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PERFORMANCE SPECIFICATION

DELIVERY SYSTEM, AERIAL, BULK FUEL

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 requirements of an Aerial Bulk Fuel Delivery System (ABFDS). The ABFDS will have altitude capabilities consistent with the specified aircraft and be of a size, capacity and weight to be transported via C-17 or C-130 aircraft. The ABFDS will be suitable for delivery of jet kerosene and diesel fuels.

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 of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

Comments, suggestions, or questions on this document should be addressed to:
U.S. AIR FORCE – WR Air Logistics Complex, AFLCMC/WNZEB, 235 Byron St. STE 19A, Robins AFB GA 31098-1813 or emailed to SPEC99@us.af.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.dla.mil.

AMSC N/A FSC 4930

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 cited in the solicitation or contract.

INTERNATIONAL STANDARDIZATION AGREEMENT

STANAG-3747	Guide Specifications (Minimum Quality Standards) for Aviation Turbine Fuels (F-34, F-35, F-40 and F-44) AFLP-3747

FEDERAL STANDARDS

FED-STD-595C/26173	Semi-gloss Grey
FED-STD-595C/31136	Lusterless Red
FED-STD-595C/37038	Lusterless Black

Colors used in government procurement are available from the Society of American Engineers (SAE) International, 400 Commonwealth Drive, Warrendale, PA 15096 or online at http://standards.sae.org/amsstd595/

COMMERCIAL ITEM DESCRIPTIONS

A-A-393	Extinguisher, Fire, Dry Chemical (Hand Portable)
A-A-50696	Reels, Static Discharge, Grounding, 50 and 75 Foot Cable Lengths
A-A-52624	Antifreeze, Multi-Engine Type
A-A-59377	Coupling Assembly, Quick Disconnect, Sexless Type

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-370	Hose 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 and JP-5
MIL-B-18013/1	Battery, Storage, Support Equipment
MIL-PRF-23377	Primer Coatings: Epoxy, High-Solids
MIL-PRF-25017	Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble
MIL-PRF-26915	Primer Coating, for Steel Surfaces
MIL-PRF-27260	Tie Down, Cargo, Aircraft, CGU-1/B
MIL-DTL-25959	Tie Down, Tensioners, Cargo, Aircraft
MIL-DTL-27443	Pallets, Cargo, Aircraft, Type HCU-6/E, HCU-12/E
MIL-PRF-52747	Nozzle Assembly, Closed Circuit Refueling, Standard and Arctic Service

MIL-DTL-53030	Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free
MIL-DTL-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-DTL-83133	Turbine Fuels, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)
MIL-DTL-83833	3000 Gallon Aerial Bulk Fuel Delivery System Bladder
MIL-PRF-85285	Coating: Polyurethane, Aircraft and Support Equipment

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-209	Lifting and Tiedown Provisions
MIL-STD-461	Electronic Interference Characteristics Requirements for Equipment
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-882	System Safety
MIL-STD-889	Dissimilar Metals
MIL-STD-1366	Interface Standard for Transportability Criteria
MIL-STD-1472	Human Engineering
MIL-STD-1791	Designing for Internal Aerial Delivery in Fixed Wing Aircraft

(Copies of these documents are available online at http://quicksearch.dla.mil/ .)

FOREIGN SPECIFICATIONS

MODUK DEF STAN 91-91	Turbine Fuel, Kerosene Type, Jet A-1 NATO Code :F-35 Joint Service Designation
GOST 305	Gas Oil D2 L-0.2-62 (Russia)
GOST 10227-86	Fuels for Jet Engines
TUPRAS 403	Diesel Fuel (Turkey)
BS EN 590	Ultra-Low Sulfur Diesel (European)
JIS K 2204	Diesel Fuel (Japan)

(Copies of these documents, except for GOST 10227-86 and DEF STAN 91-91, are available online at http://quicksearch.dla.mil. A copy of GOST 10227-86 can be obtained from the Procuring Contracting Officer (PCO). DEF STAN 91-91 can be obtained from https://www.dstan.mod.uk/).

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.

AIR FORCE INSTRUCTION (AFI)

AFI 32-7086	Hazardous Materials Management

(Copies of this document are available online at http://www.e-publishing.af.mil/ .)

DRAWINGS

ARMY

11-1-2780	Platform, Airdrop, Type V

(Copies these documents are available from 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 can be requested by sending an email to usarmy.detroit.rdecom.mbx.tardec-standardization@mail.mil/ .)

LAWS AND REGULATIONS

Code of Federal Regulations (CFR)

40CFR82	Protection of Stratospheric Ozone

(Copies of The Code of Federal Regulations (CFR) may be obtained at http://www.gpoaccess.gov/cfr/index.html or available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402.)

TEST OPERATIONS PROCEDURE (TOP)

TOP 2-2-800	Center of Gravity

(Copies of this document are available online at https://vdls.atc.army.mil/ .)

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 these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL (ASTM)

ASTM B241/B241M	Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM D975	Standard Specification for Diesel Fuel Oil
ASTM D1655	Standard Specification for Aviation Turbine Fuels

(Copies of these documents are available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken PA 19428-2959 or online at http://www.astm.org/ .)

ENERGY INSTITUTE (IE)

EI-1529	Aviation Fueling Hose and Hose Assemblies
EI-1598	Design, functional requirements and laboratory testing protocols for electronic sensors to monitor free water and/or particulate matter in aviation fuel

(Copies of this document are available online at http://publishing.energyinst.org/)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA-70	NFPA-70, National Electric Code, Article 501 Class I, Division 1

(Copies of this document are available online at http://www.nfpa.org/ .)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

ARP1247	General Requirements for Aerospace Ground Support Equipment, Motorized and Nonmotorized

(Application for copies should be addressed to SAE, Inc., 400 Commonwealth Drive, Warrendale PA 15096 or online at http://www.sae.org/.)

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 First article. When specified (see 6.2), one AFBDS shall be subjected to first article inspection in accordance with 4.2.

3.2 ABFDS description. The ABFDS shall consist of a single diesel engine and engine driven pump, complete with both suction and discharge hoses, coupling connections, and a contamination monitor (CM). The ABFDS shall not exceed the weight and dimensions as specified in 3.5. For operational use, the ABFDS will be mounted by Government personnel on a type HCU-6/E aircraft pallet built in accordance with MIL-DTL-27443. The pallet is designed to interface with the 463L cargo aircraft rail system. The HCU-6/E aircraft pallet offers up to 22 tie down points that will be used to secure the ABFDS to the pallet. No modifications to the HCU-6/E aircraft pallet are allowed. The ABFDS shall have suction hose connections to connect and pump fuel from one,

two, or three 3,000-gallon bladder tanks until the bladder tanks are essentially empty. The bladder tanks shall be built in accordance with MIL-DTL-83833. A method shall be provided to drain the fuel from the suction hoses within the confines of the aircraft prior to disconnection. The bladder tanks are transported on the C-17 and C-130 cargo aircraft via a 20-foot, Type V, Aerial Delivery Platform that utilizes a piping configuration of appropriate suction hoses and couplers allowing the ABFDS in accordance with 11-1-2780 to be connected to the bladder tanks. The ABFDS shall be capable of defueling fuel from the bladder tanks or from the host aircraft's single point refueling receptacles (SPR), and deliver the fuel either to ground receipt bladder tanks or to other aircraft. The ABFDS shall incorporate a SPR to facilitate filling or pumping from the bladder tanks to or from an external source. The ABFDS shall have the capability to evacuate discharge hoses into the onboard bladder tanks prior to being disconnected. The ABFDS shall have the capability to deliver fuel to an aircraft via a single point nozzle through either one or two 100 foot x 3-inch collapsible hoses at flow rates as specified in 3.10.1.

3.3 Design and construction. The design of the ABFDS shall promote cost effective, life-cycle sustainability by addressing considerations such as incorporating open standards, reducing pollutant emissions and wastes, and increasing fuel economy, while satisfying system performance requirements. It shall be designed and constructed so that no parts shall work loose in service, and to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service. It shall be weatherproof and designed to prevent the intrusion of water, sand, and dust into critical operating components. The total dimensions of the ABFDS shall not exceed the dimensions specified in 3.5 (the useable surface of the HCU-6/E pallet is 84 inches long by 104 inches wide). The unit height shall not exceed 67 inches with a hose storage rack installed. The ABFDS shall include cushion pads to minimize the possibility of an overstressed condition on the HCU-6/E pallet and the 463L cargo aircraft rail system. The total unit weight, with batteries and accessories installed, mounted and filled with fuel, and ready for operation, shall not exceed the weight requirements as specified in 3.5. The ABFDS shall utilize a strap hold down system compatible with the HCU-6/E aircraft pallet.

3.3.1 Materials, protective coatings, and finish.

3.3.1.1 Recycled, recovered, environmentally preferable, or bio based materials. Recycled, recovered, environmentally preferable, or bio based 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.

3.3.1.2 Protective coatings. Materials that deteriorate when exposed to sunlight, weather, or operational conditions normally encountered during the service life of the ABFDS shall not be used or shall have means of protection against such deterioration that does not prevent compliance with the performance requirements specified herein. Protective coatings that chip, crack, or scale with age or extremes of climatic conditions or when exposed to heat shall not be used. Exposed surfaces of fasteners, handles, and fittings shall also be primed and painted. Commercial item components (see 6.3.2) of the ABFDS (but not the ABFDS itself) may be prepared and coated in accordance with the manufacturer's standard practice, provided it is compatible with the exterior finish color. See 3.3.4.2 for prohibited hazardous materials.

3.3.1.2.1 Surface preparation and pretreatment. Surface preparation and pretreatment shall be in accordance with the respective primer and topcoat specifications. Structures shall be cleaned, degreased, and scuffed or blasted prior to priming; primer shall be applied before any oxidation or rusting occurs. Aluminum surfaces shall have MIL-DTL-81706, Type II, Class 1A, chemical conversion coating applied in accordance with the manufacturer's directions prior to priming.

3.3.1.2.2 Primer. Raw metal edges, to include fastener and drain holes, shall be coated with primer prior to applying the topcoat.

