INCH - POUND
MIL-PRF-32090
15 October 2001

PERFORMANCE SPECIFICATION

DELIVERY SYSTEM, FUEL, BULK, AERIAL, GENERAL REQUIREMENTS FOR

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

1. SCOPE

1.1 Scope. This specification is for the general requirements of a Aerial Bulk Fuel Delivery System (ABFDS) and a ABFDS with Alternate Capability Equipment (ACE). Throughout this specification the ABFDS with ACE will be referred to as "Unit". The Unit will have altitude capabilities consistent with the specified aircraft and be of a size and capacity that may be accommodated by the aircraft. The Unit will be suitable for the delivery of motor, jet, avgas and diesel fuels.

1.2 Classification. This specification covers two types of ABFDS that are procurable as specified (see 6.2).

1.2.1 Type – I ABFDS without ACE.

II Unit or the ABFDS with ACE.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Resources and Logistics Services Division, WR-ALC/LEEE, 295.Byron St, Robins AFB, GA 31098-1611 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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).

SPECIFICATIONS

FEDERAL

A-A-50696	Reels, Static Discharge, Grounding, 50 and 75 Foot Cable Lengths
A-A-52557	Fuel, Oil, Diesel; For Posts, Camps and Stations
A-A-59377	Coupling Assemblies, Quick Disconnect, Sexless Type

DEPARTMENT OF DEFENSE

MIL-PRF-370	Hoses and Hose Assemblies, Nonmetallic: Elastomeric, Liquid Fuel
MIL-PRF-2104	Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8ST
MIL-N-5877	Nozzle, Pressure Fuel Servicing, Locking, Type D-1, D-1R, D-2 and D-2R, Nominal 2.5 Inch Diameter
MIL-DTL-6615	Hose Assemblies, Rubber, Fuel and Water, with Reattachable Couplings, Low Temperature
MIL-B-11188/1	Battery, Storage, Lead-Acid, Waterproof 12 Volt (2HN)
MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble
MIL-PRF-46167	Lubricating Oil, Internal Combustion Engine, Arctic
MIL-PRF-52747	Nozzle Assembly, Close-Circuit Refueling, Standard and Arctic Service
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Types; NATO F34 (JP-8) and NATO F-35, and JP-8 + 100
MIL-PRF-85285	Coating: Polyurethane, High-Solids
MIL-PRF-85582	Primer Coatings: Epoxy, Waterborne
MS24484	Adapter, Pressure Fuel Servicing, Nominal 2.5 Inch Diameter
MS3506	Connector, Receptacle External Electric Power, Aircraft, 28 Volt DC Operating Power (Future Designs should use SAE-AS35061)

STANDARDS

FEDERAL

FED-STD-595	Colors use in Government Procurement

DEPARTMENT OF DEFENSE

MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-461	Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-882	Systems Safety Program Requirements
MIL-STD-889	Dissimilar Metals
MIL-STD-1472	Human Engineering

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-470	Designing and Developing Maintainable Products And Systems, Volume I and Volume II
MIL-HDBK-808	Finish, Protective and Codes for Finishing Schemes for Ground and Ground Support Equipment
MIL-HDBK-1791	Designing for Internal Aerial Delivery in Fixed Wing Aircraft

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available 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 are those cited in the solicitation.

DRAWINGS

AIR FORCE

AF Drawing 7545352	Requirements for Finishes, Protective and Codes for Warner Robins, ALC, Ground Support Equipment

(Copy of this drawing is available from the Resources and Logistics Services Division, WR-ALC/LEEE, 295 Byron St., Robins AFB, GA 31098-1611.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. 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 documents not listed in DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN PETROLEUM INSTITUTE

API Bulletin 1529-89	Hose, Fueling, Aviation
API Standard 1581	Aviation Fueling hose

(Application for copies should be addressed to the American Petroleum Institute, 1220 L Street, Northwest, Washington, DC 20005).

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA-70	National Electrical Code	DoD Adopted

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

PARACHUTE INDUSTRY ASSOCIATION

PIA-PS70085	Clevis, Tiedown, Air Delivery Type II

Application for copies should be addressed to the Parachute Industry Association, 3833 West Oakton Street, Skokie, IL. 60076 or www.pia.com.

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specified exemption has been obtained.

3. REQUIREMENT

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Recycled, recovered, or environmental preferable materials. Recycled, recovered, or environmental 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 costs.

3.2.1 Replacement parts. The ABFDS and Unit maintainability of replacement parts, components and accessories must be available through off-the shelf sources for the life cycle of the system.

3.3 Metals. Metals shall be corrosion resistant or suitably treated to resist corrosion due to fuels, salt spray, atmospheric conditions, or wear likely to be encountered in transportation, storage, or during normal service life.

3.4 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other.

3.5 Protective treatment. Materials that are subject to deterioration when exposed to climatic and environmental conditions during storage or service usage shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. The use of any protective coating that will chip, crack, abrade, peel, or scale with usage, age, or extremes of climatic and environmental conditions is prohibited.

