFS. The MFS shall be equipped with instruction plates or diagrams, including warnings and cautions describing any procedures to be followed in assembling, operating or servicing the module. Data plates shall be provided describing procedures for preparing the MFS for transport in any of the modes described in 3.6.1, and identify Helicopter Sling Lift (HSL) and Low Velocity Air Drop (LVAD) tie-down provisions. Each TRM shall be inspected, tested, and marked IAW the requirements of DOT 49 CFR 178.345-14.

3.10.2 Markings. Markings shall be black lusterless paint, conforming to MIL-DTL-53039 or MIL-DTL-53072. The following markings shall be applied to the MFS:

a. "NO STEP", read from walking surface on top of the tank, shall be stenciled on the top of the tank adjacent to the catwalk, in black 4-inch block letters.
b. Each side of the TRM and the operator's end shall be stenciled with the following in an area of unobstructed visibility: "FLAMMABLE" in 4-inch block letters and "NO SMOKING WITHIN 50 FEET" in 2-inch block letters.
c. The following messages shall be stenciled in 2-inch block letters adjacent to the forklift pockets: "FORK LIFT EMPTY ONLY" and "USE 8 FOOT TINES ONLY".
d. The following shall be stenciled in plain view on or near the manhole cover:
"DANGER - Confined Space, Do Not Enter"
"Refer to Technical Manual"

Markings (d) shall be IAW Occupational Health and Safety Administration (OSHA) 29 CFR 1910.146. When opened, the manhole cover shall in no way obscure the marking from view. General placarding requirements shall be IAW 49 CFR 172.504. All placards shall be protected against severe environmental conditions IAW paragraph 3.8 herein. Each TRM and PRM shall be marked with an identification system provided by the Government. The identification system, including owner's code, serial number, and check digit, type code and operational marks shall be marked IAW ISO 6346 and shall not interfere with other markings.

3.11 Corrosion control performance. The MFS shall operate for a minimum for 25 years service life, which shall include varying or extended periods in corrosive environments involving one or more of the following: high humidity, salt spray, road de-icing agents, gravel impingement, atmospheric contamination, and temperature extremes. Only normal washing, scheduled maintenance (exclusive of paint touch-up) and repair of accidentally damaged areas (not as a result of intended use, deficiency in design, materials, manufacturing or normal wear) shall be necessary to keep the corrosion prevention in effect.

3.11.1 Corrosion during service life. During the specified service life, surface corrosion shall be a maximum of 0.1% (ASTM D610, rust Grade 8) on inside or outside surface of any component. There shall be no loss of original base metal thickness greater than 5% or .010 inch, whichever is less. In no case shall any area exhibit Stage 2 or greater corrosion (as defined in the US Army Corrosion Rating System) during the specified service life. There shall be no effect on form, fit, or function of any component due to corrosion, throughout the specified service life.

3.12 Chemical, Biological, and Radiological (CBR) survivability. The MFS shall be chemical, biological, and radiological (CBR) contamination survivable. The MFS shall be able to withstand the materiel damaging effects of CBR contaminants and decontaminants, be decontaminable to negligible risk levels to reduce hazard to personnel operating and maintaining the system, and be capable of being operated and maintained by personnel wearing the full CBR protection (MOPP IV) IAW FM 3-11.5. Consumable items such as gaskets, hoses, etc., can be replaced and do not need to be decontaminable. The corrosion control method selected and all materials shall be compatible with CBR decontamination procedures. Interior and exterior fluid traps shall be avoided. The CBR Contamination Survivability Criteria for Army Materiel should be used as guidance.

3.13 Treatment and painting.

a. Unless otherwise specified (see 6.2), all surfaces of the MFS except as noted below, regardless of the material selected, shall have a finish coat of chemical agent resistant coating (CARC) paint IAW MIL-DTL-53039, type IV or Water Dispersible Aliphatic Polyurethane, Chemical Agent (Waterborne CARC) paint IAW MIL-DTL-64159 type II. Finish coat color shall be determined at the time of purchase and either be green 383, chip number 34094 or tan 686, chip number 33446, per FED-STD-595. .

b. The following items shall not be painted: terminal wiring connections, instruction diagrams and plates, instrumentation, rubber, lubrication fittings, hoses, nozzles and all other parts whose operation or function would be adversely affected by paint. Insulation material shall be painted unless the sound absorbing characteristics of the material are compromised.

3.14 Construction and Welding. As applicable, all welding shall conform to drawing # 12479550 for steel and # 12472301 for aluminum. The TRM tank shall be constructed IAW ASME BPVC Sec. VIII, Div. 1.

3.15 Manuals and special instructions. The MFS shall require field and sustainment maintenance manuals and other special instructions. Manuals and other special instructions shall be included as part of the end-item when specified by the contract, scope of work, or Section 6.2.

3.16 Basic Issue Items (BII). Each MFS shall be provided with BII and stowage space for the BII. BII is defined as any support items that the operator of the MFS requires to put the system in operation, operate or perform emergency and operator level repairs of the MFS.

3.17 Load and packaging plans and instructions. When specified by the contract scope of work or paragraph 6.2 herein, load, packaging plans, and instructions shall be provided for each of the MFS movement modes and configurations (see 3.6.1). These plans and instructions shall provide for protection of the equipment from damage or reduction in operation capabilities, and shall comply with the design and safe operational limitations of the required aircraft, vehicles, trailers, and pallets.

4. VERIFICATION.

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Certificate of Conformance (CoC)
b. Acceptance Inspection & Test (AI&T)

4.1.1 Certificates of Conformance (CoC). CoC's required as part of the AI&T/FAT shall be:

a. In the contractor format with sufficient supporting technical information to insure adequate evaluation and comment by the Government;
b. Required for selected requirements as set forth in Sect 3.12 – 3.17, either prior to or during any Government conducted testing for safety, HAZMAT, and operational requirements in order to assure safe operation by test site personnel;
c. Provided to verify materials identified in section 3.3 and all non-major components identified in section 3.5.7 conform, without restrictions, to their respective requirements/specifications in this PD; and, to verify the adequate count, condition, and suitability for intended use prior to the start of the FAT;
d. Included in the FAT Final Report.

4.1.2 Acceptance Inspection & Test (AI&T). An AI&T is required on each complete MFS production unit and shall be performed by the contractor's Quality Assurance representative, together with the Government QAR, except as detailed within this PD. A complete MFS production unit includes the fuel injector assembly only for the first tested unit. The AI&T shall include examinations, tests, and certifications IAW Sect 4.1 to include Table I. All acceptance inspections and test results/reports on selected FAT test units shall be provided to the PCO prior to the scheduled start of FAT.

4.1.2.1 AI&T criteria. Nonconformance to any requirement herein, breakage, leakage or failure of any component to operate as required shall constitute failure of this testing.

4.1.3 First Article Test (FAT). A FAT is required and shall be performed by the Government on four PRMs and four TRMs. The FAT shall include the test conditions, examinations, tests, and certifications set forth in Sect 4.1 through 4.17 to include Table I (also see Sect 6.3). An evaluation shall be made during FAT to determine whether the MFS is designed to reduce or eliminate as many tools, special tools, and test equipment as possible. In addition, an examination shall be made and recorded to ascertain whether all tools and test equipment required to support MFS operation, maintenance, and repair are present and adequate to support the system at the required US Army maintenance levels for the life of the system. FAT test results shall be part of the final test report.

4.1.3.1 Prior to start of FAT. Each MFS production unit selected shall be examined and tested as specified in 4.1.2.

4.1.4 The rational and economic reuse of fluids. The rational and economic reuse of fluids and pumping media for this testing is required to reduce costs.