3.3.1.2.2.1 Ferrous surfaces. Ferrous structures and surfaces shall be primed with a non-water reducible zinc rich primer in accordance with MIL-PRF-26915, Type I, Class A. The zinc rich primer may be followed, within four hours, by a coat of MIL-DTL-53030 intermediate primer in a wet-to-wet primer application. The primer system shall yield a dry-film thickness of 2.0-2.5 mils for the zinc rich primer and 0.9 to 1.1 mils for the intermediate primer, if utilized. The primer system shall be allowed to dry and fully cure in accordance with the primer manufacturer's directions prior to applying the topcoat.

3.3.1.2.2.2 Aluminum and mixed aluminum and ferrous surfaces. Aluminum and mixed aluminum and ferrous structures and surfaces shall be primed with an epoxy primer, Type II, Class N of MIL-PRF-23377. This single part primer system shall yield a dry-film thickness of 0.6 to 0.8 mils.

3.3.1.2.3 Topcoat. Topcoat shall be polyurethane in accordance with Type I, Class H of MIL-PRF-85285. Neither Chemical Agent Resistant Coating (CARC) nor powder coating shall be used. Topcoat shall be applied to a dry film thickness of 1.6 to 2.4 mils in all instances, regardless of the primer system utilized. The coating shall be free from runs, sags, orange peel, or other defects.

3.3.1.3 Dissimilar metals. Dissimilar metals, as defined in MIL-STD-889, shall not be in contact with each other. Metal plating or metal spraying of dissimilar base metals to provide electromotive compatible abutting surfaces is acceptable. The use of dissimilar metals when separated by suitable insulating material is permitted, except in systems where bridging of insulation materials by an electrically conductive fluid can occur. Sealants or gel type gasket materials shall be used between faying surfaces and butt joints.

3.3.1.4 Finish. The exterior finish color of the ABFDS and the inner surfaces of compartments shall be semi-gloss grey, Color Number 26173 of FED-STD-595.

3.3.1.5 Exclusion of water. The design of the ABFDS shall be such as to prevent water leaking into, or being driven into, any enclosed part of the ABFDS. All electrical wiring, connectors and electrical enclosures shall be provided with sealing arrangements such that the entry of water is prevented. Sharp corners and recesses shall be avoided so that moisture and solid matter cannot accumulate to initiate localized attack. Sealed floors with suitable drainage shall be provided for storage compartments, engine compartments, and other areas in the ABFDS that could collect and retain water.

3.3.1.5.1 Fluid traps and faying surfaces. There shall be no fluid traps on the ABFDS. Faying surfaces of all structural joints, except welded joints, shall be sealed to preclude fluid intrusion.

3.3.1.5.2 Ventilation. Ventilation shall be sufficient to prevent moisture retention and buildup.

3.3.1.5.3 Drainage. Drain holes shall be provided to prevent collection or entrapment of water or other unwanted fluid in areas where exclusion is impractical. All designs shall include considerations for the prevention of water or fluid entrapment and ensure that drain holes are located to effect maximum drainage of accumulated fluids. The number and location of drain holes shall be sufficient to permit drainage of all fluids when the ABFDS is on a 10-degree longitudinal slope facing both up and down and on a 10-degree side slope in each direction (right and left side facing up the slope). The minimum size of the drain holes shall be 0.375 inch.

3.3.2 Markings. All external devices, which require an operational or maintenance interface, shall be marked in accordance with MIL-STD-130. Markings shall be applied with decals and shall be 1-inch high block letters unless prohibited by the available space. In such cases, the markings shall be the largest size possible. Markings, Information/Caution shall be Lusterless Black, Color Number 37038 of FED-STD-595, and Markings, Warning/Danger shall be Lusterless Red, Color Number 31136 of FED-STD-595. The center of gravity of the ABFDS shall be stenciled on the unit within 1-inch of the calculated center of gravity. The center of gravity shall be calculated in accordance with TOP 2-2-800.

3.3.3 Identification and information plates.

3.3.3.1 Identification plate. An identification plate in accordance with MIL-STD-130 shall be securely attached to the ABFDS in a readily accessible location. The ABFDS shall have Unique Identification (UID) (also known as Item Unique Identification (IUID)) information permanently affixed on or near the respective identification plate(s), marked in accordance with MIL-STD-130. The ABFDS UID shall be marked as both a bar code and human readable markings. The identification plate shall contain the following information:

a. Serial Number.

b. Manufacturer’s Part Number.

c. National Stock Number.

d. Commercial and Government Entity (CAGE) Code.

e. Contract Number.

f. Date of Warranty Expiration.

g. Fuel Type.

h. Engine oil viscosities for ambient temperatures ranging from -25° F to +125° F.

3.3.3.2 Transportation data plate. A transportation data plate shall be securely attached to the ABFDS in a readily accessible location. The plate shall contain at least the following information:

a. Side and rear silhouette views of the ABFDS.

b. Horizontal and vertical location of the center of gravity of the ABFDS in air transportable configuration, marked on the silhouette views.

c. Shipping weight.

d. Loading cubage.

e. Overall height, width, and length.

f. Tie down information.

3.3.4 Environment, Safety, and Occupational Health (ESOH).

3.3.4.1 System safety. The design of the ABFDS shall not contain any system safety mishap risk categories greater than medium as defined in MIL-STD-882.

3.3.4.2 Hazardous material. The design shall minimize and control hazards associated with the inclusion or use of hazardous or toxic materials and the generation of toxic or noxious gases. The ABFDS shall not generate or use Class I or Class II Ozone Depleting Substances (ODS) during operation, maintenance, or disposal. Class I ODS and hazardous materials shall not be used in any system, component, or process. The ABFDS shall not contain or use either hexavalent chromium or cadmium without written approval by the procuring activity. Hazardous materials are defined in AFI 32−7086; Class I and Class II ODS are defined in 40CFR82.

3.3.4.3 Component protection. All space in which work is performed during operation, service, and maintenance shall be free of hazardous protrusions, sharp edges, or other features, which may cause injury to personnel. All rotating and reciprocating parts and all parts subject to high operational temperatures or subject to being electrically energized that are of such nature or so located as to be hazardous to personnel, shall be guarded or insulated to eliminate the hazard to the maximum extent practical. All wires, cables, tubes, and hoses shall be supported and protected to minimize chafing and abrasion and shall be located to provide adequate clearance from moving parts and high operational temperatures. Grommets shall be provided wherever wires, cables, tubes, or hoses pass through bulkheads, partitions, or structural members.

3.3.4.4 Foreign object damage (FOD). All loose metal parts, such as pins or connector covers, shall be securely attached to the ABFDS with wire ropes or chains. "Dog tag" style beaded chains shall not be provided. Removable panels, if provided, shall be attached with captive fasteners.

3.3.4.5 Fire extinguisher. Two dry chemical fire extinguishers, Type 1, Class 1, Size 20 in accordance with A-A-393, shall be mounted on the exterior of the ABFDS enclosure in a location(s) easily accessible from the control panel.

3.3.4.6 Sound levels. The maximum A-weighted sound levels produced during ABFDS pumping operations shall not exceed 84 decibel adjusted (dBA) at the operator's location, in front of the operator control panel.

3.3.4.7 Electrostatic discharge (ESD). The design of the ABFDS shall preclude equipment damage due to ESD, protect personnel from electrical shock due to static charging, and prevent ignition of explosive atmospheres due to sparking.

3.3.4.8 Design and hydrostatic pressure ratings. All pumping components shall have a minimum design operating pressure rating as required to meet all requirements as specified in 3.8.2 or 150 psig, whichever is greater, and shall withstand a hydrostatic pressure of 1.5 times the minimum design operating pressure.

3.3.5 Electromagnetic interference (EMI). The ABFDS shall be in accordance with the following radiated emission and susceptibility requirements of MIL-STD-461: RE102 (to the limits of the FIGURE RE102-4, Navy Fixed & Air Force curve) and RS103 (to the levels of TABLE VII) for the following ranges:

30MHz	1GHz at 10 Volt per metre (V/m)
1GHz	18GHz at 50V/m

3.3.6 Human systems integration. The ABFDS shall be designed in accordance with MIL-STD-1472 for ease of operation, inspection, and maintenance, including the use of arctic mittens and Mission-Oriented Protective Posture (MOPP) Level 4 Chemical Warfare Gear. Chemical Warfare Gear is not required for preventive maintenance or major corrective maintenance.

3.3.7 Fastening devices. All screws, bolts, nuts, pins, and other fastening devices shall be properly designed, manufactured, and installed with adequate means of preventing loss of torque or adjustment. Cotter pins, lock washers, or nylon patches shall not be used for this purpose, except for the attachment of trim items or as provided in commercial components. Tapped threads shall have a minimum thread engagement in accordance with Table I.

TABLE I. Minimum thread engagement.

Material	Minimum Thread Engagement
Steel	1.0 times the nominal fastener diameter
Cast iron, brass, or bronze	1.5 times the nominal fastener diameter
Aluminum, zinc, or plastic	2.0 times the nominal fastener diameter

3.3.8 Welders and welding. All welders shall be certified to weld in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M for structural components. The contractor shall make available to the Government certifications for all welders being utilized on the ABFDS. Welding

procedures and all welding on the ABFDS shall be in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M. The surface parts to be welded shall be free from rust, scale, paint, grease, and other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the welded parts. Welds shall transmit stress without cracking or permanent distortion when the parts connected by the welds are subjected to test, proof, and service loadings.

3.3.9 Service life. The ABFDS shall be designed for a minimum service life of 12 years.

3.4 Environmental conditions.

3.4.1 Operating temperature range. The ABFDS shall be capable of operating in ambient temperatures ranging from - 25° F to + 125° F.

3.4.1.1 High altitude operations. All operations shall be able to be performed at 107° F and 5,000 foot altitude ambient conditions.

3.4.2 Storage temperature range. The ABFDS shall be capable of being stored in ambient temperatures ranging from - 40° F to + 140° F.

3.4.3 Precipitation.

3.4.3.1 Rain. The ABFDS shall be capable of storage during rainfall of 5-inches per hour for three consecutive hours and 10-inches per hour for 10 consecutive minutes, with winds of up to 35 knots; and with 6-inches of rain per hour impinging on the ABFDS at angles from vertical to 45° for 30 consecutive minutes.

3.4.4 Solar radiation. The ABFDS shall not be adversely affected by full time exposure to solar radiation, such as those conditions encountered in desert environments and high altitudes.