3.6 Design

3.6.1 General design. The ABFDS shall consist of two multi-fuel air-cooled engine-pump units and each engine-pump unit shall be called a module in this specification. The two modules shall be mounted on a part number HCU-10/C, HCU-6/E, or HCU-12/E aircraft pallet designed to interface with cargo 463L system. One HU-6/E pallet for first article testing will be Government Furnished Equipment (GFE) (see 6.2) for location. The ABFDS shall pump fuel into and out of 3,000 gallon bladder tanks carried on cargo aircraft with a piping configuration consisting of hoses and appropriate couplers that allows one module to be connected to a separate bladder tank. Each module shall be provided with a single point receptacle (SPR) to facilitate filling 3,000 gallon bladders from an external source. Unit modules will have the capability to evacuate discharge hoses without being disconnected or without reverse flowing fuel through filter separator elements. The modules shall be connected by a crossover manifold to allow onboard filling or evacuation of the bladder tanks by one or both modules. The manifold shall have four suction hose connections for connecting four bladder tanks located on the aircraft to the pumping modules. Fuel for the multi-fuel engine shall be supplied through an automatic fuel system using fuel from the bladder tanks. The ABFDS shall be constructed so that all components will be restrained from causing any external damage in the event that acceleration forces of 8g along the horizontal axis in any direction and 4.5g upward are encountered. The fuel delivery subsystem shall meet the applicable

requirements of MIL-STD-461, class A1. Each ABFDS shall be capable of being equipped with an attachable/removable ACE. The ACE consists of a filter separator and associated hose rack/frame.

3.6.2 Construction. The dimensions of the two modules shall not exceed the capabilities of the HU-6/E pallet (88 inches L x 108 inches W). The unit height shall not exceed 67 inches. Each module shall include cushion pads so as to minimize the possibility of an overstressed condition on the module, HU-6/E, and the 463L cargo aircraft rail system. The unit weight, mounted on the pallet, filled with fuel and with batteries and accessories installed, shall not exceed 3,900 pounds.

3.6.3 Reliability and maintainability test. This specification requires that applicable testing be conducted to demonstrate the reliability and maintainability of the unit. The reliability of the unit shall comply with the requirements of 4.5.2 endurance testing of 140 hours Mean Time Between Failure (MTBF) without a failure. Apparent failures that are caused by some unintended factor external to the equipment need not be counted as reliability failures if the causes can be substantiated to procuring activity satisfaction. Corrective action shall be conducted to prevent the repeat of the listed failure on the first article and subsequent production units.

3.6.4 Maintainability. The maintainability of the ABFDS or Unit shall be designed and constructed for simple maintenance as referenced in MIL-HDBK-470, paragraph entitled "Maintainability Design Criteria," except rather than being merely considered. The guidelines will apply wherever appropriate to the ABFDS components and where the guidelines do not conflict with other requirements specified herein. The fuel servicing unit and components will be designed and constructed to permit maintenance by military maintenance technicians and equipment operators. Inspection or examination of the product shall demonstrate compliance with qualitative maintainability requirements. The mean corrective maintenance downtimes for all levels of maintenance below depot or equivalent levels shall be not more than 1 hour with a related maximum corrective downtimes of not more than 3 hours Mean Time To Repair (MTTR).

3.6.5 Human factors engineering. The engine, engine components, engine control panel, engine accessories, fire extinguishers and all associated components of the ABFDS shall conform to accepted human factors engineering design criteria, as described in MIL-STD-1472.

3.7 Component description.

3.7.1 Multi-fuel engines. The engine shall provide sufficient horsepower to drive the pump at manufacturers specification to deliver 300 gpm, using the fuels specified, while being operated with or without the ACE (see 3.7.2). The engine shall be capable of driving the pump at its operating speed everywhere along the pump performance curve without lugging, stalling or over speeding when operating at 5,000 feet (24.9 inches of Hg) altitude and 107°F, ambient air condition. The engines shall be equipped with cold starting capabilities as specified by this specification (see 4.5.10.2, 4.5.10.2.1 and 4.5.10.2.2). The engines shall be air-cooled or water cooled and capable of returning automatically to idle under no flow conditions. The engines shall be fitted with a flexible insulated engine exhaust extension 12 feet long. The exhaust tube shall be a 300 series stainless steel. The engine shall be equipped with a splash shield to redirect sprayed or spilled fuel away from the engine in the event of a hose or bladder rupture.

3.7.1.1 Engine Controls. The engine controls shall require:

a. A two position manual-auto switch that is used to activate/deactivate the return to idle system.

b. Manual reset to return from idle to the set rpm after experiencing a no flow condition.

c. Automatic engine shutoff switch with manual reset for high temperature.

d. Low oil pressure engine shutoff.

e. An emergency engine shutoff switch that when activated will block the air-induction system.

3.7.1.2 Diesel engine filters. The engine manufacturer or its approved source shall supply the engine oil, air, and fuel filters. The filters shall meet the following requirements:

a. Be commercially available and of a standard type.

b. Be designed by the engine manufacturer for the most severe service and the longest change interval.

c. Be compatible with the fuels and lubricants specified in 4.4.1.

3.7.1.3 Required engine lubricant. The engine utilized shall be compatible with Grade 15W40 of MIL-PRF-2104 from 0°F, to the highest temperatures specified for the end item. For temperatures below 0°F, the oil will be preheated before engine operation. The engines also shall be compatible with Arctic oil per MIL-PRF-46167 from –40°F to +60°F and to limited use to +100°F in arctic environments where seasonal oil changes are not practical. Seasonal oil changes will be required in most locations.

3.7.2 Pumps. If required (see 6.2) the pump shall be a self-priming, single-stage, centrifugal-type pump. Each pump module shall be capable of delivering 300 gpm with sufficient pressure to compensate for all pressure drops in the system design and deliver 300 gpm at full flow through 50 feet length of 3 inch discharge hose.