4.1.5 Contractor Confidence Testing (TRM only). The contractor shall conduct a reliability and a functional test IAW the test plan provided by Yuma Test Center (YTC). Nonconformance to any requirement herein to include, breakage, leakage or failure of any component, part, assembly or/and sub-assembly of the TRM shall be resolved prior to FAT. The Contractor Confidence Test shall be conducted at YTC. If one unit is used for testing, all miles shall be accumulated utilizing a HEMTT-LHS truck. If two units are used for testing, each unit shall perform 50% of the test miles on the HLS prime mover and the other 50% on the PLS trailer. Test Incident Reports (TIRs), along with pictures, shall be generated by YTC, posted on the Versatile Information Systems Integrated On-line Nationwide (VISION) Digital Library System (VDLS) at https://vdls.atc.army.mil and made available to the Government for review. The reliability test shall consist of a total of 50 pumping hours from the ground level and 800 miles of transport over the terrain profile specified in the OMS/MP (20% primary, 50% secondary, 15% trail and 15% cross country). In addition, the TRM shall perform 30% of the miles empty, 30% of the miles half full, and 40% of the miles full of fuel. The functional test shall verify, at a minimum, that the requirements as specified in paragraphs 3.5.4 Weight, 3.5.9.6 Fuel flow rate measurement, 3.5.6.1.10 Pumping assembly, and 3.9.1 Human Factor Engineering (HFE), are met and the TRM functions as intended.

4.2 Test conditions and schedule.

4.2.1 Test conditions. Unless otherwise specified, all testing and examinations shall be conducted using ambient atmospheric pressure and humidity.

4.2.2 Schedule and sequence of tests. Examinations and tests shall be scheduled to insure that each item of the schedule and sequence shall not have a detrimental effect or preclude the performance of a subsequent test/examination.

4.2.3 Advance notice of schedule. The Government shall generally provide appropriate advance notice of the schedule or changes to the schedule to allow participation or oversight.

4.2.4 Pump test fluid. The test fluid shall be fuel as specified in 3.5.9. Water may be substituted for the designated primary fuel (only) and test fluid(s) for the following tests when conducted above 33°F. The system fuel additive injector and filter/separator(s) shall be bypassed or the filter elements removed when using water.

a. Non-major component testing where exposure to or compatibility with fuels/lubricants is not required; e.g. NATO Intervehicle Receptacle.

b. Any pump, hose, or valve test.

As a pumping media (product) for any tests and product demonstrations that are not FAT or AI & T test requirements.

Table I. MFS Test Events.

Test Description		Section 3	Section 4	Cert of Conf	Accept Inspect and Test	FAT	Demo	Visual
DESIGN & OPERATING REQUIREMENTS								
101	Materials	3.3 – 3.3.8	4.3	X				
102	HEMTT LHS/PLS, PLS trailer Compatibility	3.4.1	4.4.1	X		X	X	X
103	ISO Compatibility	3.4.2	4.4.2	X	X	X	X	X
104	Forklift Compatibility	3.4.3	4.4.3	X	X	X	X	X
105	Operation	3.5.1	4.5.1			X	X	X
106	Starting, Operation, and Stopping	3.5.2	4.5.2	X	X	X	X	X
107	Failsafe Structure	3.5.3	4.5.3			X	X	X
108	Weight	3.5.4	4.5.4	X	X	X	X	
109	Component Housings, Equipment Storage Box (es), and hose storage	3.5.5 – 3.5.5.2	4.5.5		X	X	X	X
MAJOR COMPONENTS								
110	Capacity	3.5.6.1.1	4.5.6.1.1	X	X	X	X	X

Test Description		Section 3	Section 4	Cert of Conf	Accept Inspect and Test	FAT	Demo	Visual
111	Pressure Relief	3.5.6.1.2	4.5.6.1.2	X	X	X	X	X
112	Load Stabilization	3.5.6.1.3	4.5.6.1.3	X		X	X	
113	Cleaning	3.5.6.1.4	4.5.6.1.4	X	X	X	X	X
114	Manhole	3.5.6.1.5	4.5.6.1.5	X	X	X	X	X
115	Fuel level gauges	3.5.6.1.6	4.5.6.1.6	X	X	X	X	X
116	TRM Interconnection	3.5.6.1.7	4.5.6.1.7			X	X	X
117	Structural Durability	3.5.6.1.8	4.5.6.1.8	X	X	X	X	X
118	Detachable ladder	3.5.6.1.9	4.5.6.1.9	X	X	X	X	X
119	Pumping assembly	3.5.6.1.10	4.5.6.1.10	X	X	X	X	X
120	Filtration and Water Separation System	3.5.6.1.11	4.5.6.1.11	X	X	X	X	X
121	Pumprack Module (PRM)	3.5.6.2	4.5.6.2			X	X	X
122	Pump Assembly	3.5.6.2.1	4.5.6.2.1			X	X	X
123	Pump Capacity	3.5.6.2.1.1	4.5.6.2.1.1	X	X	X	X	X
124	Filtration and Water Separation System	3.5.6.2.1.2	4.5.6.2.1.2	X	X	X	X	X
125	Power Source	3.5.6.2.2	4.5.6.2.2	X		X	X	X
126	Starting System	3.5.6.2.3	4.5.6.2.3	X	X	X	X	X
127	Control Panel	3.5.6.2.4	4.5.6.2.4	X	X	X	X	X
128	Operational Fault Controls	3.5.6.2.4.1	4.5.6.2.4.1		X	X	X	X
129	Lighting	3.5.6.2.4.2	4.5.6.2.4.2	X	X	X	X	X
130	Non-tactical conditions	3.5.6.2.4.2.1	4.5.6.2.4.2.1	X	X	X	X	X
131	Tactical/blackout operations	3.5.6.2.4.2.2	4.5.6.2.4.2.2	X	X	X	X	X
132	Emergency Shutoff	3.5.6.2.5	4.5.6.2.5	X	X	X	X	X

Test Description		Section 3	Section 4	Cert of Conf	Accept Inspect and Test	FAT	Demo	Visual
133	Fuel Supply	3.5.6.2.6	4.5.6.2.6			X	X	X
134	Piping System	3.5.6.3	4.5.6.3	X	X	X	X	X
135	Emergency valve	3.5.6.3.1	4.5.6.3.1	X	X	X	X	X
136	Inspection and Clean-out	3.5.6.3.2	4.5.6.3.2		X	X	X	X
137	Vapor Recovery Pipe	3.5.6.3.3	4.5.6.3.3	X	X	X	X	X
138	Bottom Fill & Discharge Port	3.5.6.3.4	4.5.6.3.4	X	X	X	X	X
139	Filling Station Ports	3.5.6.3.5	4.5.6.3.5			X	X	X
140	Top Loading Port	3.5.6.3.6	4.5.6.3.6	X	X	X	X	X
141	Line Strainer	3.5.6.3.7	4.5.6.3.7	X	X	X	X	X
N2N-MAJOR COMPONENTS								
142	Hose	3.5.7.1	4.5.7.1	X	X	X	X	X
143	Adapters	3.5.7.2	4.5.7.2	X	X	X	X	X
144	Catwalk	3.5.7.3	4.5.7.3	X	X	X	X	X
145	Fire Extinguisher	3.5.7.4	4.5.7.4	X	X	X	X	X
146	Grounding and Bonding	3.5.7.5	4.5.7.5	X	X	X	X	X
147	Electrical system	3.5.8	4.5.8	X	X	X	X	
148	Battery	3.5.8.1	4.5.8.1	X	X	X	X	X
149	Battery Cables	3.5.8.2	4.5.8.2	X	X	X	X	X
150	Battery Box	3.5.8.3	4.5.8.3	X	X	X	X	X
151	NATO Intervehicle Receptacle	3.5.8.4	4.5.8.4	X	X	X	X	X
152	NATO Intervehicle cable and plug assembly	3.5.8.5	4.5.8.5	X	X	X	X	X