3.4.5 Fungus. All materials used in the ABFDS shall be fungus resistant or shall be suitably treated to resist fungus. Materials treated for fungus resistance shall retain their original electronic and physical properties, shall not present toxic hazards, and treatment shall last for the entire service life of the part. The ABFDS shall be suitable for operation and storage in conditions encountered in a tropical environment.

3.4.6 Salt fog. The ABFDS shall be capable of storage and operation in high temperature, high humidity, salt laden, and seacoast environments without damage or deterioration of performance.

3.4.7 Sand and dust. The ABFDS shall be capable of storage and operation during exposure to wind-blown sand or dust without damage or deterioration of performance.

3.5 Weight and dimensions. Overall weight and dimensions in air transport configuration (see 3.6.2) shall not exceed:

Weight	3,000 pounds (Excluding the pallet weight).

Length	84 inches.
Width	104 inches.
Height	67 inches.

3.6 Transportability.

3.6.1 Surface transportability. The ABFDS in stored configuration shall be transportable via all modes of surface shipment (highway, rail, and water) in accordance with MIL-STD-1366, and shall be capable of withstanding the mechanical shock and vibration characteristics of highway, rail, and water transport, except that design for rail impact testing (see 5.2.5 of MIL-STD-1366) is not required.

3.6.2 Air transportability. The ABFDS in stored configuration shall be transportable on C-17 and C-130 aircraft in accordance with MIL-STD-1791. In all air transport configurations, the ABFDS shall be capable of being restrained and withstanding, without loss of serviceability, 2.0 G up and 4.5 G down accelerations, and shall be capable of being restrained and withstanding, without loss of structural integrity, 3.0 G forward, 1.5 G aft, and 1.5 G lateral accelerations. The ABFDS shall be equipped with pressure relief devices or configured for air transport to prevent any part from becoming a projectile in the event of catastrophic loss of aircraft cabin pressure.

3.6.2.1 Equipment removal and reconfiguration. Preparation for air transport shall take no more than two man-hours and restoration to operating configuration shall take no more than two man-hours for persons using common hand tools (see 6.3.3). All equipment removed shall be stored on the ABFDS; caps and plugs shall permit moving and storage in transport configuration.

3.6.3 Tie downs. The ABFDS shall be symmetrically restrained during air and ground transport. Tie down points shall be rated at a minimum of 1,000 pounds, marked for capacity, with a clear opening compatible with MIL-PRF-27260 tie down device. Each end of each tie down device shall terminate at a tie down point and not pass through any other tie down point. There shall be no interference between tie down devices and the ABFDS. The tie down provisions shall be in accordance with 4.1 through 4.12 of MIL-STD-209.

3.7 Maintainability. The ABFDS shall be designed for maintainability in accordance with 5.9 through 5.9.18 of MIL-STD-1472; forces shall not exceed those specified for both males and females. 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.

3.7.1 Inspection and servicing provisions.

a. Pre-use inspections and servicing tasks shall not require tools.

b. Routine service and preventive maintenance shall not require special tools (see 6.3.8).

c. Drain plugs and filters shall be directly accessible from the ground and oriented to have unimpeded drainage to a catch pan.

d. The ABFDS shall be designed with maximum usage of sealed lifetime lubrication bearings.

3.7.2 Relative accessibility. Critical items that require rapid maintenance shall be most accessible. When relative criticality is not a factor, items that require the most frequent access shall be most accessible. High failure rate items shall be accessible for replacement without moving non-failed items.

3.7.3 Error-proof design. The design of the ABFDS shall incorporate error proofing in equipment mounting, installing, interchanging, connecting, and operating.

a. Equipment shall include physical features (for example, supports, guides, size, or shape differences, fastener locations, and alignment pins) that prevent improper mounting. In the absence of physical features, equipment shall be labeled or coded to identify proper mounting and alignment.

b. Equipment that has the same form and function shall be interchangeable throughout a system and related systems. If equipment is not interchangeable functionally, it shall not be interchangeable physically.

c. Connectors serving the same or similar functions shall be designed to preclude mismating or misalignment.

d. Design, location, procedural guidance, and suitable warning labels shall be provided to prevent damage to equipment while it is being handled, installed, operated, or maintained.

3.7.4 Special tools. The design of the ABFDS shall minimize the requirement for special tools (see 6.3.7). All special tools shall be provided with, and stored on, the ABFDS.

3.7.5 Diagnostic software. A copy of any diagnostic software required or recommended for maintaining the ABFDS shall be provided with each ABFDS on CD-ROM or DVD-ROM.

3.8 Engine and related equipment. The engine shall be a diesel engine compatible with fuels listed in 3.8.6 containing over 15 parts per million (ppm) sulfur. This would typically be an Environmental Protection Agency Tier 3 non-road engine, which requires a National Security Exemption (NSE) from the Clean Air Act. The engine shall be capable of operating 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 engine shall be air or liquid-cooled. The engine shall be equipped with an Automatic Control System (ACS), which automatically returns the engine to idle when zero flow conditions are detected. The engine shall be fitted with a 12-foot long flexible insulated engine exhaust extension, which is stored during flight and manually extended through the open aircraft rear door during ABFDS operation. The exhaust tube shall be 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.

3.8.1 Engine starting system.

3.8.1.1 Starter. The engine shall be equipped with a 12-volt DC electric starter.

3.8.1.2 Engine starting aids. The engine shall start within 15 seconds cranking in any ambient temperature within the required operating range of the ABFDS. Internal engine starting aids, fluid starting aids, and heat from the winterization system (see 3.9.3) may be used prior to and during the start period to facilitate engine starting under the conditions listed in Table II.

TABLE II. Engine starting aids.

Temperature Range	Starting Aids Permitted
40° F through 125° F	None
1° F through 39° F	Internal engine starting aids and fluid starting aids
-25° F through 0° F	Internal engine starting aids, fluid starting aids, and heat from the winterization system (see 3.9.3)

3.8.2 Engine air intake system. The engine air intake system shall be in accordance with 3.13.1.4.3 of SAE ARP1247. The inlet shall not draw air from directly beneath the ABFDS and shall not be located near the cooling system air outlet nor the engine exhaust outlet. Joints shall be minimized between the air filter outlet and the engine inlet air manifold and shall be designed to ensure no leakage of unfiltered air into the engine. A differential pressure air filter service indicator shall be provided.

3.8.3 Engine cooling system. If liquid-cooled, the engine cooling system shall be in accordance with 3.13.1.4.2 of SAE ARP1247. Silicone radiator hoses, constant-torque clamps, and a coolant recovery system shall be provided. Engine coolant shall be in accordance with A-A-52624, Type I, and of adequate strength to provide protection to -40° F. The engine out (top of radiator) coolant temperature shall not exceed 210° F or the engine manufacturer's recommendation. If air-cooled, the cylinder head temperature is not to exceed manufacturer's limit.

3.8.4 Engine lubrication system. The engine lubrication system shall be designed so that the ABFDS can be operated on a 15-degree longitudinal slope facing both up and down and on a 15-degree side slope in each direction (right and left side facing up the slope).

3.8.4.1 Engine oil. The engine shall be compatible with Grade 15W40 of MIL-PRF-2104 from 0° F to 125° F. Oil pre-heat for operation below 0° F is allowed. The engine shall be compatible with arctic engine oil in accordance with MIL-PRF-2104 from -40° F to 60° F.

3.8.4.1.1 Engine oil-operating temperature. The engine oil sump temperature shall not exceed 250° F or the engine manufacturer's recommendations at 125° F ambient air temperature.

3.8.4.1.2 Engine oil consumption. The engine oil consumption shall not exceed 0.0035 pounds per brake horsepower-hour (lbs/bhp-hr) under any operating condition.

3.8.4.2 Engine oil filter. The engine oil filter shall be in accordance with 3.13.1.4.4 of SAE ARP1247.

3.8.5 Exhaust system. The exhaust system shall be constructed of stainless steel and insulated. The muffler shall be constructed of aluminized steel or stainless steel. The exposed skin temperature of the exhaust system is not to exceed 700° F under all operating conditions.

3.8.6 Engine fuels and fuel system.

3.8.6.1 Engine primary fuels. The ABFDS engine shall be capable of operating on the following primary fuels (see 6.3.7):

a. JP-8, in accordance with MIL-DTL-83133, -40° F to 125° F ambient air temperature.

b. F-24, in accordance with NATO Standard AFLP-3747, -40° F to 125° F ambient air temperature. (Jet A in accordance with either ASTM D1655 or MODUK DEF STAN 91-91 with JP-8 additives in accordance with MIL-PRF-25017.)

c. Jet A1 in accordance with either ASTM D1655 or MODUK DEF STAN 91-91 with JP-8 additives in accordance with MIL-PRF-25017

3.8.6.2 Engine alternate fuels. The ABFDS engine shall be capable of operating on the following alternate fuels (see 6.3.1):

a. Diesel Gas Oil in accordance with JIS K 2204, based on nationally set seasonal temperature requirements.

b. Automotive Diesel in accordance with TUPRAS 403, based on nationally set seasonal temperature requirements.

c. Automotive Fuel, Diesel in accordance with BS EN 590, based on nationally set seasonal temperature requirements.

d. Diesel Fuel Oil, in accordance with GOST 305 and ASTM D975, based on nationally set seasonal temperature requirements.

e. JP-5, in accordance with MIL-DTL-5624, -40° F to 125° F ambient air temperature.

f. TS1 in accordance with GOST 10227-86 with JP-8 additives in accordance with MIL-PRF-25017, -40° F to 125° F ambient air temperature.

3.8.6.3 Engine emergency fuels. The ABFDS engine shall be capable of operating on the following emergency fuels (see 6.3.4):

a. Jet A, Jet A1 in accordance with ASTM D1655, all ambient temperatures.

3.8.6.4 Fuel system. Except as otherwise specified herein, the fuel system shall be in accordance with 3.13.1.5.1 through 3.13.1.5.11 of SAE ARP1247. The fuel system shall be constructed of materials, which are compatible with the fuels listed in 3.8.6.1, 3.8.6.2, and 3.8.6.3. Copper shall not be used in the fuel system. The fuel system shall be equipped with fuel shut-off valve(s) to prevent continuous spillage when fuel lines are disconnected for service.