3.7.2.1 Fuel meter assembly. Each engine-pump module shall be equipped with a flow volume toatalizer to record fuel quantity at variable pump rates. The totalizator shall be installed in the discharge manifold and between the discharge manifold and the discharge hose.

3.7.2.2 Fuel tank. Each engine-pump module shall have a manually vented fuel tank. The tank shall have a 5 gallon capacity and be designed for no spills. The tanks shall be constructed from suitable commercial stainless steel or aluminum. Commercial 5052-J32/H34 aluminum is acceptable with typical welding and joint fabrication. Plain carbon steel shall not be used. All tanks shall be mounted in a sturdy frame with band or strap hold-downs. All cushioning or gasket material shall be nonporous, non-hygroscopic, weather resistant and fuel resistant. Brackets or tabs attached directly to the tank shall not be used. A fuel feed line shall be installed between the discharge manifold and each fuel tank. The fuel feed line shall be equipped with an in-line manual shut-off ball valve. The fuel tanks shall be equipped with a float to maintain the fuel level at no more than 75% capacity. Each fuel tank shall be equipped with an OPW TFA-4 adapter and TFLC-4 locking cap or equivalent. Each tank shall be prominently marked “DO NOT USE MOGAS.”

3.7.2.3 Battery. The starting system shall be a 24 VDC electrical connectors for the battery and auxiliary power source. The battery shall be in accordance with MIL-B-11188/1 and shall be capable of being charged with a MS3506 (NSN 5935-01-050-7485) Connector.

3.7.3 Control panel. Each module shall have a control panel that contains a manual/auto and a start/stop switch, throttle control, oil-pressure gage, engine temperature gauge, ammeter or voltmeter, tachometer, outlet pressure gauge and a palm operated engine emergency shut-off switch.

3.7.4 Metal piping. The discharge and suction manifolds for each module shall be constructed from schedule 40 aluminum piping. Expansion joints, as required, for vibration damping shall be utilized. Victualic couplings shall be used where appropriate to facilitate ease of removal and installation of in-line components. A drain valve shall be provided to facilitate draining of any fuel in the manifolds and pumps prior to storage of the ABFDS. The drain valve shall be focused at the manifold's lowest point and at each pump drain plug. The drain valve shall be quarter turn ball valve style or equivalent.

3.7.5 ACE. The ACE is a module installed into the ABFDS frame between the two engine/pump modules. The ACE module shall have its own attachable/removable frame that includes: a 300 gpm filter separator, MIL-N-5877, D1 single point nozzle equipped with a 35 psi hose and pressure regulator/surge control valve and an A-A-59377 unisex dry break coupler with a 40 to 60 mesh strainer (compatible with the ACE discharge hose) and a MIL-N-5877, D2 single point nozzle equipped with a 50 psi hose end pressure regulator/surge control valve and an A-A-59377 unisex dry break coupler with 40-60 mesh strainer (compatible with the ACE discharge hose). Additionally, each ACE shall be provided with one MIL-PRF-52747, close circuit refueling nozzle equipped with an A-A-59377 unisex dry break coupler with 40 to 60 mesh strainer which is compatible with the ACE discharge hose.

3.7.5.1 Filter separator. The 300 gpm ACE module filter separator is designed to fit between the two pumping modules, connecting to both module outlets permitting operation from either pumping module. It shall be fitted with a manual vent and manual drain valve with sufficient hose to allow overboard venting and drainage. The outlet of the filter separator will be equipped with a A-A-59377 unisex dry break coupler compatible with the ACE 2" discharge hose. The filter separator performance, design, construction and first article testing shall comply with Group II, Class B, Test Series 1, 2, and 3 of API 1581 (third edition, May 89) with the following deviations:

a. The allowable effluent fuel contamination limit for free water shall not exceed 10 parts per million and any single sample shall not exceed 15 parts per million.

b. Additive I shall be Stadis 450 manufactured by E.I. DuPont and Nemours Company in lieu of ASA 3.

c. Additive II shall be HITEC-580 conforming to MIL-PRF-25017 in lieu of HITEC E-515.

3.7.5.1.1 Vessel. The vessel shall be designed and fabricated in accordance with the ASME Code for Unfired Pressure Vessels using aluminum alloy (see 3.2.2.2 of API 1581). The vessel shall be horizontal (end opening) or vertical and shall be designed for a working pressure of 150 psi and 300 gpm flow rate. Swing-type bolts shall be attached to the vessel for retaining the cover in a lock tight position. Additional requirements are:

a. A direct reading piston type differential pressure gauge that measures differential pressure across coalescers and separators shall be installed

b. A stainless steel manual vent shall be installed on top of the vessel.

c. Sampling connections shall be provided at outlet connections to the vessel.

3.7.5.1.2 Sampling connection. A sampling connection shall be provided at the outlet connection to the housing. The sampling connection shall consist of a 0.25 inch sampling probe facing upstream, 0.25 inch ball valve, a 0.25 inch quick disconnect coupling and aluminum dust cap. The quick disconnect coupling shall be equal to Snap-Tite Incorporated, part number APEC-4M. The connection shall be capable of accepting a sampling kit for drawing the samples required to assure fuel quality.

3.7.5.1.3 Straps. Tie down straps with ratchets that are compatible with tie down points on pallet shall be provided to secure both ABFDS modules and the ACE module, when installed, to the pallet (10,000 psi rated capacity for each strap).