Test Description		Section 3	Section 4	Cert of Conf	Accept Inspect and Test	FAT	Demo	Visual
153	Auxiliary Intervehicle cable and plug assembly	3.5.8.6	4.5.8.6	X	X	X	X	X
154	Fuel	3.5.9	4.5.9	X		X	X	X
155	Fuel Dispensing Points	3.5.9.1	4.5.9.1	X	X	X	X	X
156	Fuel Dispensing Nozzle	3.5.9.2	4.5.9.2	X	X	X	X	X
157	Filtered Fuel Recirculation	3.5.9.3	4.5.9.3		X	X	X	X
158	Fuel Evacuation	3.5.9.4	4.5.9.4			X	X	X
159	Petroleum Test Kit	3.5.9.5	4.5.9.5	X	X	X		X
160	Fuel Flow Rate Measurement	3.5.9.6	4.5.9.6	X	X	X	X	X
161	Fill and Discharge	3.5.9.7	4.5.9.7	X	X	X	X	X
INTERFACE REQUIREMENTS								
162	Transportability	3.6.1	4.6.1	X		X	X	
163	Tie-Down Provisions	3.6.1.2	4.6.1.1	X		X	X	
164	Slinging Provisions	3.6.1.3	4.6.1.2.	X		X	X	
165	Air transport	3.6.1.4	4.6.1.3	X		X	X	
166	Air Transport Fixed Wing	3.6.1.4.1	4.6.1.3.1	X		X	X	
167	Air Transport Rotary Wing	3.6.1.4.2	4.6.1.3.2	X		X	X	
168	Low Velocity Air Drop	3.6.1.4.3	4.6.1.3.3	X		X	X	X
169	Rail Transportability	3.6.1.5	4.6.1.4 & 4.6.1.4.1	X		X	X	X
170	Highway Transport	3.6.1.6	4.6.1.5	X		X	X	X
171	Water Transport	3.6.1.7	4.6.1.6	X		X		
172	Safety Approval	3.6.1.8	4.6.1.7	X		X		

Test Description		Section 3	Section 4	Cert of Conf	Accept Inspect and Test	FAT	Demo	Visual
173	Lubricants	3.6.2	4.6.2	X	X	X	X	
OWNERSHIP & SUPPORT REQUIREMENTS								
174	Safety	3.7.1	4.7.1	X	X	X	X	
175	TRM top access	3.7.1.1	4.7.1.1	X	X	X	X	X
176	Non-skid surface	3.7.1.2	4.7.1.2	X	X	X	X	X
177	Workmanship	3.7.1.3	4.7.1.3	X	X	X	X	X
178	Human Factors Engineering	3.7.2	4.7.2	X		X	X	
179	Reliability	3.7.3	4.7.3			X	X	
180	Maintainability	3.7.4 & 3.7.4.1	4.7.4			X	X	
181	Servicing, Operation & Maintenance	3.7.5 through 3.7.5.2	4.7.5			X	X	
182	Camouflage	3.7.6	4.7.6		X	X	X	X
183	Environmental	3.8 through 3.8.15	4.8 through 4.8.15	X		X	X	X
184	Personnel Integration (MANPRINT)	3.9	4.9			X	X	
185	Identification, Marking, Information & Data Plates	3.10 3.10.1 3.10.2	4.10	X	X	X		X
186	Corrosion Control Performance	3.11 3.11.1	4.11	X		X	X	X
187	NBC Survivability	3.12	4.12	X		X		X
188	Treatment & Painting	3.13	4.13	X	X	X		X
189	Construction & Welding	3.14	4.14	X	X	X		X

Test Description		Section 3	Section 4	Cert of Conf	Accept Inspect and Test	FAT	Demo	Visual
190	Manuals & Special Instructions	3.15	4.15	X	X	X	X	X
191	Basic Issue Items (BII)	3.16	4.16			X	X	
192	Loading & Packaging Plans & Instructions	3.17	4.17	X	X	X	X	X

4.3 Materials. Materials required in 3.3 through 3.3.8 shall be verified by CoC IAW 4.1.1.

4.4.1 HEMTT LHS/PLS and PLS trailer compatibility. Verify conformance to the requirements of 3.4.1 by CoC, visual inspection, demonstration, and measurements.

4.4.2 ISO compatibility. Verify conformance to the requirements of 3.4.2. CoC, visual inspection, demonstration, and measurements shall verify the fit of MFS within the ISO container interface dimensions.

4.4.3 Forklift compatibility. Verify conformance to the requirements of 3.4.3 and ISO 1496-5 by CoC, visual inspection, demonstration, and measurements. Dimensional conformation shall be provided.

4.5 Design and operating requirements. The requirements of 3.5 through 3.5.9.8 shall be demonstrated through the system design analysis, successful completion of the FAT and AI&T requirements, the absence of non-compliance and material faults during the performance of the contract, and the projected completion of the service life requirement. Failure to comply with all the requirements of 3.3, 3.4 and 3.5, any of their subparagraphs or/and specifications shall constitute failure of these tests.

4.5.1 Operation. Verify conformance to the requirements of 3.5.1 by demonstration.

4.5.2 Starting, operation, and stopping. Verify conformance to the requirements of 3.5.2 by CoC and demonstration. Verify leakproofness of the MFS during operational capability testing. Verify emergency stop capability to shut the system down within five seconds after activation. Verification of start time of five minutes after each environmental test for component operation shall be performed during FAT. Verification of start time of five minutes at ambient conditions for component operation shall be performed during AI & T.

4.5.3 Failsafe structure. Verify conformance to the requirements of 3.5.3 by visual inspection and demonstration.

4.5.4 Weight. Each module and sub-module including the TRM, the PRM flatrack and the PRM sub-module including BII and components installed to be handled by a forklift, empty of fuel, shall be weighed to verify conformance to the requirements of 3.5.4 and actual data shall be recorded and added to the calculated weight for fuel.

4.5.5 Component Housings, Equipment Storage Box (es), and hose storage. Verify conformance to the requirements of 3.5.5, 3.5.5.1, and 3.5.5.2 by visual inspection and demonstration.

4.5.6 Major components.

4.5.6.1 TRM.

4.5.6.1.1 Capacity. Verify conformance to the requirements of 3.5.6.1.1 by CoC and demonstration on level ground. Any leak or overflow outside the confines of the tank shall constitute a failure of this test.

4.5.6.1.2 Pressure relief. Verify conformance to the requirements of 3.5.6.1.2 by CoC and demonstration during operational testing. During FAT only verify conformance to the requirements of 3.5.6.1.2 by subjecting the complete system to altitude chamber testing. The chamber shall be initially evacuated to a pressure altitude of 10,000ft to represent flight cruise under normal conditions and then evacuated to a pressure altitude of 45,000ft to represent loss of cabin pressure under emergency conditions. Time at 10,000ft shall be indefinite whereas time at 45,000ft would be limited to 30 minutes.

4.5.6.1.3 Load stabilization. Verification shall consist of contractor CoC prior to testing, and Government-conducted mobility testing according to the requirements of paragraph 3.4.1 and 3.5.6.1.3. The trailer shall be operated to meet the LHS and PLS profiles as specified in Appendix A-1 Table II and Appendix A-2 Table III. In addition, stability and brake performance of the prime movers, with and without trailer in tow, carrying MFS at 0%, 35%, 65%, and 100% fill, shall be verified by: 1) performing the NATO Lane Test IAW AVTP 03-160W at 40 Miles Per Hour (MPH) without tire lift, 2) longitudinal slope testing of 60% by prime mover alone and 30% by prime mover and trailer combination, and traversal of a 30% side slope in a sinusoidal pattern in both directions without tire lift, 3) 40° approach and 60° departure angles, and 4) braking tests IAW TOP 2-2-608 performance requirements. Baffles, surge plates, or other load stabilization provisions, valves, and seals shall be visually inspected prior to and at the completion of each test phase, with varying fuel load, to ensure no damage has occurred.

4.5.6.1.4 Tank cleaning. Verify conformance to the requirements of 3.5.6.1.4 by CoC, visual inspection, and demonstration.

4.5.6.1.5 Manhole. Verify conformance to the requirements of 3.5.6.1.5 by visual inspection and demonstration.

4.5.6.1.6 Fuel level gauges. Conformance to the requirements of 3.5.6.1.6 shall be verified through demonstration.

4.5.6.1.7 TRM interconnection. Conformance to the requirements of 3.5.6.1.7 shall be verified through demonstration.

4.5.6.1.8 Structural durability. Verify conformance to the requirements of 3.5.6.1.8 by CoC and loading/unloading, transportation and operational testing. Loading/unloading testing shall constitute a total of 1000 load/unload cycles for each MFS test unit. Load/unload cycles accrued during reliability testing (ref. para. 4.7.4) may count towards meeting this requirement. No more than one-half of the total load/unload cycles shall be completed at no less than one-half and no more than three-quarters payload capacity; the remaining cycles shall be completed at full payload capacity. System level qualification of the structure shall be through dynamic testing (such as rail car impact "bump test") with the outer structure secured to the test platform (floor) using the designed tiedown provisions. The test item shall be filled with fuel or a fluid of equivalent or greater density and shall include all components in the shipping configuration. The TRM shall be subjected to pressure and leakage test testing as specify in 49CFR178.346-5.