3.8.6.4.1 Fuel priming pump. The ABFDS shall be equipped with an electric fuel pump in addition to the mechanical fuel pump. The electric fuel pump shall be used as a priming pump capable of re-priming the engine fuel system following fuel exhaustion within one minute.

3.8.6.4.2 Fuel filters. Primary and secondary fuel filters and a heated fuel/water separator shall be provided. The fuel/water separator shall include a water coalescer and a drain valve that is readily accessible by an operator or a mechanic. A combination fuel filter and fuel/water separator may be provided. Fuel filter elements shall be easily replaceable by a mechanic using nothing more than common hand tools (see 6.3.3) without loss of engine prime.

3.8.6.4.3 Fuel tank. The fuel tank shall be in accordance with 3.13.1.5.5 through 3.13.1.5.9 of SAE ARP1247. The tank shall be designed so that the ABFDS can be operated on a 15-degree longitudinal slope facing up and down and on a 15-degree side slope in each direction (right and left side facing up the slope). The tank shall have at least a 3 gallon capacity, manually vented, and be designed for no spills. A fuel feed line shall be installed between the discharge manifold and the fuel tank. The fuel feed line shall be equipped with an in-line manual shutoff ball valve. The fuel tank shall be equipped with a float to maintain the fuel level at no more than 75% capacity when the fuel in bladder is compatible with the engine. The fuel tank shall be equipped with an OPW TFA-4 adapter and TFLC-4 locking cap or equivalent. The tank shall be prominently marked “DO NOT USE MOGAS.”

3.8.7 Engine diagnostic and emergency shutdown systems.

3.8.7.1 Engine diagnostic system. If the engine is equipped with an electronic control module, a diagnostic system shall be provided with a means to indicate engine faults; it shall be equipped with a Controller Area Network (CAN) bus connector. If the ABFDS is equipped with a diagnostic or built-in-test system, the engine diagnostic system shall be integrated with it; if not, it shall be a stand-alone system.

3.8.7.2 Engine emergency shutdown system. The engine shall be equipped with an engine emergency shutdown system activated by the following conditions:

a. Low oil pressure, less than 10 psi or in accordance with the engine manufacturer’s recommendations.

b. Coolant over heat or cylinder head temperature over heat condition in accordance with the engine manufacturer’s recommendations.

c. Engine over speed should the engine exceed 110% rated speed. This is required for engines over 100 bhp and optional for engines less than 100 bhp rated horsepower.

d. Emergency dead man control is activated.

3.8.8 Engine operator instruments. The following instruments shall include but not be limited to:

a. Digital tachometer.

b. Coolant temperature gauge if liquid-cooled, or cylinder head temperature gauge if air-cooled.

c. Low coolant level indicator if liquid-cooled.

d. Oil pressure gauge.

e. Hour meter.

f. Mode selector

g. Start/stop switch.

h. Manual throttle.

i. Ammeter.

j. Voltmeter.

k. Palm operated emergency engine shut off.

l. Any additional controls required for operation of the pump and engine system.

3.9 Electrical system. The ABFDS shall have a 12-volt, negative ground electrical system in accordance with 3.13.1.2 of SAE ARP1247 and NFPA-70, National Electric Code, Article 501 Class I, Division 2.

3.9.1 Alternator. A single alternator charging system in accordance with 3.13.1.4.9 of SAE ARP1247 shall be provided. The alternator shall be capable of restoring the energy expended during an engine start in less than 60 minutes of operation at - 25° F.

3.9.2 Batteries and battery compartment.

3.9.2.1 Batteries. Batteries shall be of the commercial maintenance-free sealed lead acid, starved electrolyte, gas recombination, spiral wrapped, absorbent gas mat (AGM), top post type in accordance with MIL-B-18013/1.

3.9.2.2 Battery compartment. The batteries shall be secured in an enclosed corrosion-resistant, weatherproof box or compartment and shall be readily accessible. The container shall have a type of battery restraint to prevent movement and possible shorting out if in a metal type container.

3.9.2.3 Battery cables. The battery cables shall be sized to handle the system voltage and current levels, be clearly identified with "+" and "-" or red and black markings, and shall not be spliced.

3.9.3 Winterization system. A winterization system shall be provided. The winterization system shall include heaters for engine coolant, engine oil, and the fuel tank, as well as battery warmers. The winterization system shall be 12-volt and be able to operate using a 12/24/28 volt inverter designed to operate from the aircraft 28-volt DC power via a standard cable capable of interfacing with MS3506 connector, which shall be included with the system. The winterization system shall incorporate high-temperature shutoff switches to prevent overheating of any fluid or component.

3.10 Performance.

3.10.1 ABFDS pump. The ABFDS pump shall be a self-priming, engine driven, fuel-dispensing unit. When adequate Net Positive Suction Head (NPSH - see 6.3.6) is available, the pump shall have the ability to deliver fuel to an aircraft through a single point nozzle via a single 100 foot x 3 inch collapsible hose at up to 600 gpm and via two 100 foot x 3 inch collapsible hoses and single point nozzles at up to 1,200 gpm. It is recognized that the number of bladder tanks supplying fuel to the pump at any given time can limit the available NPSH. A drain plug shall be installed at the pump housing low point. Maximum engine speed shall not exceed maximum rated pump speed.

3.10.1.1 Pumping controls. The ABFDS shall have an ACS, which shall provide operator-selected pumping modes as follows.

a. Fuel Servicing - High Pressure mode. The ACS shall (1) control the flow rate by varying the engine RPM, and (2) adjust the flow rate to prevent single point nozzle pressure from exceeding 50 ± 5 psi. In the event the secondary pressure control is activated due to the failure of the primary pressure control system, fuel flow is to continue. At no time shall the flow through either hose exceed 600 gpm. The ACS shall prevent pump suction pressure from dropping below that required to maintain adequate NPSH by controlling the engine RPM.

b. Fuel Servicing - Low Pressure mode. The ACS shall (1) control the flow rate by varying the engine RPM, and (2) adjust the flow rate to prevent either single point nozzle pressure from exceeding 30 ± 5 psi. In the event the secondary pressure control is activated due to the failure of the primary pressure control system, fuel flow is to continue. At no time shall the flow through either hose exceed 600 gpm. The ACS shall prevent pump suction pressure from dropping below that required to maintain adequate NPSH by controlling the engine RPM.

c. Defuel mode. The ABFDS shall defuel fuel from the host aircraft (for example, a C-17) rather than fuel bladders at flow rates up to 200 gpm with the assistance of aircraft boost

pumps. The ACS shall prevent pump suction pressure from dropping below that required to maintain adequate NPSH by controlling the engine RPM.

d. Manual mode. The manual throttle controller shall control engine speed.

3.10.1.1.1 Operator control panel. Electronic Light Emitting Diode (LED) digital displays shall be provided and shall be readable from a distance of 15 feet during daytime or nighttime operations. In addition to the engine controls and instruments required by 3.8.8, the operator control panel shall include the following digital displays.

a. Pump output pressure.

b. Nozzle pressure.

c. Flow rate and total flow.

3.10.2 Pressure control system.

3.10.2.1 Single point nozzle pressure and flow control. When using a fuel-servicing mode to deliver fuel through one or both discharge hoses, the primary nozzle pressure control system shall limit the nozzle pressure to 30 ± 5 psi when in low pressure mode and 50 ± 5 psi when in high pressure mode by controlling the engine speed with the ACS. A secondary pressure control system for each discharge hose shall limit the nozzle pressure to 55 psi when in either pressure mode. Hose end pressure control valves are allowed for secondary pressure control. At no time shall the flow through either hose exceed 600 gpm.

3.10.3 Flow meter. The ABFDS shall be equipped with two flow meters with totalizer capability, one for each of the two discharge hose connections. The ABFDS shall record fuel quantity at variable flow rates. The meters shall be accurate to +/- 1%, easy to read, operate, and maintain and shall be installed between the discharge manifold and the discharge hose connections.

3.10.4 Contamination monitor. The ABFDS shall be equipped with a contamination monitor (CM) in accordance with EI 1598 for the prevention of both water and particulate contamination. The CM shall be capable of measuring and recording excessive water and particles and automatically terminate fuel flow into and out of the bladders when 10 ppm of free water in the fuel or solid contaminates exceeding 0.5 mg/liter are detected. The CM shall be capable of being manually disabled during flow operations. The CM shall have the ability to monitor water and particulates during fuel delivery and be connected to an automatic shutoff valve capable of terminating fuel delivery when 10 ppm of free water or particulates exceeding 0.5 mg/liter are detected. An override of the fuel shutoff shall be provided.

3.10.5 Metal piping. The discharge and suction manifolds shall be constructed of seamless schedule 40 aluminum in accordance with ASTM B241/B241M. Pipe mounting shall prevent failure due to chaffing, vibration, or movement, due to operational or mobility induced forces. Piping shall be protected and shall not be used as a step. Provisions for the relief of fuel pressure build-up in the piping and hose(s) shall be included. Expansion joints, as required, for vibration damping shall

be utilized. Groove couplings shall be cut or rolled in accordance with coupling manufacturer's requirements and recommendations. Pipe and fittings shall be either flange or groove connected, or a combination, and 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 located at the manifold's lowest point and at each pump drain plug. The drain valve shall be quarter turn ball valve style.

3.10.6 Aircraft servicing nozzles. The unit shall be equipped with four D3 single point nozzles and two MIL-PRF-52747 closed circuit refueling nozzles. The nozzles shall be compatible with the discharge hoses. All nozzles shall be equipped with a 40-mesh strainer and an A-A-59377 sexless coupler with ball valve (CLA-VAL 380GF Sexless Coupler or equivalent).

3.10.7 Sampling device. A fuel-sampling device shall be provided downstream of the contamination monitor(s), prior to the meter, and easily accessible while standing in front of the operator control panel. Adequate space shall be provided to connect in-line samplers approved by the Air Force for solids and water samples. In-line sampling connections shall be compatible with Gammon type in-line samplers. The sampling device shall consist of the necessary corrosion resistant piping, a quarter turn ball valve, and a quick disconnect with a dry break coupler and dust plug for connection to the sampling kit. The sampling connection shall be a Gammon Technical Product -1110 or equivalent.

3.10.8 Straps and tensioners. The ABFDS straps and tensioners will be supplied by the user and are in accordance with MIL-PRF-27260, compatible with the tie down points on the HCU-6/E pallet, and will secure the ABFDS to the pallet. The tensioners (with ratchets) supplied will be supplied by the user and are in accordance with MIL-DTL-25959.