3.7.6 Wireless dead man control. A wireless dead man for aircraft ground refueling systems shall be provided for each ABFDS. The dead man shall have the capability to operate the left or right module independently or both modules simultaneously. The dead man transmitter shall be a 10 mW (minimum) output power capability, powered by quantity of eight 4 V NiCd batteries and shall not weigh more than 0.3 kg with batteries installed. The unit shall be a squeeze handle type device. The unit shall have a push-button for emergency stops. The receiver shall be a 0.5 UV sensitivity, with a bandwidth of +/-kHz. The power supply shall be a 12/24 VDC +/-15%. The unit shall have minimum range capability of 120 ft. The unit shall have a push-button for emergency stops. Upon release of the dead man switch the engine shall return to idle and the discharge fuel flow stopped within 3 seconds. The unit shall be housed in ABS polycarbonate material. The unit shall not weigh more than 0.8 kg, with connection box and aerial. The wireless dead man is available from Delta Electronics or Carter Ground Fueling Company (PN DE 212-1N-01).

3.7.7 Hoses assemblies. ABFDS and Unit shall be provided with the following hose assemblies.

a. Type I, ABFDS.

1. Four each, MIL-DTL-6615, Type I, with internal ground wire, 3 inches I.D. X 25 feet long discharge hose.

2. Suction hose will be MIL-PRF-370, Type B, with sufficient diameter to meet fuel flow requirements and not cavitate the pump.

3. Each ABFDS will be equipped with three suction hoses: one hose 8 feet long, one hose 28 feet long and one hose 50 feet long.

b. Type II, Unit.

1. Two each API 1529, Grade 2, Type C, 2-inches I.D. X 60 feet discharge hoses with API internally expanded couplers and unisex coupler.

2. Suction hose will be the same as required in a.2 above.

c. All ABFDS and Units shall be provided with the following:

1 One each 0.75 inch I.D. X 25-foot long rubber hose to connect the forward 3,000 gallon bladder air eliminator to the aft 3,000 gallon bladder air eliminator. Each end of the hose will have a number 12 push on flare type coupler.

2 One each 0.75 inch I.D. X 20 long foot rubber hose to connect aft air eliminator to the aircraft vent. Each end of the hose will have a number 12 push on flare type coupler.

3. All hose ends shall be equipped with A-A-59377 unisex dry break couplers unless otherwise specified.

3.7.8 Aircraft refueling nozzles. In addition to ACE nozzle requirements in 3.7.5, each ABFDS shall be provided with one MIL-N-5877, D1 and one MIL-N-5877, D2 nozzle, each equipped with A-A-59377 unisex dry break couplers with 40-60 mesh strainers which are compatible with 3 inch discharge hoses.

3.7.9 Nozzle, coupler and adapter storage. Each ABFDS shall be equipped with convenient nozzle, coupler and adapter storage capability.

3.7.10 Couplers and adapters. Each ABFDS and Unit shall be furnished with the following additional components:

a. Three each 4 inch female camlock "X" A-A-59377, unisex dry break coupler. The contractor for suction hoses in 3.7.7 a.2, a.3 and b.2 shall determine unisex size. Unisex shall meet the requirements of 3.7.1.

b. Two each 4 inch female camlock X single point adapter (MS24484).

c. Two each 3 inch female camlock X single point adapter (MS24484).

d. Two each 4 inch male camlock X 4 inch male camlock adapter.

e. Two each 4 inch male camlock X 4 inch male camlock adapter.

f. Two each 3 inch male camlock X3 inch male camlock adapter.

g. Two each 3 inch unisex X 2 inch unisex.

h. Two each 3 inch female camlock X 3 inch female camlock coupling.

i. Storage requirements are as required in 3.7.9.

3.7.11 Hose storage rack. Each ABFDS and Unit shall have an identical attachable/removable hose rack sized to store all hoses specified in 3.7.7. The hose rack must not interfere with the ACE when installed.

3.7.12 Fire extinguisher requirements. Each ABFDS and Unit module shall be equipped with an approved and properly NFPA rated fire extinguisher(s) of sufficient capacity to extinguish a fire involving the pump and filter components. Fire extinguishers shall not contain chemicals/solvents that are ozone depleting.

3.7.13 Additional requirements. The ABFDS and Unit shall be equipped with a weatherproof storage container which contains:

a. Tank platform clevises (quantity of four PIA-PS70085).

b. Caps for sealing couplings ends on the crossover manifolds when removed

c. Shims for tightening cam locking couplings (30)

d. Quick disconnect plug and hose assembly to facilitate engine crankcase drain (1)

e. Battery powered, volatile fume detection meter. This meter is in a leather carrying case, 17.5" L x 6" W x 13" H (meter not to be supplied by contractor).

3.8.14 Electrical system. An electrical system shall be provided to enable each engine pump unit to be started independently of any other electrical system. The system shall contain a storage battery, a battery box with drainage facilities, an engine-driven spark-proof alternator, a voltage regulator and wiring, relays, and connectors as necessary. Wiring methods shall be in accordance with NFPA-70, National Electric Code, Article 501 Class I, Division 2.

3.7.14.1 Bonding. Each ABFDS module shall be bonded to the pallet and the ACE module, when installed, shall be bonded to the ABFDS module. The ACE module shall be equipped with one bonding reel that meets the requirements of A-A-50696 with the exception. That exception is the bonding reel shall be provided with a length of 145 to 150 feet ground cable (15 ohm resistance) that a hand crank reel may be used and that a governor brake arm assembly that maintains a slow retraction rate for the cable and prevents a run-away return of the cable.