4.5.6.1.9 Detachable ladder. Verify conformance to the requirements of 3.5.6.1.10 by demonstration during operational testing.

4.5.6.1.10 Pump Assembly. Verify conformance to the requirements of 3.5.6.1.10 by CoC and demonstration during operational testing.

4.5.6.1.11 Filtration and Water Separation System. Verify conformance to the requirements of 3.5.6.1.11 by CoC, visual inspection, and demonstration during operational testing. Qualification test is required to meet requirement. The F/S, filled with test fluid, shall be subjected to a hydrostatic pressure test as specified in 3.5.6.1.11. The air relief valve and water drain valve shall be closed during this test. Evidence of leakage, permanent deformation, or other defects that harmfully affect the performance and serviceability of the F/S shall constitute failure of this test

4.5.6.2 PRM. Verify conformance to the requirements of 3.5.6.2 through visual inspection and demonstration

4.5.6.2.1 Pump assembly. Verify conformance to the requirements of 3.5.6.2.1 by visual inspection and demonstration.

4.5.6.2.1.1 Pump capacity. Conformance to the requirements of 3.5.6.2.1.1 shall be verified by CoC, during visual inspection, and demonstration.

4.5.6.2.1.2 Filtration and water separation system. Verify conformance to the requirements of 3.5.6.2.1.2 by CoC, visual inspection, and demonstration during operational testing. Qualification test is required to meet requirement. The filtration and water separation system shall be capable of withstanding a hydrostatic test pressure of 150% of the MFS maximum working pressure for a minimum period of 10 minutes.

4.5.6.2.2 Power source. Verify conformance to the requirements of 3.5.6.2.2 by CoC, visual inspection, and demonstration during operational testing to include all environments IAW

paragraph 3.8 and fuels IAW paragraph 3.5.9 herein. During AI&T verify conformance to the requirements of 3.5.6.2.2 by demonstration at ambient conditions only.

4.5.6.2.3 Starting system. Verify conformance to the requirements of 3.5.6.2.3 by CoC and demonstration.

4.5.6.2.4 Control panel. Conformance to the requirements of 3.5.6.2.4 shall be verified by CoC and visual inspection during and after operational and environmental testing.

4.5.6.2.4.1 Operational fault controls. Conformance to the requirements of 3.5.6.2.4.1 shall be verified by visual inspection and operation testing at the operational fault shut-offs: emergency, excessive product temperature, high engine temperature, low operating pressure and, low fuel level and overfill condition. Automatic fault shut-off shall be tested to determine whether, once the activation cause has been corrected, the system resets to normal operating status.

4.5.6.2.4.2 Lighting. The requirements of 3.5.6.2.4.2 shall be verified by CoC, demonstration, and testing.

4.5.6.2.4.2.1 Non-tactical conditions. The requirements of 3.5.6.2.4.2.1 shall be verified by CoC, demonstration, and testing.

4.5.6.2.4.2.2 Tactical/blackout operations. The requirements of 3.5.6.2.4.2.2 shall be verified by CoC, demonstration, and visual inspection. Results shall be recorded.

4.5.6.2.5 Emergency shutoff. Conformance to the requirements of 3.5.6.2.5 shall be verified by CoC and operational demonstration during operational test.

4.5.6.2.6 Fuel supply. Verify conformance to the requirements of 3.5.6.2.6 by operational demonstration to operate a minimum of 4 hours.

4.5.6.3 Piping system. Verify conformance to the requirements of 3.5.6.3 by CoC, visual inspection, and operation of valves.

4.5.6.3.1 Emergency valve. Verify conformance to the requirements of 3.5.6.3.1 by CoC, visual inspection, and demonstration. Verification of function shall be performed during FAT.

4.5.6.3.2 Inspection and clean out. Verify conformance to the requirements of 3.5.6.3.2 by visual inspection for valve location and by demonstration.

4.5.6.3.3 Vapor recovery pipe. Verify conformance to the requirements of 3.5.6.3.3 by CoC, visual inspection, and demonstration.

4.5.6.3.4 Bottom fill and discharge ports. Verify conformance to the requirements of 3.5.6.3.4 by visual inspection and demonstration.

4.5.6.3.5 Retail dispensing ports. Verify conformance to the requirements of 3.5.6.3.5 by visual inspection and demonstration.

4.5.6.3.6 Top loading port. Verify conformance to the requirements of 3.5.6.3.6 by CoC and demonstration. During AI & T conformance to the requirements of 3.5.6.3.6 shall be performed by visual inspection of safe access using the catwalk.

4.5.6.3.7 Line strainer. Verify conformance to the requirements of 3.5.6.3.7 by demonstration of the accessibility for inspection and cleaning.

4.5.6.3.8 Bleed reservoir. Verify conformance to the requirements of 3.5.6.3.8 by CoC, visual inspection, and demonstration.

4.5.7 Non-major components.

4.5.7.1 Hose. Verify conformance to the requirements of 3.5.7.1 by CoC, visual inspection, and demonstration.

4.5.7.2 Adapters. Verify conformance to the requirements of 3.5.7.2 through 3.5.7.2.2 by CoC, visual inspection, and operation.

4.5.7.3 Catwalk. Verify conformance to the requirements of 3.5.7.3, by CoC, demonstration, visual inspection, and during operational testing to ensure the catwalk can meet load requirement (hold two personnel) and safely load fuel.

4.5.7.4 Fire extinguisher. Verify conformance to the requirements of 3.5.7.4 by CoC, demonstration, and visual inspection including type, size, capacity, packing, brackets and accessibility.

4.5.7.5 Grounding and Bonding. Verify conformance to the requirements of 3.5.7.5 through 3.5.7.5.1 by CoC, which shall include analysis, test and evaluation, and modeling and simulation where available/appropriate. In addition, performance and suitability for intended use shall be demonstrated by operational test during the conduct of the FAT. The absence of the item or insufficient quantities of this item, absence or inadequacy of the CoC, unsuitability for intended use, inability to perform the installation, set-up/takedown, and/or unrestricted operation with the required number and types of the system personnel, and/or failure to comply with the requirements of 3.5.7.5 shall constitute failure.

4.5.8 Electrical system. Verify conformance to the requirements of 3.5.8 by CoC and demonstration.

4.5.8.1 Battery. Verify conformance to the requirements of 3.5.8.1 by CoC and operational test. Verify type, count, and condition of insulated boots at terminals. Demonstrate cold starts and accessibility.

4.5.8.2 Battery cables. Verify conformance to the requirements of 3.5.8.2 by CoC, demonstration, and visual inspection when connected to the batteries. Verify mounting condition, marking, color, and suitability for intended use.

4.5.8.3 Battery box. Verify conformance to the requirements of 3.5.8.3 by CoC, demonstration, and visual inspection.

4.5.8.4 NATO intervehicle receptacle. Verify conformance to the requirements of 3.5.8.4 by CoC, visual inspection, and demonstration when connected to a cable assembly IAW NATO STANAG 4074.

4.5.8.5 NATO intervehicle cable and plug assembly. The NATO intervehicle cable and plug assembly shall be verified by CoC for compliance certification to NATO STANAG 4074 and 3.5.8.5 and tested for ability to provide emergency power and starting.

4.5.8.6 Auxiliary intervehicle cable and plug assembly. Verify conformance to the requirements of 3.5.8.6 by CoC for compliance certification to NATO STANAG 4074 and tested for ability to provide power and starting.

4.5.9 Fuel. Verification shall consist of contractor CoC prior to testing. Conformance to the requirements of 3.5.9 shall be verified through operational testing and visual inspection.

4.5.9.1 Fuel Dispensing points. Verify conformance to the requirements of 3.5.9.1 by CoC and demonstration during operational testing.

4.5.9.2 Fuel dispensing nozzle. Verify conformance to the requirement of 3.5.9.2 by CoC, demonstration, and visual inspection.