3.10.9 Remote and dead man control. An electronic remote and dead man controller shall be provided. The remote and dead man controller shall start and stop the engine and start and stop flow from either hose outlet. The dead man function shall be a squeeze handle or push button type device. The controller shall have a push-button for an emergency stop, which stops the engine and terminates flow through both hoses. Upon activation of the dead man switch, the ACS shall control engine speed depending on which pumping mode is selected. If Manual mode is selected and the dead man is activated, the engine speed shall be controlled by the manual throttle. Upon release of the dead man device, the engine speed shall return to idle and the flow of fuel shall terminate within 3 seconds. The unit shall be lightweight with a cable and reel capable of providing 100 feet of reach from the ABFDS.

3.11 System components.

3.11.1 Hose assemblies. The following hose assemblies complete with storage racks shall be provided:

a. Four discharge/defueling hoses, Angus 3-inch Armoured Chemicoil, or equivalent. The four hoses shall consist of two 100 foot and two 30 foot long with an A-A-59377

sexless coupler with ball valve (CLA-VAL 380GF Sexless Coupler or equivalent) on both ends.

b. One each 10-foot, 30-foot, and 50-foot in length by 4-inch internal diameter (I.D.) suction hoses that are to be used to connect one to three MIL-DTL-83833 bladder tanks to the ABFDS. The 50-foot length suction hose is not applicable to the 3000 lb weight restriction identified in 3.5. The suction hoses shall be in accordance with MIL-PRF-370, Type B and include an A-A-59377 4-inch sexless coupler with ball valve (CLA-VAL 380GF Sexless Coupler or equivalent) on both ends. When specified (see 6.2b), for extreme climatic temperature locations only, the hose assemblies shall be EI 1529, Grade 2, Type CT hose.

c. One 0.75-inch I.D. by 25-foot long rubber hose to connect the forward bladder tank air eliminator to the aft bladder tank air eliminator. Each end of the hose shall have a number 12 push-on flare type coupler and incorporate a pressure gauge.

d. One 0.75-inch I.D. by 20-foot long foot rubber hose to connect the aft air eliminator to the aircraft vent. Each end of the hose shall have a number 12 push-on flare type coupler.

3.11.2 Nozzle, coupler, and adapter storage. The ABFDS shall be equipped with convenient nozzle, coupler and adapter storage capability.

3.11.2.1 Couplers and adapters. The following additional components shall be provided.

a. Two 4-inch A-A-59377 sexless couplers with ball valves (CLA-VAL 380GF Sexless Coupler or equivalent) in accordance with MS24484 single point adapters.

b. Two 3-inch A-A-59377 sexless couplers with ball valves (CLA-VAL 380GF Sexless Coupler or equivalent) in accordance with MS24484 single point adapters.

c. Two 3-inch by 2-inch A-A-59377 sexless couplers without ball valves (CLA-VAL 380GF Sexless Coupler or equivalent) adapters.

3.11.2.2 Hose storage rack. The ABFDS shall have an attachable/removable hose rack sized to store all hoses specified above. The hose rack shall be of sufficient build and sturdiness to withstand weight, deployment, and employment of hoses.

3.11.3 ABFDS storage container and accessories. The ABFDS shall be equipped with a weatherproof storage container, which contains:

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

b. Quick disconnect plug and hose assembly to facilitate engine crankcase drain.

c. Battery powered, volatile fume detection meter complete with carrying case, RAE Systems, MultiRAE P/N GVMBB3-A1C1E00-WT1.

3.11.4 Bladder tanks and accessories. The bladder tanks shall be in accordance with MIL-DTL-83833 and shall include the following accessories. The proper number of accessories shall be included to accommodate three bladder tanks except for the straps and tensioners.

a. Sufficient single and T-connections to connect vent lines to air eliminators/bladder vent.

b. Bladder tank vent system that includes a gravity valve (see 6.3.5) and an air eliminator with float to prevent liquid escape through vent system. One vent system per fuel bladder.

c. Size 12 push-on type flare couplers.

d. Three quarter (3/4) inch I.D. rubber hose with 12 push-on flare fittings to mate with aircraft over board vent system.

e. Female 6-inch Camloc to 4-inch sexless couplers with ball valves (CLA-VAL 380GF Sexless Coupler or equivalent) and elbows for the suction line connections to the bladder.

3.11.5. ABFDS associated equipment. The ABFDS shall be fully compatible with the following equipment:

3.11.5.1 HCU-6/E aircraft pallet. One type HCU-6/E aircraft pallet in accordance with MIL-DTL-27443, designed to interface with the 463L cargo aircraft rail system.

3.11.5.2 Type V Ariel Delivery Platform. A 20-foot Type V Aerial Delivery Platform in accordance with 11-1-2780 for each bladder tank.

3.11.5.3 3,000 gallon bladder tank. The ABFDS shall include two approved 3,000 Gallon Aerial Bulk Fuel Delivery System Bladders in accordance with MIL-DTL-83833.

3.12 Bonding. The ABFDS shall be bonded to the pallet via a suitable clamping device. No modifications to the HCU-6/E pallet are permitted. The ABFDS shall be equipped with one bonding reel in accordance with A-A-50696 with the exception that the bonding reel shall be provided with a length of 145 to 150 feet ground cable (15 ohm resistance) and a hand crank reel and governor brake arm assembly to maintain a slow retraction rate for the cable, preventing a run-away return of the cable.

3.13 Aircraft compatibility. The ABFDS shall be able to show compatibility with the C-17 and C-130J aircraft.

3.14 Workmanship. The ABFDS, including all parts and accessories, shall be constructed and finished in a thoroughly workman-like manner. Workmanship objectives shall include freedom from blemishes, defects, burrs, and sharp corners and edges; accuracy of dimensions, surface

finish, and radii of fillets; thoroughness of welding, painting, and riveting; marking of parts and assemblies; and proper alignment of parts and tightness of assembly fasteners.

3.14.1 Bolted connections. Boltholes shall be accurately punched or drilled and shall be deburred. Threaded fasteners shall be tight and shall not work loose during testing or service usage.

3.14.2 Riveted connections. Rivet holes shall be accurately punched or drilled and shall be deburred. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads shall be full, neatly made, concentric with the rivet holes and in full contact with the surface of the component.

3.14.3 Gear and lever assemblies. Gear and lever assemblies shall be properly aligned and meshed and shall be operable without interference, tight spots, loose spots, or other irregularities. Where required for accurate adjustment, gear assemblies shall be free of excessive backlash.

3.14.4 Cleaning. The ABFDS shall be thoroughly cleaned. Loose, spattered, or excess solder; welding slag; stray bolts, nuts, and washers; rust; metal particles; pipe compound; and other foreign matter shall be removed during and after final assembly.

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)

Requirements shall be verified in accordance with Table III.

TABLE III. Requirement verification matrix.

Section 3 Requirement	Verification Method	Section 4 Verification
3.1 First article.	N/A	N/A
3.2 ABFDS description.	Examination Certification	4.5.1 Examination of product.
3.3 Design and construction.	Examination	4.5.1 Examination of product.
3.3.1 Materials, protective coatings, and finish.	Certification	4.5.1 Examination of product.

TABLE III. Requirement verification matrix – Continued.

Section 3 Requirement	Verification Method	Section 4 Verification
3.3.1.1 Recycled, recovered, environmentally preferable, or bio based materials.	Certification	4.5.1 Examination of product.
3.3.1.2 Protective coatings.	Certification	4.5.1 Examination of product.
3.3.1.2.1 Surface preparation and pretreatment.	Certification	4.5.1 Examination of product.
3.3.1.2.2 Primer.	Certification	4.5.1 Examination of product.
3.3.1.2.2.1 Ferrous surfaces.	Certification	4.5.1 Examination of product.
3.3.1.2.2.2 Aluminum and mixed aluminum and ferrous surfaces.	Certification	4.5.1 Examination of product.
3.3.1.2.3 Topcoat.	Certification	4.5.1 Examination of product.
3.3.1.3 Dissimilar metals.	Examination Certification	4.5.1 Examination of product.
3.3.1.4 Finish.	Examination Certification	4.5.1 Examination of product.
3.3.1.5 Exclusion of water.	Examination	4.5.1 Examination of product.
3.3.1.5.1 Fluid traps and faying surfaces.	Examination	4.5.1 Examination of product.
3.3.1.5.2 Ventilation.	Examination	4.5.1 Examination of product.
3.3.1.5.3 Drainage.	Examination	4.5.1 Examination of product.
3.3.2 Markings.	Examination	4.5.1 Examination of product.
3.3.3 Identification and information plates.	N/A	
3.3.3.1 Identification plate.	Examination	4.5.1 Examination of product.
3.3.3.2 Transportation data plate.	Examination	4.5.1 Examination of product.
3.3.4 Environmental, safety, and occupational health (ESOH).	N/A	N/A
3.3.4.1 System safety.	Analysis	4.5.2 System safety hazard analysis.
3.3.4.2 Hazardous material.	Certification	4.5.1 Examination of product.
3.3.4.3 Component protection.	Examination	4.5.1 Examination of product.
3.3.4.4 Foreign object damage (FOD).	Examination	4.5.1 Examination of product.
3.3.4.5 Fire extinguisher.	Examination	4.5.1 Examination of product.
3.3.4.6 Sound levels.	Test	4.5.3 Sound level test.
3.3.4.7 Electrostatic discharge (ESD).	Analysis	4.5.4 Electrostatic discharge analysis.
3.3.4.8 Design and hydrostatic pressure ratings.	Test	4.5.5 Hydrostatic pressure test.
3.3.5 Electromagnetic interference (EMI).	Test	4.5.6 Electromagnetic interference test.
3.3.6 Human systems integration.	Certification	4.5.1 Examination of product.

TABLE III. Requirement verification matrix – Continued.