3.7.15 Finishes and protective treatment. Refer to MIL-HDBK-808 as a reference only as modified by Air Force drawing 7545352 for cleaning, painting, plating, anodic films and chemical treatments. A listing of the procedures used shall be furnished the procuring activity and shall be included in the required Test Report. All exposed metal surfaces shall be coated with FED-STD-595 color 24052 (semi-gloss green) using primer/topcoat in accordance with MIL-PRF-85582/MIL-PRF-85285. All aluminum moving parts and parts subject to wear shall be given a hard anodic coating.

3.7.16 Identification. All parts shall be marked in accordance with MIL-STD-130, when practical.

3.7.17 Environmental requirements. Diesel engines shall be in accordance with the Appendix "Diesel Engine Performance Requirements.

4. VERIFICATION

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

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 First article inspection. The first article shall be submitted in accordance with 3.1. Initial inspection of the first article shall consist of a first article test in accordance with 4.5 and an operational, test, and evaluation (OT&E) unit in accordance with 4.7. First article shall be performed on one complete unit at the contractor's facility, or at other facilities acceptable to the government. Unless otherwise specified (see 6.2), one unit shall be subjected to the tests specified under 4.4 and 4.5. Presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.3 Conformance inspection. Each ABFDS and Unit module shall be tested as specified in 4.5.1, 4.5.4 and 4.5.10. Noncompliance with any specified requirements or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.4 Test fluids and conditions.

4.4.1 Test Fluids. Engine test fuel shall be diesel, JP-5, JP-8 or Jet-A in accordance with MIL-DTL-5624 and MIL-DTL-83133. Fuel transfer pump test fluid shall not be water; fuel transfer pump test fluid may

be hydrocarbon other than JP-5, JP-8, or Jet-A. (For example: Stoddard's solvent, number 2 diesel fuel high flash point kerosene). Hydrostatic proof pressure fluid shall be water. If different (see 6.2).

4.4.2 Test conditions. The testing setup shall simulate the aircraft installation and flight conditions encountered during actual operation.

4.5. First article test methods.

4.5.1 Examination. The examination of the Unit shall be conducted to confirm compliance with the requirement herein. The ACE module shall be installed to ensure proper clearance of the ACE module components with the hose rack above the pump module containing ABFDS equipment hoses. The examination shall be accomplished using the test plan that shall identify all specific required attributes for which inspection is made, how conformance is determined, and results obtained.

4.5.2 Engine-pump endurance test. The diesel engine and fuel transfer pump module shall be subjected to a 140 hour endurance test. Endurance testing shall consist of seven continuous cycles of one hour tests followed by one hour of non-operation. The module shall be configured with flow through one nozzle during these tests. The one hour test shall consist of an idle for 15 minutes, followed by running the engines at 1500 rpm for 15 minutes and followed by a maximum rpm run of 29 minutes (full flow condition). After the seven cycles of continuous testing, the engine shall be interrupted by one hour of non-operation. The engine pump shall be capable of delivering 300 gpm at 130 psi at the pump outlet. Upon completion of the 140 hour endurance period, the engine pump module of either failure or impending failure of the engine-pump module shall be cause for rejection. A failure is any malfunction which cannot be corrected with 30 minutes adjustment, repair, or replacement action using degradation of performance below specified in this paragraph shall be cause for rejection.

4.5.3 Hydrostatic testing. The Unit shall be hydrostatic proof tested at not less than 110% of the maximum pressure requirement for not less than 10 minutes. All valves shall be open during hydrostatic testing. There shall be neither external leaks, permanent deformation nor evidence of impending failure of the Unit either during or as a consequence of hydrostatic testing. The Unit shall have passed if it is capable of withstanding a proof pressure of the maximum operating pressure of 130 psig without evidence of external leakage, permanent deformation or impending failure. Separable items, such as dry break coupling adapters and combination assemblies, shall be "bench" hydrostatic proof tested in the same manner as the Unit.

4.5.4 Engine testing requirements. The following tests are required to determine the selected engine and accessory equipment suitability for Air Force worldwide operations. These tests shall be accomplished with the engine installed in the end item. The tests may be conducted concurrently with the other end item tests or as separate tests. The test schedule is a generic flight line SE schedule and may be changed with end item user coordination and strong evidence that the particular end item will see a significantly different schedule in actual operation.

4.5.4.1 Engine control tests. Engine controls shall be exercised five times consecutively on both modules to demonstrate compliance with 3.7.6. Engine low oil pressure, over temperature conditions and engine emergency shutdown shall be simulated.

4.5.5 Air transportability test. The Unit shall withstand transport loads as referenced in MIL-HDBK-1791. The ACE module when installed shall be secured to the pump module to withstand the forces specified in 3.6.1.

4.5.6 Continuity test. The Unit shall have electrical continuity confirmed across all fuel conveying interfaces (joints, connections) and from fuel conveying components to the pumping module frames.

4.5.7 High altitude – hot day simulation test. The Unit shall be set up to test for maximum rpm performance at 5,000 feet above sea level (24.9 In Hg) and 107°F. In order to avoid using an environmental test chamber, the engine air intake may be throttled with an intake plenum chamber. The intake air must be at least 80°F and the barometric pressure adjusted using standard SAE correction formulas to obtain an intake air density equal to 24.9 in Hg at 107°F. The pump shall be run at maximum flow for one hour. The Unit shall have passed if the Unit is capable of operating for one hour with an engine air intake density equal to 24.9 inches HG at 107°F maximum, delivers 300 gpm flow @ 130 psig outlet pressure and if the exhaust smoke does not exceed Bosch 4.5.