4.5.9.3 Filtered fuel recirculation. Verify conformance to the requirements of 3.5.9.3 during operational testing.

4.5.9.4 Fuel evacuation. Verify conformance requirements of 3.5.9.4 during operational demonstration.

4.5.9.5 Petroleum test kit. Verification shall consist of contractor CoC to the requirements of 3.5.9.5 and by obtaining product sample for testing during FAT.

4.5.9.6 Fuel flow rate measurement. Verification shall consist of contractor CoC regarding features in the requirements of 3.5.9.6 and by visual examination; performance shall be verified by operational testing.

4.5.9.7 Fill and discharge. The requirements of 3.5.9.7 shall be verified by CoC and demonstration during operational testing.

4.6 Interface requirement.

4.6.1 Transportability. Verify conformance to the requirements of 3.6.1 through 3.6.1.1 by CoC and demonstration.

4.6.1.1 Tie-down provisions. Verify conformance to 3.6.1.2 by CoC to ensure that MFS provisions meet the material, test, and process requirements of MIL-STD 209. Physical testing shall be performed on the TRM and PRM. The MFS shall be inspected for required marking and signs.

4.6.1.2 Slinging provisions. Verify conformance to 3.6.1.3 by CoC to ensure that MFS provisions meet the material, test, and process requirements of MIL-STD 209. Physical testing shall be performed on the TRM and PRM. The MFS shall be inspected for required marking and signs.

4.6.1.3 Air transport. Verify conformance to 3.6.1.4 by CoC and demonstration. The TRM in its airlift shipping configuration, full, shall not leak while the tank is tipped at 60 degree angle in each flight orientation (Port, Starboard, Aft, and Forward with respect to the aircraft). Tipping of the tank may be accomplished using ramps or a crane. The TRM shall be held in each tipped condition for a minimum of 15 minutes and be observed for leakage. Any sign of leakage, permanent deformation, or failure causing an unsafe condition as a result of this test shall constitute failure of this test.

4.6.1.3.1 Air transport, fixed-wing. Verify conformance to 3.6.1.4.1 by CoC and demonstration. The MFS shall be certified as safely transportable by all the aircraft types specified in 3.6.1.4.1 through the use of MIL-STD-1366 and recommendations in MIL-HDBK-1791, as applicable; design analysis, examinations, test, modeling and simulation, and observations.

4.6.1.3.2 Air transport, rotary-wing. Verify conformance to 3.6.1.4.2 by CoC, examination, analysis and demonstration.

4.6.1.3.3 Low Velocity Air Drop (LVAD). Prior to the start of the Government conducted LVAD test, a contractor-generated packaging and loading plan for the TRM should be provided to the PCO, Natick, and Yuma Proving Grounds (YPG) test director in order to develop the required packaging/loading to safely conduct this testing. A pressure and leakage test as specified in 49CFR178.346-5 should be performed after each airdrop of the TRM. Government conducted TRM airdrop testing should include both live airdrop testing and Simulated Airdrop Impact Testing (SAIT), if required. The live airdrop testing should be performed filling the tank with water to a volume equivalent in weight to a full tank of fuel as specified in paragraph 3.6.1.4 and have provisions that would minimize sloshing as if the tank was full. Sixty days prior to the first scheduled airdrop test, Natick Soldier Center (NSC) and HQ Aeronautical Systems Center should review the TRM at YPG and the NSC developed airdrop rigging procedures, and evaluate the system for safety for Air Force fixed wing transport and airdrop by all the aircraft types specified in 3.6.1.4.3 through the use of MIL-STD-1366, recommendations in MIL-HDBK-1791, and, as applicable, design analysis, examinations and test, modeling and simulation, and observations. Natick Airdrop representative should

notify the PM PAWS System Acquisition Manager of the results of this evaluation, 30 days prior to start of the first scheduled air drop testing.

4.6.1.4 Rail transportability. Verification of conformance with 3.6.1.5 shall include CoC and demonstration. The MFS, with fuel, when properly stored in its rail shipment configuration, shall be examined and analyzed to determine if the system can withstand shock loads resulting from rail impact without failure, damage, permanent deformation, or reduction in operational or design capability.

4.6.1.4.1 Rail impact test. To verify conformance to 3.6.1.5, the rail impact test shall be conducted IAW MIL-STD-810, with the MFS, with fuel, on COFC flatcar and of the MFS when mounted on its prime movers. The MFS shall be properly stored in its rail configuration and mounted on a rail car in its rail shipment configuration. Load condition shall be dependent on system capability. As a minimum, a series of four impacts shall be performed. In addition to the general failure criteria of 3.6.1.5, any MFS component that breaks free from or loosens within the ISO container(s) or shows any sign of permanent deformation as a result of the impact test series shall constitute failure of this test.

4.6.1.5 Highway transport. The MFS shall verify compliance for road transport in all required configurations identified in 3.6.1.6 through CoC, detailed design analysis, examinations, and operational testing.

4.6.1.6 Water transport. The MFS shall be CoC certified as safely transportable by all the watercraft specified in 3.6.1.7 through design analysis, examinations, modeling, or/and simulation. The MFS shall be tested during FAT by being loaded on a representative vessel.

4.6.1.7 Safety approval. Verify conformance to paragraph 3.6.1.8 by CoC shall verify compliance. In addition, conformance to 3.6.1.9, maximum gross weight markings on the container shall be compared for consistency with the maximum gross weight information on the safety approval weight plate. Upon witnessing successful tests, the approval authority shall issue to the owner, a notice of approval that authorizes the attachment of safety approval plates to the containers. The notice of approval shall be included with the FAT report. A visual inspection shall confirm the ISO containers have the proper weight included on the plates.

4.6.2 Lubricants. Lubricants IAW 3.6.2 shall be used during all testing based on applicable ambient temperatures. Verify conformance to the requirements of paragraph 3.6.3 herein during demonstration. Compliance with lubrication fittings requirements shall be verified by visual observation and demonstration during maintenance. Compliance with lubricant requirements shall be met by CoC by each engine and pump manufacturer for acceptability of exclusive use of all oil, gear oil and grease lubricants listed in 3.6.2. CoCs shall be made a part of the FAT test report.

4.7 Ownership and support verification.

4.7.1 Safety. The requirements of 3.7.1 shall be verified by CoC, visual inspection, and demonstration, supplemented by observations recorded during operational testing.

4.7.1.1 TRM top access. The requirements of 3.7.1.1 shall be verified by CoC, visual inspection, and demonstration, supplemented by observations recorded during operational testing.

4.7.1.2 Non-skid surfaces. The requirements of 3.7.1.2 shall be verified by CoC, visual inspection, and demonstration, supplemented by observations recorded during operational testing.

4.7.1.3 Workmanship. The requirements of 3.7.1.3 shall be verified by CoC, visual inspection, and demonstration, supplemented by observations recorded during operational testing.

4.7.2 Reliability. The requirements of 3.7.2 shall be verified by operational testing, contractor CoC including supporting subcontractor documentation/certifications, actual observation, and during government testing in all required operating conditions and environments. The mileage, loading/unloading, and operating hours profiles shall be in accordance with the PLS Mission Profile, the LHS Mission Profile, and the Operational Mode Summary/Mission Profile (OMS/MP) (see appendix A-1, A-2, B-1 and B-2). Scoring criteria, the definition of an EFF and other terms are contained in a separate document called the Failure Definition and Scoring Criteria (FDSC). Failure to meet the requirements of paragraph 3.7.2 herein shall constitute failure of this test.

4.7.3 Maintainability. The maintainability requirements of 3.7.3 and 3.7.3.1 shall be demonstrated by operational testing. Total maintenance man-hours (broken out by scheduled and unscheduled maintenance actions) and total number of unscheduled maintenance actions shall be recorded during the reliability test specified in 4.7.2.

4.7.4 Servicing, operation and maintenance. Verify inclusion of required tools identified in paragraphs 3.7.4 through 3.7.4.2 by visual inspection. During the conduct of the FAT, the MFS shall be continuously evaluated for compliance with the requirements of 3.7.4 through 3.7. 4.2, and this evaluation, including any deficiencies and corrective actions, shall be included in the FAT Final Report.