Section 3 Requirement	Verification Method	Section 4 Verification
3.3.7 Fastening devices.	Examination	4.5.1 Examination of product.
3.3.9 Service life.	Analysis	4.5.7 Service life analysis.
3.4 Environmental conditions.	N/A	N/A
3.4.1 Operating temperature range.	Test	4.5.8.1 High temperature storage and operation test.
		4.5.8.3 Low temperature storage and operation test.
3.4.1.1 High altitude operations.	Test	4.5.8.2 High altitude operation test.
3.4.2 Storage temperature range.	Test	4.5.8.1 High temperature storage and operation test.
		4.5.8.3 Low temperature storage and operation test.
3.4.3 Precipitation.	N/A	N/A
3.4.3.1 Rain.	Test	4.5.9.1 Rain test.
3.4.4 Solar radiation.	Certification	4.5.1 Examination of product.
3.4.5 Fungus.	Certification	4.5.1 Examination of product.
3.4.6 Salt fog.	Test	4.5.9.2 Salt fog test.
3.4.7 Sand and dust.	Test	4.5.9.3 Sand and dust test.
3.5 Weight and dimensions.	Test	4.5.10 Weight and dimension tests.
3.6 Transportability.	N/A	N/A
3.6.1 Surface transportability.	Analysis	4.5.11.1 Surface transportability analysis.
3.6.2 Air transportability.	Analysis	4.5.11.2 Air transportability analysis.
3.6.2.1 Equipment removal and reconfiguration.	Demonstration	4.5.11.3 Equipment removal and reconfiguration demonstration.
3.6.3 Tie downs.	Analysis	4.5.11.4 Tie down analysis.
	Test	4.5.11.5 Tie down test.
3.7 Maintainability.	Demonstration	4.5.12 Maintainability demonstration.
3.7.1 Inspection and servicing provisions.	Demonstration	4.5.13 Inspection and servicing provisions demonstration.
3.7.2 Relative accessibility.	Examination	4.5.1 Examination of product.
3.7.3 Error-proof design.	Examination	4.5.1 Examination of product.
3.7.4 Special tools.	Certification	4.5.1 Examination of product.
3.7.5 Diagnostic software.	Certification	4.5.1 Examination of product.
3.8 Engine and related equipment.	Examination	4.5.1 Examination of product.
	Certification	

TABLE III. Requirement verification matrix – Continued.

Section 3 Requirement	Verification Method	Section 4 Verification
3.8.1 Engine starting system.	N/A	N/A
3.8.1.1 Starter.	Examination	4.5.1 Examination of product.
3.8.1.2 Engine starting aids.	Demonstration	4.5.14 Engine starting aids demonstration.
3.8.2 Engine air intake system.	Examination	4.5.1 Examination of product.
3.8.3 Engine cooling system.	Examination	4.5.1 Examination of product.
	Certification	
3.8.4 Engine lubrication system.	Certification	4.5.1 Examination of product.
3.8.4.1 Engine oil.	Certification	4.5.1 Examination of product.
3.8.4.1.1 Engine oil-operating temperature.	Certification	4.5.1 Examination of product.
3.8.4.1.2 Engine oil consumption.	Certification	4.5.1 Examination of product.
3.8.4.2 Engine oil filter.	Certification	4.5.1 Examination of product.
3.8.5 Exhaust system.	Test	4.5.15 Exhaust system test.
3.8.6 Engine fuels and fuel system.	N/A	N/A
3.8.6.1 Engine primary fuels.	Certification	4.5.1 Examination of product.
3.8.6.2 Engine alternate fuels.	Certification	4.5.1 Examination of product.
3.8.6.3 Engine emergency fuels.	Certification	4.5.1 Examination of product.
3.8.6.4 Fuel system.	Examination	4.5.1 Examination of product.
	Certification	
3.8.6.4.1 Fuel priming pump.	Test	4.5.16 Fuel priming pump test.
3.8.6.4.2 Fuel filters.	Examination	4.5.1 Examination of product.
3.8.6.4.3 Fuel tank.	Certification	4.5.1 Examination of product.
	Test	4.5.17 Fuel tank test.
3.8.7 Engine diagnostic and emergency shutdown systems.	N/A	N/A
3.8.7.1 Engine diagnostic system.	Examination	4.5.1 Examination of product.
3.8.7.2 Engine emergency shutdown system.	Demonstration	4.5.18 Engine emergency shutdown demonstration.
3.8.8 Engine operator instruments.	Examination	4.5.1 Examination of product.
3.9 Electrical system.	Certification	4.5.1 Examination of product.
3.9.1 Alternator.	Certification	4.5.1 Examination of product.
3.9.2 Batteries and battery compartment.	N/A	N/A
3.9.2.1 Batteries.	Certification	4.5.1 Examination of product.
3.9.2.2 Battery compartment.	Examination	4.5.1 Examination of product.
3.9.2.3 Battery cables.	Examination	4.5.1 Examination of product.
3.9.3 Winterization system.	Demonstration	4.5.8.3 Low temperature storage and operation test.
3.10 Performance.	N/A	N/A

TABLE III. Requirement verification matrix – Continued.

Section 3 Requirement	Verification Method	Section 4 Verification
3.10.1 ABFDS pump.	Test	4.5.19 ABFDS pump endurance test.
3.10.1.1 Pumping controls.	Test	4.5.20 Pumping controls test.
3.10.1.1.1 Operator control panel.	Examination	4.5.1 Examination of product.
3.10.2 Pressure control system.	N/A	N/A
3.10.2.1 Single point nozzle pressure and flow control.		4.5.21 Single point nozzle pressure and flow control test.
3.10.3 Flow meter.	Examination	4.5.1 Examination of product.
	Certification	
3.10.4 Contamination monitor.	Test	4.5.22 Contamination monitor test
3.10.5 Metal piping.	Examination	4.5.1 Examination of product.
3.10.6 Aircraft servicing nozzles.	Examination	4.5.1 Examination of product.
3.10.7 Sampling device.	Demonstration	4.5.23 Sampling device demonstration.
3.10.8 Straps and tensioners.	Certification	4.5.1 Examination of product.
3.10.9 Remote and dead man control.	Certification	4.5.1 Examination of product.
	Demonstration	4.5.24 Remote and dead man control demonstration.
3.11 System components.	N/A	N/A
3.11.1 Hose assemblies.	Examination	4.5.1 Examination of product.
3.11.2 Nozzle, coupler, and adapter storage.	Examination	4.5.1 Examination of product.
3.11.2.1 Couplers and adapters.	Examination	4.5.1 Examination of product.
3.11.2.2 Hose storage rack	Examination	4.5.1 Examination of product.
3.11.3 ABFDS storage container and accessories.	Examination	4.5.1 Examination of product.
3.11.4 Bladder tank and accessories.	Examination	4.5.1 Examination of product.
3.11.5. ABFDS associated equipment.	Certification	4.5.1 Examination of product
3.11.5.1 HCU-6/E aircraft pallet.	Certification	4.5.1 Examination of product
3.11.5.2 Type V Ariel Delivery Platform.	Certification	4.5.1 Examination of product
3.11.5.3 3,000 gallon bladder tank.	Certification	4.5.1 Examination of product
3.12 Bonding.	Examination	4.5.1 Examination of product.
	Certification	

TABLE III. Requirement verification matrix – Continued.

Section 3 Requirement	Verification Method	Section 4 Verification
3.13 Aircraft Compatibility.	Demonstration	4.5.25 Aircraft compatibility demonstration.
3.14 Workmanship.	Examination	4.5.1 Examination of product.
3.14.1 Bolted connections.	Examination	4.5.1 Examination of product.
3.14.2 Riveted connections.	Examination	4.5.1 Examination of product.
3.14.3 Gear and lever assemblies.	Examination	4.5.1 Examination of product.
3.14.4 Cleaning.	Examination	4.5.1 Examination of product.

4.2 First article inspection. The first article ABFDS shall be subjected to the analyses, demonstrations, examinations, and tests as described in 4.5.1 through 4.5.25. The contractor will provide or arrange for all test equipment and facilities. Unless otherwise approved by the procuring activity, the first article ABFDS shall be in the same configuration at all times and configuration changes shall not be made during the first article inspection. Except as otherwise specified, all testing in which the engine is operated shall be performed using JP-8 turbine fuel. The compatibility test shall be performed after successful completion of the first article inspection. After all testing is completed, the contractor shall return the ABFDS to a completely serviceable, A condition asset

4.3 Conformance inspection. Each production ABFDS shall be subjected to the examination described in 4.5.1 and the following test in section 4: 4.5.5, 4.5.14, 4.5.19, 4.5.20, 4.5.21, and 4.5.24.

4.4 Inspection requirements.

4.4.1 General inspection requirements. Apparatus used in conjunction with the inspections specified herein shall be laboratory precision type, calibrated at proper intervals to ensure laboratory accuracy.

4.4.2 Data. During all testing specified herein, at least the following data, unless not applicable, shall be recorded at intervals not to exceed 30 minutes. Additional data or shorter intervals shall be provided as appropriate for any specific test.

a. Date.

b. Time started.

c. Time finished.

d. Ambient temperature.

e. Ambient humidity.

4.4.3 Test rejection criteria. Throughout all tests specified herein, the ABFDS shall be closely observed for the following conditions, which shall be cause for rejection.

a. Failure to conform to design or performance requirements specified herein or in the contractor's technical proposal.

b. Any spillage or leakage of any liquid, including fuel, coolant, or lubricant, under any condition, except as allowed herein.

c. Structural failure of any component, including permanent deformation, or evidence of impending failure.

d. Evidence of excessive wear. If excessive wear is suspected, the original equipment manufacturers (OEM's) specifications or tolerances shall be utilized for making a determination.

e. Evidence of corrosion or deterioration.

f. Misalignment of components.

g. Conditions that present a safety hazard to personnel during operation, servicing, or maintenance.

h. Shutdown faults from:

(1) Engine cooling system.
(2) Engine lubrication system.
(3) Engine protective circuits.

4.5 Test methods.

4.5.1 Examination of product. Each ABFDS shall be examined to verify compliance with the requirements herein prior to accomplishing any other demonstrations or tests listed in 4.5. A contractor-generated, Government-approved checklist shall be used to identify each requirement not verified by an analysis, certification, demonstration, or test, and shall be used to document the examination results. Particular attention shall be given to materials, workmanship, dimensions, surface finishes, protective coatings and sealants and their application, welding, fastening, and markings. Proper operation of each ABFDS function shall be verified. Certifications and analyses shall be provided in accordance with Table IV. Each production ABFDS shall be inspected to a Government-approved reduced version of the checklist.

TABLE IV. Certifications and analyses.