4.5.8 Exhaust engine manifold temperature test. The exhaust manifold temperature shall not exceed 700°F upon the external surface of the engine or upon the surface of the exhaust manifold shields. Exhaust temperatures shall be recorded when the engine is operating in the high temperature chamber at 125°F (see 4.5.10.1).

4.5.9 Pressure test. The engine-pump fuel tank shall be pressure tested to a positive pressure of 19 psig and a negative pressure of 10 psig. No leakage, deformation, or rupture shall be acceptable.

4.5.10 Environmental tests. The following environmental tests shall be conducted on the ABFDS in accordance with the specified methods of MIL-STD-810.

4.5.10.1 High temperature test. The Unit shall be subjected to high temperature in accordance with method 501, procedure I. No adverse effects that would affect operation at normal temperature shall result from the 50-hour exposure at 160°F. The chamber temperature shall be reduced to 125°F and the test described in 4.6.3 conducted. The engine-pump modules shall be stopped for 5 minutes and restarted. Each module shall be operated at 300 gpm with a maximum of 50 +5 psi at the nozzle in the open position for 0.5 hour. The modules shall be stopped for 5 minutes and restarted and operated at idle speed for 0.5 hour. All starts shall be accomplished within 5 minutes of the original attempt. The ABFDS shall operate satisfactorily and perform its intended functions throughout this test. There shall be no evidence of leakage, damage, thermal degradation or impending failure of any portion of the unit.

4.5.10.2 Low temperature test. The Unit shall be subjected to low temperature in accordance with method 502, procedure 1, except after the 60-F soak for 50 hours the chamber temperature shall be raised to –25°F and stabilized for 24 hours. The modules shall be started within 10 minutes of the initial attempt and shall demonstrate the ability to pump fuel at 300 gpm with a maximum of 50 + 5 psi at the nozzle for a minimum period of 10 minutes. With temperatures between 0° and 25°F, the starting system shall allow the unit to start and be ready to perform any function in its basic design within five minutes of operator start initiation. The starting system energy storage subsystem shall have the capacity at –25°F to provide a minimum of two starts. The starting energy replenishment system shall at –25°F, recover from one start in one hour running time and two starts in two hours running time. The unit shall be inspected during the test and there shall be no evidence of leakage, damage, degradation, failure, or impending failure of any portion of the unit.

4.5.10.2.1 Test requirements. Units properly winterized with suitable fuel, lubricants, and hydraulic fluid shall have unlimited stand-alone starting and restarting capability at –25°F. The starting system energy storage subsystem shall have the capacity to provide a minimum of two starts at a -25°F. The starting energy replenishment subsystem shall at –25°F recover from one start in one hour running time and two starts in two hours running time.

Note: Stand-alone means no starting aids may be used that are not contained within the units (no outside aids such as 110 volt power or separate heater as an example).

4.5.10.2.2 Cold starting test conditions. The following test conditions shall be maintained. The cold start test shall be accomplished with the engine installed in the end item.

a. Engine fuel. The fuel shall be a light kerosene with cloud point below –25°F, such as JP-5, JP-8, Jet A or Jet A1, commercial No. 1 Diesel, DF-1 or DF-A per A-A-52557.

b. Engine lubricating oil. The engine lubricating oil shall be drained, flushed and filled with arctic lubricating oil per MIL-PRF-46167.

4.5.10.3 Humidity test. The ABFDS shall be subjected to humidity in accordance with method 507, procedure (Natural, cycle 1 for 5 days). After the tests, inspect the unit for evidence of leakage, damage, degradation, failure or impending failure. Repeat the cycle 1 for a total of 5 humidity cycles inspecting after each cycle. The ABFDS shall be removed from the test chamber and be capable of operating for a minimum of ten minutes at 300 gpm flow at 130 psig outlet pressure. The engine controls test, referenced in 4.6.4.1, shall be conducted with the exception that each control needs to be exercised only once to verify proper functioning of all engine controls and safeties (except for the dead man function). ABFDS shall have passed if the unit produces 300 gpm flow at 130 psig, if all engine controls and safeties function properly and if there is no evidence of leakage, damage, thermal degradation, or impending failure of any portion of the unit.

4.5.10.4 Fungus test. The ABFDS shall be subjected to fungus with method 508. The ABFDS shall be subjected to 28 days of fungus testing per procedure 1. The contractor will specify which samples (source of sample and material) will be placed into the test chamber. ABFDS samples shall be examined for evidence of fungus after seven days and at the end of the test. The ABFDS shall have passed if there is no evidence of fungus growth on the samples tested with certification verifying that there is no fungus nutrient materials contained in the supplied component.

4.5.10.5 Salt fog test. The ABFDS shall be subjected to salt-fog in accordance with method 509 (48 hour exposure period). The ABFDS shall be placed into the salt fog chamber. Upon completion of the exposure period, the unit shall be removed from the chamber and connected to a fuel supply source. The unit shall be operated for a minimum of ten minutes at 300 psig minimum at 130 psig outlet pressure. The engine controls test (see 4.5.4.1) shall be conducted, except that each control needs to be exercised once, to verify proper functioning of all engine controls and safeties (except for the dead man function). The ABFDS shall have passed if there is no evidence of excessive corrosion on the ABFDS system, if the unit produces a minimum of 300 gpm flow at 130 psig outlet pressure, if all engine controls and safeties function properly and if there is no evidence of leakage, damage or failure of any portion of the system.