4.7.5 Camouflage. Conformance to the requirements of 3.7.5 shall be verified by visual inspection and test.

4.8 Environmental requirements. The MFS in its design and operational modes (see 3.5) shall be subjected to the following environmental tests in its (unpacked) normal operational configuration, except when specified otherwise. All test procedures shall be IAW MIL-STD-810. On a continuing basis during and at the conclusion of each procedure of this test, the system shall be examined for any damage, leakage, failure of the system to operate as required, or degradation of system design or operational capabilities. Not less than one (1) MFS shall be tested according to each requirement, unless indicated otherwise below.

a. At the conclusion of each test and prior to the start of the next test method, the (engine) air filters/filtered vents shall be removed, examined, and the results recorded

for adequacy of filtration, proper sealing, and any evidence of failure or significant degradation. The air filters/filtered vents shall then be replaced with new filter elements prior to the start of the next test.

b. At the conclusion of each test and prior to the start of the next test, an examination and abbreviated oil/lubricants analysis shall be completed and recorded for all lubricants to determine serviceability and potential need for replacement during operations in extreme conditions. All lubricants shall be replaced with new fluids/greases prior to the start of the next test.

4.8.1 Temperature. The MFS shall be tested to the temperature requirements of 3.8.1 in a temperature environment according to Procedure I (Storage), Procedure II (Operation), and Procedure III (Manipulation) of Test Methods 501.45 and 502.45. Temperature sensors shall be located in all locations and in operational fluids that may be harmed by high and low temperatures. Pumpage temperatures, engine exhaust temperatures, engine oil temperatures, pump casing temperatures, and housing temperatures shall be monitored and recorded at regular intervals. Test temperatures shall be as given in 3.8.1. The temperature qualification shall be conducted by filling the tank at a fuel temperature of -28ºF and topping off as needed after holding for 24 hours. After the tank and other systems are sealed and placed into the airlift configuration, the entire system shall be heated to a temperature of 125ºF and held for 24 hours.

4.8.1.1 Low Temperature. The MFS shall be tested IAW Procedures I, II, and III of Test Method 502.45 to the low temperature requirements of 3.8.1 to verify that it can be stored, operated, and manipulated in a low temperature environment without performance degradation. Temperature sensors shall be located in all locations and in operational fluids that may be harmed by exposure to low temperatures. As a minimum, pumpage temperature, engine oil temperatures, engine exhaust temperature, pump casing temperature, and housing temperatures shall be monitored and recorded at regular intervals. Test temperatures shall be the lowest values given in 3.8.1. Test duration for storage is not less than 24 hours and not less than six (6) hours for operation.

4.8.1.2 High Temperature. The MFS shall be tested to the high temperature requirements of 3.8.1 to verify that it can be stored, manipulated, and operated in hot weather without performance degradation. The MFS shall be soaked at 160 degrees Fahrenheit for 24 hours IAW MIL-STD-810, Method 501.45, Procedure I. The temperature shall be lowered to 120 degrees Fahrenheit, fuel filled, and the MFS operated IAW MIL-STD-810, Method 501.45, and Procedure II for six (6) hours. During these six (6) hours, the MFS shall be shut down and restarted at equal intervals. The MFS shall perform as designed without any degradation in performance during the six (6) hours of operation.

4.8.2 Sand. The MFS shall be tested for conformance with the requirements of 3.8.2 in a sand environment according to Procedure II of test Method 510.45. The MFS shall be subjected to a blowing sand condition for a minimum total duration of 360 minutes, 90 minutes minimum per side. The blowing sand concentration and air velocity shall be maintained at the levels specified in 3.8.2. The MFS shall be operated during the last hour of the test. Upon test completion, the MFS shall be started and operated for a period of not less than 30 minutes.

4.8.3 Dust. The MFS shall be tested for conformance to the requirements of 3.8.3 in a dust environment according to Procedure I (Dust) of Test Method 510.45. The MFS, in full operational mode (running), shall be subjected to blowing dust condition for a minimum of six hours. The dust concentration and air velocity for the blowing dust test shall be maintained at the levels specified in 3.8.3. At the conclusion of this test, the MFS shall be inspected for visible signs of damage and operated for not less than 30 minutes.

4.8.4 Humidity. The MFS shall be tested for conformance to the requirements of 3.8.4 in a high humidity environment according to Test Method 507.45. The test shall be conducted for 5 cycles IAW figure 507.4 -1.

4.8.5 Solar radiation. The MFS shall be tested for conformance to the requirements of 3.8.5 in a solar radiation environment according to Procedure I of Test Method 505.45. Test duration shall be not less than 5 cycles (the 1st, 3rd, and 5th cycles empty, the 2nd and 4th cycles filled with fuel) of 24 hours each. Temperature sensors shall be located in critical areas where temperature can be expected to be the highest. The diurnal cycle A1 shall be for hot-dry conditions. Upon completion of the test, the MFS shall be examined for damage and operated for not less than 30 minutes.

4.8.6 Rain. The MFS shall be tested for conformance to the requirements of 3.8.6 according to Procedure I (Rain and Blowing Rain) of Test Method 506.45. A rainfall rate as specified in 3.8.6 impinging on the system at angles from the vertical up to 45 degrees shall be used. Test item temperature shall be a minimum of 20 °F higher than the rain temperature at the beginning of each exposure period. A wind velocity as specified in 3.8.6 shall be used for this test. The MFS shall be operated for a minimum of 2 hours, 30 minutes per face, during the Blowing Rain Test. On completion of exposure, the MFS shall be operated at full capacity for not less than 30 minutes.

4.8.7 Salt fog. The MFS shall be tested for conformance to the requirements of 3.8.7 in a salt fog environment according to Procedure I of Test Method 509.45 of MIL-STD-810 in normal operating mode. Duration of this test shall be four 24-hour periods. Upon completion of the test the MFS including all electrical components shall be examined for damage and operated for not less than 30 minutes. In addition to the requirements of 4.1.4, no visible surface corrosion of any metal parts, coated or uncoated, is permitted.

4.8.8 Noise limits. Verify conformance to the requirements of 3.8.8 by CoC. In addition, noise levels shall be tested for conformance to the requirements of 3.8.8 when the MFS is operating under full load. Noise levels shall be recorded at the operator's position and occasionally occupied positions. The operator's position is defined as 24 inches horizontally and 12 inches vertically from the control panel. Occasionally occupied positions are defined as anywhere within a 20-ft. diameter around each of the major components (but outside a circle of 4-ft. diameter around the engine) and 55 inches above the ground. Distance from the noise source shall also be recorded at not fewer than 12 equal (horizontal) arc increments at which readings of 85-dB (A) are measured. One measurement shall be the greatest distance from the noise source at which 85 dB (A) is measured. Noise levels shall be provided as dB (A) level. Sound level meters shall conform to Type 1 per ANSI S1.4. Filter bands shall be Type 3-D,

Extended Range per ANSI S1.11. The remaining recording instrumentation shall conform to SAE J 184 and, as applicable, ANSI S1.4. NOTE: Standard test conditions shall apply (see 4.2.1).

4.8.9 Electromagnetic Interference (EMI). To verify conformance to the requirements of 3.8.9, the system shall be tested for electromagnetic interference IAW MIL-STD-461, procedures RE-102 and RS-103 for Army ground equipment. Standard test conditions shall apply (see 4.2.1). The system shall be tested for ESD and inter-system EMC requirements as specified in MIL-STD-464.

4.8.10 High Altitude Electromagnetic Pulse (HEMP). The MFS shall be tested IAW MIL-STD-461, requirement RS105, to verify conformance to 3.8.10.

4.8.11 Altitude. The MFS shall be tested for conformance to the requirements of 3.8.11 by Procedures I and II of Method 500.45 of MIL-STD 810. Procedure I shall be conducted for a one hour storage period at an altitude of not less than 40,000 feet above sea level. Procedure II shall be conducted at an altitude of not less than 7,500 feet above sea level with the MFS operating at rated capacity for not less than one (1) hour.

4.8.12 Ozone. COC IAW 4.1.1 shall verify compliance with the requirements of 3.8.12.

4.8.13 Environmental hazard prevention. Compliance with the requirements of 3.8.13 shall be verified by CoC and recorded operational performance during the conduct of the FAT.