Paragraph	Required Certifications and Analyses
3.2 ABFDS description.	Contractor certification that the ABFDS is in accordance with the requirements of 3.2.
3.3.1 Materials, protective coatings, and finish.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.
3.3.1.1 Recycled, recovered, environmentally preferable, or bio based materials.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.1.
3.3.1.2 Protective coatings.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.2.
3.3.1.2.1 Surface preparation and pretreatment.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.2.1
3.3.1.2.2 Primer.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.2.2.
3.3.1.2.2.1 Ferrous surfaces.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.2.2.1.
3.3.1.2.2.2 Aluminum and mixed aluminum and ferrous surfaces.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.2.2.2.
3.3.1.2.3 Topcoat.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.2.3.
3.3.1.3 Dissimilar metals.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.3.
3.3.1.4 Finish.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.1.4.
3.3.4.1 System safety.	Contractor system safety hazard analysis (see 4.5.2).
3.3.4.2 Hazardous material.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.4.2.
3.3.4.7 Electrostatic discharge (ESD).	Contractor electrostatic discharge analysis. (see 4.5.4).
3.3.6 Human systems integration.	Contractor certification that the ABFDS is in accordance with the requirements of 3.3.6.
3.3.9 Service life.	Contractor service life analysis (see 4.5.7)
3.4.4 Solar radiation.	Contractor certification that the ABFDS is in accordance with the requirements of 3.4.4.
3.4.5 Fungus.	Contractor certification that the ABFDS is in accordance with the requirements of 3.4.5.
3.6.1 Surface transportability.	Contractor surface transportability analysis (see 4.5.11.1)
3.6.2 Air transportability.	Contractor air transportability analysis (see 4.5.11.2).

TABLE IV. Certifications and analyses – Continued.

Paragraph	Required Certifications and Analyses
3.6.3 Tie downs.	Contractor tie down analysis (see 4.5.11.4).
3.7.4 Special tools.	Contractor certification that the ABFDS is in accordance with the requirements of 3.7.4.
3.7.5 Diagnostic software.	Contractor certification that the ABFDS is in accordance with the requirements of 3.7.5.
3.8 Engine and related equipment.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.
3.8.3 Engine cooling system.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.3.
3.8.4 Engine lubrication system.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.4.
3.8.4.1 Engine oil.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.4.1.
3.8.4.1.1 Engine oil-operating temperature.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.4.1.1.
3.8.4.1.2 Engine oil consumption.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.4.1.2.
3.8.4.2 Engine oil filter.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.4.2.
3.8.6.1 Engine primary fuels.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.6.1.
3.8.6.2 Engine alternate fuels.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.6.2.
3.8.6.3 Engine emergency fuels.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.6.3.
3.8.6.4 Fuel system.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.6.4.
3.8.6.4.3 Fuel tank.	Contractor certification that the ABFDS is in accordance with the requirements of 3.8.6.4.3.
3.9 Electrical system.	Contractor certification that the ABFDS is in accordance with the requirements of 3.9.
3.9.1 Alternator.	Contractor certification that the ABFDS is in accordance with the requirements of 3.9.1.
3.9.2.1 Batteries.	Contractor certification that the ABFDS is in accordance with the requirements of 3.9.2.1.
3.10.3 Volumetric Flow meter.	Contractor certification that the ABFDS is in accordance with the requirements of 3.10.3.
3.10.8 Straps and tensioners.	Contractor certification that the ABFDS is in accordance with the requirements of 3.10.8.
3.10.9 Remote and dead man control.	Contractor certification that the ABFDS is in accordance with the requirements of 3.10.9.

TABLE IV. Certifications and analyses – Continued.

Paragraph	Required Certifications and Analyses
3.11.5. ABFDS associated equipment.	Contractor certification that the ABFDS is in accordance with the requirements of 3.11.5.
3.11.5.1 HCU-6/E aircraft pallet.	Contractor certification that the ABFDS is in accordance with the requirements of 3.11.5.1.
3.11.5.2 Type V Ariel Delivery Platform.	Contractor certification that the ABFDS is in accordance with the requirements of 3.11.5.2.
3.11.5.3 3,000 gallon bladder tank.	Contractor certification that the ABFDS is in accordance with the requirements of 3.11.5.3.
3.12 Bonding.	Contractor certification that the ABFDS is in accordance with the requirements of 3.12.

4.5.2 System safety hazard analysis. A system safety hazard analysis of the ABFDS shall be conducted in accordance with 4.3.1 through 4.3.8 of MIL-STD-882 to demonstrate compliance with the mishap risk requirement of 3.3.4.1.

4.5.3 Sound level test. With the ABFDS operating at the maximum fuel flow rate, while meeting the weight and dimensions outlined in 3.5, the free field noise level shall not exceed 84 dBA at 40 feet from the exhaust on the aft ABFDS centerline with the microphone 5 feet above the ground to demonstrate compliance with 3.3.4.6.

4.5.4 Electrostatic discharge analysis. An engineering analysis shall be performed to demonstrate compliance with the electrostatic discharge requirement of 3.3.4.7.

4.5.5 Hydrostatic testing. The ABFDS shall be hydrostatic proof tested at 150% of the maximum operating pressure for not less than 10 minutes to demonstrate compliance with the requirements in 3.3.4.8. 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 result of hydrostatic testing. The unit shall have passed if it withstands the proof pressure 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.

4.5.6 Electromagnetic interference test. The first article ABFDS shall be tested in accordance with MIL-STD-461: RE 102 and RS 103 to demonstrate compliance with 3.3.5.

4.5.7 Service life analysis. An engineering analysis shall be performed to demonstrate compliance with the service life requirement of 3.3.9.

4.5.8 Environmental testing.

4.5.8.1 High temperature storage and operation test. The first article ABFDS shall be tested in accordance with MIL-STD-810, Method 501.6, Procedures I to demonstrate compliance with 3.4.1. The ABFDS shall be subjected to a 50-hour exposure at 140° F. No adverse effects that would affect operation at normal temperature shall result from the 50-hour exposure. The chamber temperature shall then be reduced to 125° F, and the unit operated for the one-hour operational cycle as described in 4.5.6. 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.

4.5.8.2 High altitude operation test. The first article ABFDS shall be configured to simulate test conditions for maximum rpm performance at 5,000 feet above sea level (24.9 in Hg) and 107° F to demonstrate compliance with the requirements of 3.4.1.1. In order to avoid using an environmental test chamber, the engine air intake may be throttled with an intake plenum chamber. The intake air shall 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 ABFDS shall have passed if the ABFDS is capable of operating at maximum flow for one hour with an engine air intake density equal to 24.9 inches Hg at 107° F maximum.

4.5.8.3 Low temperature storage and operation test. The first article ABFDS shall be tested in accordance with MIL-STD-810, Method 502.6, Procedures I, to demonstrate compliance with 3.4.2. The ABFDS shall be subjected to a -40° F soak for 50 hours. The chamber temperature shall then be raised to -25° F in order to demonstrate the winterization requirement in 3.9.3. Using the winterization kit, the engine shall be started within 10 minutes of the initial attempt, and the unit shall be operated for the one-hour operational cycle. 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.

The following low temperature operation test conditions shall be maintained during the low temperature operation test. 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, commercial No. 1 Diesel, DF-1 or DF-A in accordance with ASTM D975.

b. Engine lubricating oil. The engine lubricating oil shall be drained, flushed, and filled with arctic lubricating oil in accordance with MIL-PRF-2104.

4.5.9 Precipitation.

4.5.9.1 Rain test. A first article ABFDS shall be tested in accordance with MIL-STD-810, Method 506.6, Procedure II, to demonstrate compliance with 3.4.3.1.

4.5.9.2 Salt fog test. A first article ABFDS shall be tested in accordance with MIL-STD-810, Method 509.6, to demonstrate compliance with 3.4.6.

4.5.9.3 Sand and dust test. A first article ABFDS shall be tested in accordance with MIL-STD-810, Method 510.6, Procedures I (12 hours) and II (90 minutes per side), to demonstrate compliance with 3.4.7.

4.5.10 Weight and dimension tests. The weight and dimensions of the ABFDS shall be measured to demonstrate compliance with the weight and dimension requirements of 3.5.

4.5.11 Transportability verification.

4.5.11.1 Surface transportability analysis. An engineering analysis shall be performed to demonstrate compliance with 3.6.1. The engineering analysis shall utilize the data for road transportation in accordance with MIL-STD-810, Method 514.7, Table 514.7C-II.

4.5.11.2 Air transportability analysis. An engineering analysis shall be performed to demonstrate compliance with the air transportability requirements of 3.6.2. The analysis shall include the tie downs and all major components and their ability to withstand the accelerations specified in 3.6.2. The evaluation shall also include a dimensional analysis for the ABFDS while loaded aboard the C-17 and C-130 aircraft.

4.5.11.3 Equipment removal and reconfiguration demonstration. A first article ABFDS shall be configured for transport on C-130 aircraft and then reconfigured for operation to demonstrate compliance with 3.6.2.1. It shall be demonstrated that the forces required do not exceed those allowed in MIL-STD-1472.

4.5.11.4 Tie down analysis. An engineering analysis shall be performed and shall include the tie downs and all major components and their ability to withstand the accelerations specified in 3.6.3.

4.5.11.5 Tie down test. A first article ABFDS shall be tested to demonstrate compliance with the tie down provision requirements of 3.6.3.

4.5.12 Maintainability demonstration. A maintainability demonstration shall be performed to verify the requirements of 3.7. All recommended preventive maintenance tasks shall be performed and the task times shall be recorded. It shall be demonstrated that the forces required do not exceed those allowed in MIL-STD-1472. All preventive maintenance tasks recommended to be performed daily and at the routine PMI shall also be performed by personnel wearing arctic mittens.

4.5.13 Inspection and servicing provisions demonstration. The corrective maintenance demonstration shall be demonstrated to verify compliance with the requirements of 3.7.1. The demonstration shall be planned and performed using Test Method 9 of MIL-HDBK-470 as guidance. The contractor shall prepare a list of the corrective maintenance tasks for all expected failures over the life of the ABFDS. The Government shall select 30 of these tasks, which shall be performed, and the task times shall be recorded. It shall be demonstrated that the forces required do not exceed those allowed in MIL-STD-1472.

4.5.14 Engine starting aids demonstration. A demonstration shall be performed on the first article to verify that the engine starting aids operate in accordance with the requirements in 3.8.1.2. The starting aids operation shall be verified at ambient conditions for production models only.

4.5.15 Exhaust system test. Exhaust temperatures shall be recorded when the engine is operating in the high temperature chamber at 125° F (see 4.5.8.1) to demonstrate compliance with the requirements of 3.8.5.

4.5.16 Fuel priming pump test**.** The fuel priming pump system shall be tested to verify compliance with the requirements of 3.8.6.4.1. The test shall allow the engine to run to fuel exhaustion, then refuel the tank, and operate the electric primer. The engine shall start in one minute or less.

4.5.17 Fuel tank test. The fuel tank shall be tested to verify all requirements of 3.8.6.4.3. As part of the test, the engine fuel tank shall be pressure tested to a + 5 psig and -5 psig. No leakage, deformation, or rupture shall be acceptable.

4.5.18. Engine emergency shutdown demonstration. A demonstration shall be performed to verify that the emergency engine shutdown shall shut down the engine in accordance with the requirements as specified in 3.8.7.2.

4.5.19 ABFDS pump endurance test. An ABFDS pump endurance test shall be conducted in order to verify the requirements of 3.10.1. The diesel engine and fuel transfer pump shall be subjected to seven continuous two-hour cycles consisting of one hour of operation followed by one hour of non-operation. The one hour of operation shall consist of the engine at idle with no flow for 15 minutes, followed by running the engine/pump to achieve 600 +0/-50 gpm through one discharge hose and nozzle for 15 minutes followed by 1200 +0/-100 gpm for 30 minutes through two discharge hoses and nozzles. Adequate NPSH shall be provided to the pump to support the flow rates. During each operational cycle, it shall be demonstrated that the ACS single point nozzle pressure control system limits the pressure at either nozzle to no more than 35 psi when in the low-pressure mode and to no more than 55 psi when in the high-pressure mode. In addition, it shall be demonstrated during each operational cycle that the flow control system limits the flow to no more than 600 gpm through either hose. After one hour of continuous operation, the engine shall be turned off for one hour of non-operation. Upon completion of seven continuous two hour cycles, an engine or pump failure or impending failure shall be cause for rejection. A failure is any malfunction, which cannot be corrected within 30 minutes. Any adjustment, repair, or replacement action, which results in degradation of system performance below specified in this paragraph, shall be cause for rejection.

4.5.20 Pumping controls test. A pumping controls test shall be performed to verify all the requirements in 3.10.1.1 for all modes of operation.

4.5.21 Single point nozzle pressure and flow control test. A test shall be conducted to demonstrate that the flow and pressure control system is in accordance with the requirements of 3.10.2.1. The test shall demonstrate that when in fuel servicing operations and utilizing one or both discharge hoses, the primary nozzle pressure control system shall limit the nozzle pressure to 30 ± 5 psi when in low-pressure mode and 50 ± 5 psi when in high-pressure mode by controlling the engine speed

with the ACS. It shall be demonstrated that the secondary pressure control system for each discharge hose shall limit the nozzle pressure to 55 psi when operating in either pressure mode. At no time shall the flow through either hose exceed 600 gpm.

4.5.22 Contamination monitor test. The contamination monitor and cutoff valve shall be tested by injecting fuel contaminated with water and solids at 75% of the levels in 3.10.4 into the fuel stream and increasing the injection rate until the level is over 100% of the level in 3.10.4. The fuel flow shall cut off following introduction of the contaminated fuel, which exceeds the level in 3.10.4. The contaminated fuel shall then be drained and replaced with clean fuel after which monitor shall reset and shut off valve open. This test may be performed and certified by the contamination monitor manufacturer.

4.5.23 Sampling device demonstration. A demonstration shall be performed to verify the sampling device is in accordance with the requirements in 3.10.7. It shall be shown that adequate space is provided to connect in-line samplers approved by the Air Force for solids and water samples.

4.5.24 Remote and dead man control demonstration. A demonstration shall be performed to show that the remote and dead man controller system is in accordance with the requirements of 3.10.9. The demonstration shall show (1) the system is capable of starting and stopping the engine and starting and stopping flow from either hose outlet, (2) the push-button stops the engine and terminates flow through both hoses, (3) upon activation of the dead man switch, the ACS shall control engine speed depending on which pumping mode is selected. If Manual mode is selected and the dead man is activated, the manual throttle, (4) upon release of the dead man device, shall control the engine speed the engine speed shall return to idle and the flow of fuel shall terminate within 3 seconds.

4.5.25 Aircraft compatibility test. An aircraft compatibility test shall be conducted in order to verify the requirements in 3.13. The test (1) shall be conducted using the C-17 and C-130J model aircraft, (2) shall show the on and off loading of a two bag configuration for both the C-17 and C-130J aircraft, (3) shall show the utilization of the C-17 and C-130J as a fuel supply source for the ABFDS, and (4) shall show the use of the aircraft auxiliary power connection to power the winterization system (5) shall show mounting compatibility to the HCU-6/E aircraft pallet.

5. PACKAGING

5.1 Packaging requirements. 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. It will permit the offloading of fuel directly from the integral aircraft tanks and the airborne tanks into base fuel storage and dispensing systems. The ABFDS provides aircraft refueling support capability at forward operating locations. It will permit the offloading of fuel directly from the airborne tanks directly into aircraft.

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

b. CT hose, if required (see 3.11.1b).

c. Packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Alternate fuel. An alternate fuel is a fuel that can be used in place of the primary fuel with a possible loss of efficiency. Engine adjustments may be necessary. The use of an alternate fuel may result in a change of maintenance or overhaul cost.

6.3.2 Commercial item.

(1) Any item, other than real property, that is of a type customarily used by the general public or by non-Governmental entities for purposes other than Governmental purposes, and—

(i) Has been sold, leased, or licensed to the general public; or

(ii) Has been offered for sale, lease, or license to the general public;

(2) Any item that evolved from an item described in paragraph (1) of this definition through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation;

(3) Any item that would satisfy a criterion expressed in paragraphs (1) or (2) of this definition, but for—

(i) Modifications of a type customarily available in the commercial marketplace; or

(ii) Minor modifications of a type not customarily available in the commercial marketplace made to meet Federal Government requirements. Minor modifications means modifications that do not significantly alter the non-Governmental function or essential physical characteristics of an item or component, or change the purpose of a process. Factors to be considered in determining whether a modification is minor include the value and size of the modification and the comparative value and size of the final product. Dollar values and percentages may be used as guideposts, but are not conclusive evidence that a modification is minor;

(4) Any combination of items meeting the requirements of paragraphs (1), (2), (3), or (5) of this definition that are of a type customarily combined and sold in combination to the general public;

(5) Installation services, maintenance services, repair services, training services, and other services if—

(i) Such services are procured for support of an item referred to in paragraph (1), (2), (3), or (4) of this definition, regardless of whether such services are provided by the same source or at the same time as the item; and

(ii) The source of such services provides similar services contemporaneously to the general public under terms and conditions similar to those offered to the Federal Government;

(6) Services of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed or specific outcomes to be achieved and under standard commercial terms and conditions. For purposes of these services—

(i) “Catalog price” means a price included in a catalog, price list, schedule, or other form that is regularly maintained by the manufacturer or vendor, is either published or otherwise available for inspection by customers, and states prices at which sales are currently, or were last, made to a significant number of buyers constituting the general public; and

(ii) “Market prices” means current prices that are established in the course of ordinary trade between buyers and sellers free to bargain and that can be substantiated through competition or from sources independent of the offerors.

(7) Any item, combination of items, or service referred to in paragraphs (1) through (6) of this definition, notwithstanding the fact that the item, combination of items, or service is transferred between or among separate divisions, subsidiaries, or affiliates of a contractor; or

(8) A nondevelopmental item, if the procuring agency determines the item was developed exclusively at private expense and sold in substantial quantities, on a competitive basis, to multiple State and local Government. (Reference the Federal Acquisition Regulation (FAR) 2.101)

6.3.3 Common hand tool. A non-powered tool that is likely to be found in a typical mechanic's toolbox. Common hand tools include open end, boxed end, combination, socket (both 6- and 12-point in both standard and deep-well), and hex key wrenches, in SAE sizes up to and including 1-inch and metric sizes up to and including 25-mm; ratchet handles, extensions, and swivels; slotted and Phillips-head screwdrivers; regular and snap-ring pliers; and a ball-peen hammer.

6.3.4 Emergency fuel. An emergency fuel is a fuel that can be used when the primary and alternate fuels are not available. This fuel is not for use on a continuing basis, but is to be employed only when the primary and/or alternate fuel and equipment fuels are unobtainable and operation is mission essential. It is highly likely engine performance and longevity will be severely impacted.

6.3.5 Gravity valve. A valve that is actuated by gravity; opens under positive G force and closes under negative G force.

6.3.6 NPSH. The margin of pressure over vapor pressure, at the pump suction nozzle, is Net Positive Suction Head (NPSH). NPSH is the difference between suction pressure (stagnation) and vapor pressure. The net positive suction head may refer to one of two quantities in the analysis of cavitation: The Available NPSH: a measure of how close the fluid at a given point is to boiling, and so to cavitation. The Required NPSH: the head value at a specific point required to keep the fluid from cavitating.

6.3.7 Primary fuel. Primary fuel is the fuel used during tests to demonstrate system performance.

6.3.8 Special tool. A tool that is not commercially and readily available from a source other than the ABFDS contractor.

6.4 Key words.

ABFDS
Bladder
Camlock
Filter-separator
Lubricants
Multi-fuel engine
Nozzle

6.5 International standardization agreement implementation. This specification implements STANAG-3747 – Guide Specifications (Minimum Quality Standards) for Aviation Turbine Fuels (F-34, F-35, F-40 and F-44) – AFLP-3747. When amendment, revision, or cancellation of this specification is proposed, the preparing activity must coordinate the action with the U.S.

National Point of Contact for the international standardization agreement, as identified in the ASSIST database at https://assist.dla.mil/ .

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

MILITARY INTEREST:

Custodians:
Army - AT
Navy - YD
Air Force - 184

Preparing Activity:
Air Force - 184

Reviewer:
Air Force – 06, 99
DLA - CC

Agent:
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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.dla.mil/ .