4.5.10.6 Sand and dust test. The ABFDS shall be subjected to sand and dust in accordance with method 510. The ABFDS shall be subjected to sand and dust concentrations that are at least 95% by weight of silicon dioxide. The sand shall be sub-angular structure with a mean Krumbiein number (roundness factor) equal to 0.2 and a hardness factor of 7 mohs. The dust concentration for the blowing dust shall be maintained at 10.6 grams per cubic meter (g/m^3). The sand concentration shall be 0.177 g/m^3. The configuration of the test item must reproduce, as closely as possible, the configuration that it would assume during storage or use during deployment. The test shall be conducted for 90 minutes per face for the blowing sand test and 6 hours at 23°C (73°F). Upon completion of the exposure, the unit shall be inspected for deterioration and removed from the chamber. The unit shall be connected to a fuel supply source and operated for a minimum of ten minutes at 300 gpm minimum at 130 psig outlet pressure. The engine control tests (see 4.5.4.1) shall be conducted, except that each control needs to be exercised once

to verify proper functioning of all engine controls and safeties (less dead man function). The ABFDS shall have passed the test if the unit produces a minimum of 300 gpm flow at 130 psig outlet pressure, if all engine controls and safeties function properly and if there is no evidence of leakage, damage or impending failure of any portion of the system.

4.5.10.7. Rain test. The ABFDS shall be subjected to rain in accordance with method 506, procedure II. The ABFDS shall be placed in the rain chamber in the operating configuration. The unit shall be operated at 300 gpm and 130 psig outlet pressure for a 15 minute period. Upon completion of the test, the ABFDS shall be removed from the chamber and examined for water penetration. ABFDS shall have passed the test: if there is no evidence of water penetration into the sealed portions of the system, if the unit produces a minimum of 300 gpm flow at 130 psig outlet pressure and if there is no evidence of leakage, damage, or impending failure of any portion of the system.

4.6 Operational, test and evaluation (OT&E). A user OT&E on a second production unit in an operational environment shall be conducted which will task the unit to mission roles. The testing and evaluation shall be conducted after completion of the first article test. The OT&E unit may be provided for the environmental and mobility tests if a shorter first article inspection time is required. Upon completion of the first article inspection, the second unit will undergo OT&E by Air Force personnel for 30 days at a location be determined by contract (see 6.2). Any changes made to the first article unit due to deficiencies found during the first article inspection shall be made to the OT&E unit before shipping to OT&E location.

4.7.1 Test. Testing shall include but not be limited to the following:

a. Normal filling of all tanks using single-point system.

b. Normal pumping (each engine-pump module delivering fuel from its respective tank). Pumps shall deliver the specified fuel flow to atmosphere.

c. One pump operation: pump fuel from all tanks using only one engine-pump unit. Test each module in this manner.

d. Evacuate all lines after normal filling and emptying of tanks.

e. Fill each tank, pumping with the modules.

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 System Command. Packaging data retrieval is available from the managing Military Department's 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 ABFDS is intended for transporting bulk fuel by aircraft to tactical air and ground forces operating from forward expeditionary airfields, assault strips, and division support areas. The ABFDS equipped with ACE (Unit) is intended to provide aircraft refueling support capability at forward operating locations. It will permit the offloading of fuel directly from the airborne tanks into base fuel storage and dispensing systems.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, document number, and date of this specification.

b. Required type (see 1.2.1).

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

d. When first article is required (see 3.1)

e. Location delivery for GFE (see 3.6.1).

f. Required pump out put (see 3.7.2).

g. Test fluid to be used if other than specified in 4.4.1.

h. Identify OT&E test location for second unit (see 4.6).

i. Packaging requirements (see 5.1).

6.3 Government furnished equipment. The contracting officer should arrange the delivery of the GFE property listed in 6.2.e.

6.4 Part or Identifying Number (PIN). The PIN to be used for the ABFDS or Unit acquired to this specification be created as follows:

M	XXXXX-	XX
Prefix for military specification	Specification number	Type (see 1.2.1)

6.5 Subject term (key word) listing.

Bladder	Nozzle
Camlock	Pumps
Environmenta	Tanks
Filter-separator	Winterized
Lubricants	Wireless dead man control
Multi-fuel engine	

APPENDIX A

DIESEL ENGINE PERFORMANCE REQUIREMENTS

A.1 Scope

A.1.1 Scope. This document provides selection guidance and performance requirements for commercial diesel engines used in Air Force (AF) end item Support Equipment

A.2 APPLICABLE DOCUMENTS. No applicable documents are cited in this appendix.

A.3 DIESEL ENGINES

A.3.1 Engine certifications. In addition to any other contract required engine certification or warranty, an engine manufacturer's certification must be obtained for any engine selected and included in the first article test report. The engine manufacturer must certify the following:

a. The engine selected by the end item contractor is acceptable for the intended use with the fuels and lubricants specified. The general engine application (cooling/starting as an example) shall also be approved.

b. The engine is a current production model and production is not scheduled to be terminated in the foreseeable future.

c. At such time production is terminated, the engine manufacturer shall, to the best of its ability, maintain spare parts support for a minimum of 10 years.

d. If the engine is not manufactured in the U.S., the manufacturer must have a complete distribution and service system in the U.S. for both commercial and Air Force requirements and the manufacturer must also certify compliance with the criteria outlined in A.3.1.c.

e. The engine shall satisfy all performance requirements set forth in the end item equipment specifications, this document, and all exhaust emission requirements as outlined in A.4.2.

A.4 END ITEM DIESEL ENGINE REQUIREMENTS

A.4.1 Identification marking. Unless otherwise specified, the engine shall be identified in accordance with engine manufacturer's standard practice.

A.4.2 Engine exhaust and crankcase emissions. The Department of Defense (DoD) has been directed to exercise "Environmental Leadership" and meet all Federal, State, and Local environmental regulations. AF SE is designed to be mobile, portable and standardized so forces from different locations can meet at a deployed site, and use common SE. Meeting local requirements with unique equipment is not practical so all SE must meet the strictest environmental requirements promulgated by the state of California or the EPA as outlined in the following paragraphs.

A.4.2.1 California Air Resources Board (CARB), Utility, Lawn and Garden Engine (ULGE) Rule. The CARB rule goes into effect 1 January 1995 for engines rated 25 hp and below. There appears to be regulatory omission between 25 and 50 hp in California and from 0 to 50 hp in EPA standards for diesel

engines. It is believed these omissions will be filled by extending the CARB ULGE Rule to 50 hp. It is further believed that engines using indirect injection and/or other exhaust emission reduction technology can be adapted to meet this rule.

a. Engines rated 25 hp or less must have CARB ULGE certification before production deliveries begin. This testing can be part of the bid sample testing required for Commercial Item Description (CID) end items or the first article test for performance specification end items.

b. Engines rated between 25 and 50 hp must have manufacturers or independent test laboratory test data showing the engine meets the emission requirements of the CARB ULGE rule before production deliveries begin. This also can be part of the bid sample testing or first article testing.

A.4.2.2 The CARB ULGE Rule. The CARB ULGE rule is a complex legal/technical requirement document with many cross-references in California law. Engine manufacturers/importers normally have personnel with detailed knowledge of these requirements. Suggest end item contractors discuss these requirements with the suppliers. If additional information is required, including a list of engines that are certified (25 hp and below), contact Air Resources Board at 9528 Telstar Ave., El Monte, CA 91731.

A.4.2.3 United States EPA, Non-road Engine Rule (NER). On 17 June 1994, the EPA promulgated the NER for diesel engines 50 hp and greater rated power. Actual emission standards will be phased in over time by horsepower classes for new engines.

a. Engines rated from 50 to 100 hp must meet the NER standard by 1 Jan 98. Engines in this class do not have the on-road technology from which to draw. Engine manufacturers and importers shall be researched for items that have an engine to meet this non-road standard or will agree to participate in the certification process as a part of the acquisition process. If no engine supplier will agree to meet the standards, then an engine shall be selected that the supplier will certify his intentions to meet the standards with the same basic model type so future end item changes can be kept to a minimum to install a certified engine.

b. Engines rated 100 to 175 hp must meet the NER standard by 1 Jan 97. The Ford, Dodge, and Chevy/GMC pickup truck diesels (and possibly others) have the on-road certification technology to meet the non-road requirements. Engines in this category must meet the non-road standard by the time first article or bid sample testing begins, or be accomplished as a part of the testing so that production engines meet the NER.

c. Engines 175 to 750 hp must meet the NER standard, 1 Jan 96. Engines in this class should be available before this date because this is the class that has had to meet the on road standard for some time. While the on/non road standards are different, the engine technology (turbo charged, after cool, and electronic fuel injection control) is well established and should allow engines to meet the non-road requirements. Engines in this class must meet the NER by the time first article testing or bid sample testing begins or be accomplished as part of the testing so that production engines will meet the NER.

d. Engines rated above 750 hp. Any requirements for engines over 750 hp will be handled on a case by case basis.

A.4.2.3.1 Engines not certified at time of production If engines will not be certified by the time production begins, a waiver of this requirement can be requested from the procuring activity. The request

APPENDIX

shall describe all efforts taken to comply with the non-road standard and propose a remedial plan for bringing the engine into compliance post-production.

A.4.2.3.1 Complex rule. As above, the rule is complex, lengthy, and with many cross-references. Suggest end item contractors discuss this requirement with engine suppliers. If additional information is required, contact the U.S. EPA, Washington, DC 20460 (202) 233-9256. The EPA does not maintain a list of engines meeting this requirement; individual suppliers maintain their own lists.

Custodians:
Army – AT
Navy - YD
Air Force - 99

Review activities:
DLA - CC

Preparing activity:
Air Force – 84

Project Number 4930-0386

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-32090	**2. DOCUMENT DATE *(YYYYMMDD)*** 2001/10/15

3. DOCUMENT TITLE DELIVERY SYSTEM, FUEL, BULK, AERIAL, GENERAL REQUIREMENTS FOR

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	**b. ORGANIZATION**	
c. ADDRESS (Include Zip Code)	**d. TELEPHONE** (Include Area Code) (1) Commercial: (2) DSN: (3) FAX: (4) EMAIL:	**7. DATE SUBMITTED** ***(YYYYMMDD)***

8. PREPARING ACTIVITY

a. NAME Albert Morales	**b. TELEPHONE** **Commercial: (478) 926-7046 x144 DSN: 468-7046 x144** **FAX: (478) 926-7973 EMAIL: albert.morales@robins.af.mil**
c. ADDRESS WR-ALC/LEEE 295 Byron St. Robins AFB, GA 31098-1611	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office 8725 John J. Kingman, Suite 2533 Fort Belvoir VA 22060-6221 Telephone (703) 767-6888 DSN: 427-6888