4.8.14 Fuel Spill Control Kit. Conformance to the requirements of 3.8.14 shall be verified by visual inspection and demonstration.

4.8.15 EPA compliant power source. Compliance with the requirements of 3.8.15 shall be verified by CoC that power source manufacturer meets the emission standards.

4.9 Manpower and Personnel Integration (MANPRINT). Compliance with the requirements of 3.9 shall be verified during operational applications and performance testing.

4.9.1. Human Factors Engineering (HFE). The requirements of 3.9.1 shall be verified by Coc and by demonstration during the operational testing. All identified valves and controls shall be tested for conformance to the applicable requirements of 3.9.1.

4.10 Identification, marking, information, and data plates. Compliance with the requirements of 3.10 through 3.10.2 shall be verified by CoC, observations, and operational testing during the conduct of the FAT and AI&T.

4.11 Corrosion control performance. The contractor's compliance with the requirements of 3.11 and 3.11.1 shall be verified by CoC, including supporting subcontractor documentation/certifications, by actual observation and test during the FAT in all required operating configurations and environments. Results and observations shall be included in the Final Test Report. Any failure to meet the requirements of 3.11 and/or 3.11.1 shall constitute failure of test.

4.12 CBR compatibility. Compliance with the requirements of 3.12 shall be verified by CoC and demonstration during the FAT.

4.13 Treatment and painting. The requirements of 3.13 shall be verified by contractor CoC including supporting subcontractor documentation/certifications to demonstrate compliance, and by actual observation and test during FAT in the required operating configurations and environments herein. Treatment and coating type, color conformance (see 6.2 or contract delivery order), visual and tactile observation of workmanship and finish, separate CoC of materials and processes, and any additional related contractual requirements shall be observed and recorded. Failure to meet the requirements of 3.13 shall constitute failure of test.

4.14 Construction and welding. Objective quality evidence shall be obtained, recorded, retained for Government review, and a conformance certification shall be provided to verify all welding has been completed IAW 3.14. Separate CoC's shall be provided to verify that all material, workmanship, and documentation are in compliance with the applicable requirements of 3.14 and that the fuel storage vessel (tank) has been constructed IAW requirements of 3.14. To verify conformance to the requirements of 3.14, the tank shall be tested for leaks at a pressure of at least 3 psi by the air pressure, soap bubble method. All welded seams, joints and piping shall be coated with a soap and water solution and inspected for leaks. During and after test, no visible liquid leakage shall be in evidence. Should leaks or defects be noted, they shall be reported, repaired, and the test repeated.

4.15 Manuals and special instructions. CoC shall verify conformance with the requirements of 3.15. When specified for inclusion with the MFS, other deliverable, or required by 6.2 herein, an inspection for count, condition, packaging, and placement/location shall be made to verify both the adequacy and accuracy of the items. Testing shall assess adequacy of content.

4.16 Basic issue items (BII). Verify BII equipment and associated storage space for compliance to the requirements of 3.16 by visual inspection.

4.17 Loading and packaging plans and instructions. CoC and an inspection for count, condition, packaging, and placement/location of the loading and packaging plans and instructions shall be made to verify compliance with the requirements of 3.17 and adequacy for intended use. Packaging plans and instructions shall be analyzed and evaluated during the FAT to determine adequacy in:

a. All transportation types and modes (with and without ISO Containers),
b. Impact on service life and maintenance ratio,
c. Impact on level and types of repairs,
d. Impact on MANPRINT, and
e. The prevention and elimination of HAZMAT.

5. PACKAGING.

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be

performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's U.S. Army Tank-Automotive and Armaments Command (TACOM). Packaging data retrieval is available from the managing Military Department or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES.

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The MFS is transported to remote locations using the HEMTT-LHS, PLS truck, and PLS trailer. Once emplaced, the MFS provides bulk and retail fuel support to both tactical vehicles and aircraft. The TRMs are used to transport fuel from rear area resupply points forward to consuming equipments. The TRM as a stand-alone are used primarily with the M978 HEMTT tanker to form a 5,000-gallon distribution platform. These 5,000-gallons platforms will transport fuel to Forward Support Companies (FSCs) and transfer the fuel into HEMTT tankers. The TRMs will also provide backup for FSC tankers by performing retail operations. The TRMs and PRMs of the MFS combine to form a fuel supply point capable of refueling up to eight vehicles or aircraft simultaneously. The MFS shall be capable of rapid emplacement and recovery to allow it to support rapidly changing support operations.

6.1.1 Future TRM Applications. Refueling concepts for the Army Objective Force use the TRM as the primary fuel transportation, storage, and issue system. In some instances, the vehicle requiring fuel engages the TRM and uses the on-board vehicle fuel system to transfer fuel from the TRM to the vehicle. Other equipment systems requiring fuel may not have a self-load capability. These systems will require the addition of a pumping assembly integral to the TRM that is capable of providing a flow rate of a minimum of 50 GPM. Consideration should be given in the design of the TRM that will allow for the future addition of a pumping assembly capable of meeting a 50 GPM flow requirement. The pump may be powered by an electric motor or a fuel consuming power source such as a fuel cell.

6.2 Ordering data. Acquisition documents shall specify the following:

a. Title, number, and date of this publication.

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1, 2.2 and 2.3).

c. For submission for first article inspection and the number of units required (see 4.1.3).

d. When the Government shall conduct any or all of the first article examinations and tests. When the Government shall conduct some but not all of the first article

examinations and tests, the contracting officer should specify which examinations and tests shall be conducted by the Government and when examinations and tests shall be conducted by the contractor (see 3.2, 4.1.3, and 6.3).

e. Identification and marking other than as specified (see 3.10).

f. Treatment and painting other than as specified (see 3.13)

g. Manuals and special instructions required (see 3.15).

h. Load and packaging plans and instructions required (see 3.17).

i. Packaging required (see 5.1).

j. Battery type required

k. Tools, special tools, and test equipment quantity required

6.3 First article. When a first article inspection is required, the item(s) shall be a first article production unit(s). The first article shall consist of one or more units. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of the first article examination results, and disposition of the first article(s). Invitation for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government. Bidders offering such products, who wish to rely on such production or test, shall furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Data Requirements. The contracting officer should include requirements for such data as technical publications, instructional materials, illustrated parts lists, and contractor's maintenance and operation manuals to be furnished with the trailer mounted fire extinguisher.

6.5 Definitions. The following definitions apply for this specification.

6.5.1 Recovered materials. Recovered materials are those materials that have been collected from solid waste and reprocessed to become a source of raw materials as distinguished from virgin raw materials.

6.5.2 Mission orientated protective posture (MOPP). MOPP IV protection consists of a two-piece protective overgarment, protective mask with hood, overboots and rubber gloves with cotton liners. The overgarment is closed and hood is pulled down and adjusted (Field Manual FM3-100).

6.5.3 Special tools and test equipment. Special tools and test equipment are defined as not found in the Army's General Mechanics tool kit (NSN 5180-01-548-7634), Organizational

Maintenance Common #1 tool kit (NSN 4910-00-754-0654), Common #2 tool kit (NSN 4900-00-754-0650), and tool kit Supplement #1 (NSN 4910-00-754-0653), U.S. Army Supply Catalogs 4910-95-A73 or 4910-95-A74. The SKO Supply Catalog website is "http://158.2.5.50/codebase/index.html". These kits and other tool kits/sets (US Army) are managed by USA TACOM-Rock Island, AMSTA-AC-CTTS, Rock Island, IL, 61299.

6.5.4 BII. BII is defined as any support items that the operator of the system shall require in order to put in operation, recover, operate, and to perform emergency repairs.

6.5.5 NATO fuel designations. STANAG 1135 describes the NATO F-34 fuel designations.

6.5.6 Maintenance ratio. The maintenance ratio is defined as the ratio of the total active maintenance in man-hours required (scheduled and unscheduled) to the total operating time. It does not include Preventive Maintenance Checks and Services (PMCS), which is performed to keep the system in operating condition.

6.5.7 Inter-Theater transport. The system, prepped for operation but empty, is transported by air, sea, or land from CONUS to an OCONUS location, or between two OCONUS locations in separate theaters.

6.5.8 Intra-Theater transport. The system prepped for operation and with payload from empty to full, is transportable by appropriate air, sea, or land means between locations in the same theater or operational area.

6.5.9 Fuel Leak. A fuel leak is defined as any leakage of a fluid great enough to form drops that would fall from the leaking item.

6.6 Corrosion control.

a. Corrosion control can be achieved by a combination of design features (as in TACOM Design Guidelines for Prevention of Corrosion in Combat and Tactical Vehicles, March 1988) or any automotive corrosion design guide such as SAE J447, material selection (e.g. composites, corrosion resistant metal, galvanized steel), organic or inorganic coatings (e.g. zinc phosphate pre-treatment, corrosion resistant plating, E-coat, powder coating) and production techniques (e.g. coil coating, process controls, welding , inspection, and documentation).

b. Corrosion Protection for low-carbon sheet steel can be achieved by hot dip galvanizing IAW ASTM A123, or electro-galvanized .75 mil minimum thickness IAW ASTM B633 (or minimum coating thickness of .75 mil on pre-galvanized sheet .063 in. or less), with zinc phosphate pre-treatment, epoxy prime preferably E-coat primer and CARC top coat. Alternate designs may be evaluated by comparison to a galvanized sample (as described above) using ASTM D522 Mandrel Bend Test and Accelerated Corrosion Test GM 9540P and gravelometer testing. Failure constitutes a defect such as extensive corrosion at scribe, chipping of coatings, loss of adhesion or significant penetration of base material (Per ASTM D3359).

c. Due to changes in climatic conditions and the development of newer materials and processes, all accelerated corrosion tests undergo a continuous adjustment to reflect these conditions. Therefore, modifications to the testing are to be expected over time. However any changes need to be agreed upon with the Government prior to testing.

6.7 Subject term (key word) listing.

Filter separator
Compatibility
Pump assembly
Filling station
Dispensing Hose
Nozzle
Tanks
Fuel
NBC

APPENDIX A-1

TABLE II. PLS Mission Profile.

Terrain	% of Cycle	Typical Speed
Hard Surface	25	55
Hilly secondary road	25	45
Level secondary road	25	45
Hilly trail	10	30
Level trails	10	30
Hilly rough Trails	2 ½	15
Level rough trails	2 ½	15

Primary roads. Two or more lanes, all weather, maintained, hard surface (paved) roads with good driving visibility used for heavy and high density traffic. These roads have lanes with a minimum width of 108 inches (2.75 M), road crown to 20 degrees and the legal maximum GVW/GCW for the country or state is assured for all bridges. These roads are surfaces having Root Mean Square (RMS) value of 0.1 inch (2.54 mm).

Secondary roads. Two lanes, all weather, occasionally maintained, hard or loose surface (e.g. large rock, paved, crushed rock, gravel) intended for medium-weight, low-density traffic. These roads have lanes with minimum width of 98.5 inches (2.5 m) and no guarantee that the legal maximum GVW/GCW for the country or state is assured for all bridges. These roads are surfaces having a RMS value varying between 0.3 inch (7.63 mm) - 0.6 inch (15.24 mm).

Trails. One lane, dry weather, unimproved, seldom maintained loose surface roads, intended for low-density traffic. Trails have a minimum width of 98.5 inches (2.5 M), no large obstacles (boulders, logs, and stumps) and no bridging. These are surfaces having a RMS value varying between 0.5 inches (12.7 mm) - 1.5 inches (38.1 mm).

APPENDIX A-2

TABLE III. LHS Mission Profile.

%	Terrain	Max Safe Speed Up To	Miles (per interval)
15	Hard Surface	55 mph	150
75	Secondary Road	45 mph	750
5	Cross Country - Level	30 mph	50
5	Cross Country - Hilly	15 mph	50

APPENDIX B-1

OPERATIONAL MODE SUMMARY/MISSION PROFILE (OMS/MP) For the MFS.

The modules are transported to the deployment site. The distance can vary from a few miles to several hundred. Transport is over types of terrain as defined in the Appendix A for the PLS and HEMTT-LHS. The TRMs are transported at any fuel level from empty to full. At the completion of emplacement site selection and prior to the arrival of the MFS modules, the site will receive minimal preparation (e.g., clearing areas of brush). The MFS deployment begins as follows:

- POL truck companies deliver full TRMs to the operating unit. This is primarily Division and below forces.
- Storage TRMs are emplaced, secured, and grounded.
- PRMs are emplaced, secured, and grounded.
- MOS 92F petroleum handling personnel manifold the storage tanks together with non-collapsible hose.
- Fitting assemblies, suction hoses and discharge hoses are deployed and connected starting at the storage TRMs.
- Fuel and oil servicing nozzles are attached to discharge hoses, ground rods emplaced, and grounding wires connected.
- Appropriate environmental precautions are completed.

1. Receiving Bulk Fuel. After beginning operations and TRMs are emptied. The TRM is isolated from the system by closing valves and hoses disconnected. When a LHS with a full TRM arrives, the TRM is off-loaded in the required position and connected in to the MFS after quality surveillance testing of the fuel. The empty TRM is uploaded onto the LHS for transport back to the fuel resupply point.

2. Issuing Fuel. The MFS will have a minimum of eight fuel dispensing points capable of servicing both tactical vehicles and aircraft. In addition, the MFS will have the capability of bulk loading tankers or filling 500-gallon drums. The operating time of the PRM will vary based on the number of customers, fuel acceptance rates, and the amount of time spent recirculating fuel. All issued and recirculated fuel will pass through the filter separator. The average daily throughput of the MFS is expected to equal its storage capacity. Table IV below depicts the breakout of expected daily fuel issue operations for the MFS. The MFS will have the capability to dispense fuel simultaneously at all dispensing points at a minimum flow rate of 50 GPM.

TABLE IV. 25,000 Gallon MFS Daily Operation.

Percentage of Fuel Issued by Customer Type			
Bulk Tanker	500 gallon Drum	Vehicle	Aircraft
40%	25%	15%	20%

3. Pump Operating Times Typical PRM operating hours/day issuing or recirculating fuel are shown below in Table V.

TABLE V. MFS Average Daily PRM Operating Hours.

One PRM - multiple TRMs	7

4. Transportation. The MFS will be transported to the emplacement location by the PLS, HEMTT-LHS or PLS trailer. The system will be transported over all types of terrain in accordance with the profile and distances given in Table VI below. A typical module will travel a minimum of 50 miles per day.

TABLE VI. Transportation Profile.

%	Terrain	Miles (per interval)
20	Primary Roads	150
50	Secondary Roads	750
15	Trails	50
15	Cross Country	50

5. Environmental Conditions. The environmental conditions in which the MFS will operate are shown below in Table VII.

TABLE VII. Operating Environmental Conditions.

Climate Types	Usage
Hot	25%
Basic	75%

APPENDIX B-2
OPERATIONAL MODE SUMMARY/MISSION PROFILE (OMS/MP)
For the TRM.

a. Wartime OMS/MP: This configuration utilizes individual TRMs for retail operations. Individual TRMs are normally used in this manner to support remote locations.

1) Receiving Bulk Fuel: Empty individual tankracks are normally replaced with full tankracks; however, tankers can be used to fill empty tankracks.

2) Issuing Fuel: When the TRM is mounted on the PLS trailer, fuel is issued through the retail nozzle through gravity flow or with the pump. However, when the TRM in on the ground the pump is used.

b. Pump Operating Times: Typical electric pump operating hours/day issuing fuel is shown below in Table VIII:

TABLE VIII. Pump Operating Time.

Individual TRM Average Daily Pump Operating Hours	
Pumping hours	2

c. Environmental Conditions. The environmental conditions in which the TRM will operate are shown below in Table IX:

TABLE IX. Pump Operating Time.

Climate Types	Usage
Hot	25%
Basic	75%

d. Movement Terrain. The movement terrain expected to be encountered by the TRM is shown below in Table X:

TABLE X. Movement Terrain.

Terrain		Miles (per interval)
Primary Roads	20%	8
Secondary Roads	50%	20
Trails	15%	6
Cross Country	15%	6
Total miles	100%	40

Custodians:

Army - AT

Preparing activity:

Army - AT

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil.