

INCH-POUND

MIL-DTL-62011E
w/AMENDMENT 2
20 June 2023
SUPERSEDING
MIL-DTL-62011E
w/AMENDMENT 1
24 October 2018

DETAIL SPECIFICATION

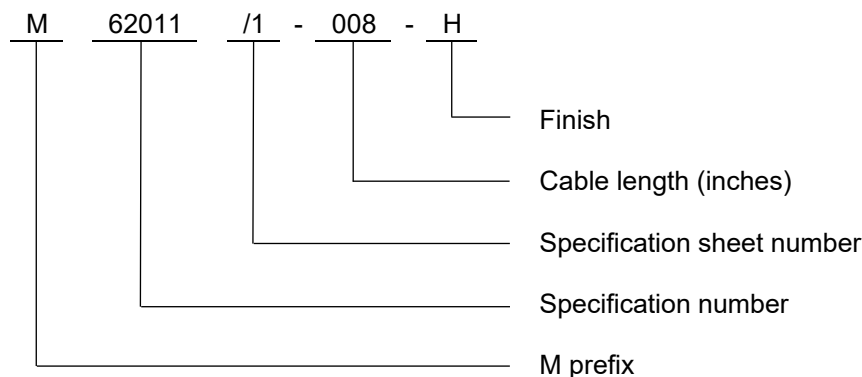
PUMP, FUEL, ELECTRICALLY-OPERATED: 24-VOLT DC, IN-TANK TYPE, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers electrically-operated 24-volt (V), direct current (dc), in-tank fuel pumps capable of delivering 200 gallons per hour (gph) with outlet pressure at 4 pounds per square inch gauge (psig) (28 kPa) (see 6.1).

1.2 Part or Identifying Number (PIN). The PIN consists of the letters M, the basic specification number, specification sheet number, a dash, three numbers for length and a letter for finish.



2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 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 had been made to ensure the completeness of the list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 or 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Columbus, Attn: DSCC-VAI, P.O. Box 3990, Columbus OH 43218-3990, or emailed to FluidFlow@dla.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>.



2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the solicitation or contract.

FEDERAL STANDARD

FED-STD-H28 - Screw-Thread Standards for Federal Services

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-16232 - Phosphate Coating, Heavy, Manganese or Zinc or Base
MIL-DTL-62011/1 - Pump, Fuel, Electrically-operated: 24-Volt DC, In-tank Type, Top-mounted Connector, Type I
MIL-DTL-62011/2 - Pump, Fuel, Electrically-operated: 24-Volt DC, In-tank Type, Side-mounted Connector, Type II

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130 - Identification Marking of US Military Property
MIL-STD-202 - Electronic and Electrical Component Parts
MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests

(Copies of these documents are available online at <https://quicksearch.dla.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 B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM D471 - Standard Test Method for Rubber Property-Effect of Liquids
ASTM D975 - Standard Specification for Diesel Fuel
ASTM D4814 - Standard Specification for Automotive Spark-Ignition Engine Fuel
ASTM F1136/F1136M - Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Material to Fungi

(Copies of these documents are available online at <http://www.astm.org>.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO/IEC DIS 17025 - General Requirements for the Competence of Testing and Calibration Laboratories

(Copies of these documents are available online at www.ansi.org.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

SAE-AMS 2417	-	Plating, Zinc-Nickel Alloy
SAE-AMS-QQ-N-290	-	Nickel Plating (Electrodeposited)
SAE-AMS-QQ-P-416	-	Cadmium Plating (Electrodeposited)
SAE-AMS-STD-753	-	Corrosion-Resistant Steel Parts: Sampling, Inspection and Testing for Surface Passivation

(Copies of these documents are available online at <http://www.sae.org>.)

2.4 Order of precedence. Unless otherwise noted here in or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.4.

3.3 Materials.

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

3.2.1.1 Recovered materials. The term "recovered materials" means materials, which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. Unless otherwise specified, none of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification.

3.3.2. Pump motor housing. The pump motor housing shall be made of CRES.

3.3.3 Pump body, mounting bracket and hardware plating. The pump body, mounting bracket and hardware shall be plated to resist corrosion, see 3.3.4 and 3.3.5.

3.3.4 Cadmium plating. All steel alloys other than CRES.

3.3.4.1 Electrical cable connectors. Electronic cable connector's shall be cadmium plating in accordance with SAE-AMS-QQ-P-416, type 1, class 1.

3.3.4.2 Screws, nuts, and bolts. Screws, nuts, and bolts shall be cadmium plated in accordance with SAE-AMS-QQ-P-416, type II, class 3.

3.3.4.3 Cushion retainer, pump cover, and discharge tube fitting. Cushion retainer, pump cover, and discharge tube fitting shall be cadmium plated in accordance with SAE-AMS-QQ-P-416, type I, class 2.

3.3.4.4 Cadmium is not recommended. Carbon steel material with cadmium plating shall only be used when other materials and finishes specified in this document cannot meet performance requirements (see 6.5).

3.3.5 Other plating's. Used on electronic cable connectors, screws, bolts, nuts, cushion retainer, pump cover, and discharge tube.

3.3.5.1 Zinc plating hexavalent free. Zinc plating in shall be in accordance with ASTM B633, type VI, Fe/Zn 5 and shall be hexavalent chromium free.

3.3.5.2 Zinc/Aluminum. Zinc/Aluminum in accordance with ASTM F1136/F1136M, grade 3, NC and shall be shall be hexavalent chromium free.

3.3.5.3 Zinc phosphate. Zinc phosphate shall be in accordance with MIL-DTL-16232, type Z, class 1.

3.3.5.4 Zinc nickel. Zinc nickel shall be in accordance with SAE-AMS 2417, type 1.

3.3.5.5 Nickel. Nickel plating shall be in accordance with SAE- AMS-QQ-N-290, class 2, grade B.

Note: For new design it is recommended that phosphate coating be specified when electrodeposited zinc or cadmium plating is not required.

3.3.5.6 Nickel is not recommended. Carbon steel material with nickel plating shall only be used when other materials and finishes specified in this document cannot meet performance requirements.

3.3.5.7 Finish. All plating's shall be capable of meeting the 96 hour salt spray test in accordance with 4.6.22. Fluid passages, other openings, and internal threads shall not be subject to the plating thickness requirement and may have bare areas provided they are protected with a light film of oil. The following exceptions shall apply:

- a. Phosphate coated fittings shall be subjected to all tests as specified in MIL-DTL-16232, Class 1, except for the salt spray test. The salt spray test is required only to verify the phosphating process or changes thereto.
- b. Passivated fittings shall be subjected only to the copper sulfate tests as specified in SAE-AMS-STD-753, test method 102. Fittings passing this test shall be returned to stock for usage after each fitting is thoroughly rinsed in deionized water and thoroughly dried.

3.4 Design and construction.

3.4.1 Motor assembly. When tested as specified in 4.6.2 the motor assembly shall be hermetically sealed.

3.4.2 Threaded parts. All screw threads shall conform to FED-STD-H28.

3.4.3 Dissimilar metals. Except where necessary to complete an electrical circuit, contact between dissimilar metals that would encourage galvanic corrosion shall be avoided. Where such contact is not necessary to complete an electrical circuit, but is otherwise unavoidable, protection against electrolysis and corrosion shall be provided.

3.5 Performance.

3.5.1 Pressure and flow. The pump pressure and flow characteristics shall equal or exceed those illustrated by the curves shown on the individual specification sheet with the pump motor current not exceeding 4.5 amperes under any of these operating conditions at 800 feet (244 meters) elevation, when tested as specified in 4.6.3.

3.5.2 Pumpdown. The pump shall equal or exceed the pressures and flow rates specified on the individual specification sheet at all fuel levels 1.5 inches (38.1 mm) or more above the lowest point of the pump, when tested as specified in 4.6.4. When pump delivery drops to 0 gph, air pressure developed in the fuel line shall not exceed 0.5 psig (3.4 kPa).

3.5.3 Dry operation. When tested as specified in 4.6.5, the pump shall be capable of withstanding operation in a dry fuel tank for a period of not less than 4 hours, without evidence of damage or impairment of performance.

3.5.4 Electromagnetic compatibility. When tested as specified in 4.6.6, the pump shall meet the CE102 requirements of MIL-STD-461 pertaining to military vehicles. If a radio frequency noise filter is required, the radio-frequency noise filter shall be an integral part of the pump.

3.5.5 Dielectric strength. The pump insulation shall show no loosening, cracking, charring, burning, smoking, rupture, or other damage with the internal ground and radio suppressor ground strap(s) disconnected, when tested as specified in 4.6.7.

3.5.6 Vapor separation. When tested as specified in 4.6.8, the pump shall equal or exceed the pressures and flow rates on figure 1 with fuel at 155°F (68.3° C). When the pump inlet is removed from the heated fuel and then re-submerged, the pump shall re-establish that performance within a period of 5 seconds.

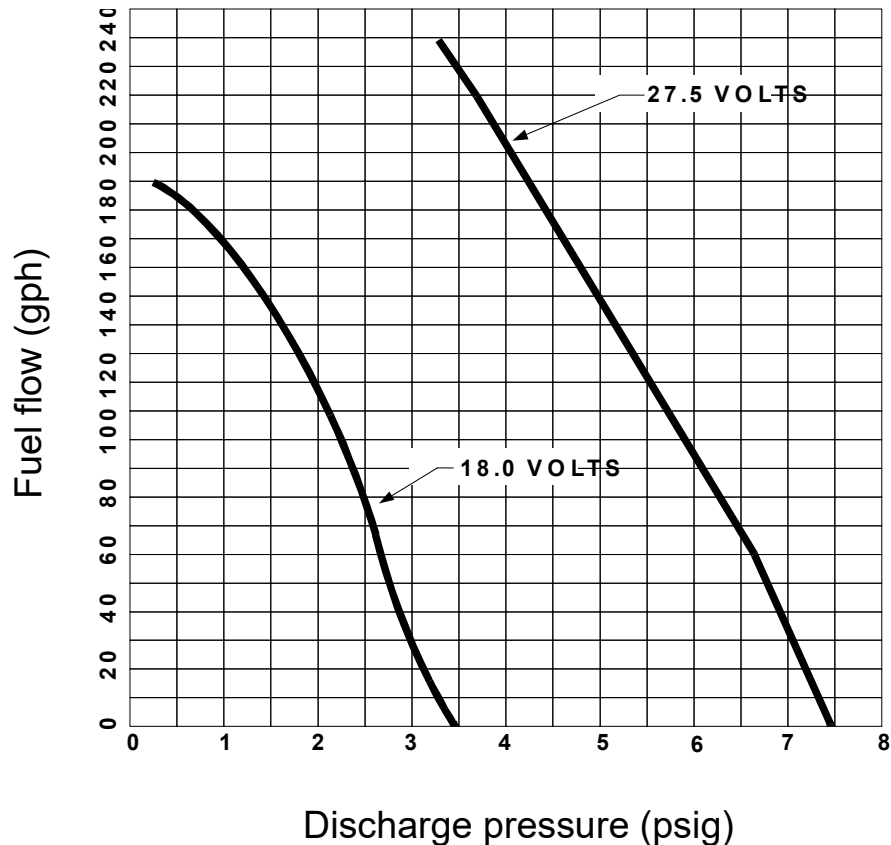


FIGURE 1. Pressure and flow characteristics.

3.5.7 Flow through. When tested as specified in 4.6.9, the minimum flow at the pump outlet shall be not less than 60 gph (3.8 lph). When the pump is electrically disconnected and the pump is subjected to either a 1 psig (7 kPa) pressure at the pump inlet or, where a pump by-pass system is used, a vacuum of approximately 2 inches (51 mm) of mercury at the pump outlet.

3.5.8 On-off cycling. When tested as specified in 4.6.10, the pump shall equal or exceed the pressures and flow rates on figure 1 within 3 seconds after power is turned off and then reapplied.

3.5.9 Endurance. When tested as specified in 4.6.11, the pump shall equal or exceed the pressures and flow rates on figure 1 after not less than 1,500 hours of continuous operation. The pump shall require no maintenance during this time period.

3.5.10 Coupling capability (static). The pump delivery shall reach a minimum of 200 gph (757 lph) at 4 psig (27.6 kPa) within 60 seconds of starting, when tested as specified in 4.6.12.

3.5.11 Coupling capability (dynamic). An operating pump shall start pumping within 5 seconds after immersion, and the impeller shall not decouple when tested as specified in 4.6.13.

3.5.12 Electrical continuity. The electrical resistance between the pump housing and the wire braid on the power cable, and between the 0.4375-28 UNEF-2A thread and the wire braid, shall be less than 1 ohm, when tested as specified in 4.6.14. See the appropriate specification sheet for the locations of these items.

3.6 Environmental requirements.

3.6.1 Low and high temperature operation. When tested as specified in 4.6.15.1 and 4.6.15.2, the pump shall equal or exceed the pressures and flow rates on figure 1 at any temperature between -65°F and 130°F (-54°C and 54°C).

3.6.2 Explosion-proofness. When tested as specified in 4.6.16, the pump shall not cause ignition of an explosive fuel mixture.

3.6.3 Shock resistance. When tested as specified in 4.6.17, the pump shall withstand, without damage or impairment of performance, a shock of 25 gravity units (g) applied in the direction of each of the three major axes.

3.6.4 Vibration resistance. When tested as specified in 4.6.18, the pump shall not malfunction and shall equal or exceed the pressures and flow rates on figure 1 when exposed to vibrations between 10 and 55 Hz with an amplitude of .03 inches (0.8 mm).

3.6.5 Fungus resistance. When tested as specified in 4.6.19, the pump shall be fungus resistant.

3.6.6 Fuel resistance. Pump elastomeric parts (if used) that contact fuel shall be fuel resistant, then tested as specified in 4.6.20.

3.6.7 Contaminated fuel. When tested as specified in 4.6.21, the pump shall equal or exceed the pressures and flow rates on figure 1 after being exposed to or operated with contaminated fuel.

3.6.8 Corrosion resistance. The pump shall be corrosion resistant when tested as specified in 4.6.22.

3.6.9 Temperature shock. The pump shall withstand exposure to temperature shock when tested as specified in 4.6.23.

3.6.10 Humidity. When tested as specified in 4.6.24, the pump shall withstand exposure to humid conditions.

3.7 Marking. The pump shall be marked for identification in accordance with MIL-STD-130. Marking shall be permanent with the location optional, and shall include the following information:

- a. Operating voltage.
- b. Name or CAGE Code of manufacturer.
- c. Date of manufacture.

3.8 Grounding.

3.8.1 Grounding potential. The design and construction of the fuel pump shall insure that all external parts, surfaces are at ground potential at all times during normal operation. The design shall include consideration of ground currents and voltage limits. In no case shall the shield be depended upon for a current-carrying ground connection.

3.8.2 Grounding. Ground connections to shields, hinges, and other mechanical parts shall not be made to complete electrical circuits. A point on the electrically conductive chassis or equipment frame shall serve as the common tie point for the static ground and powerground. The path from the tie point to ground shall:

- a. Be continuous and permanent.
- b. Have ample carrying capacity to conduct safely any fault currents that may be imposed on it.
- c. Have impedance sufficiently low to limit the potential above ground and to facilitate the operation of over current devices in the circuits.
- d. Have sufficient mechanical strength of the material to minimize possibility of ground disconnection.

3.8.3 Grounding to chassis. Ground connection to an electrically conductive chassis or frame shall be mechanically secured by soldering to a spot welded terminal lug or to a portion of the chassis or frame that has been formed into a soldering lug, or by use of a terminal on the ground wire and then securing the terminal by a screw, nut and a lockwasher. The screw shall fit in a tapped hole in the chassis or frame or it shall be held in a through-hole by a nut. When the chassis is made of steel, the metal around the screw hole shall be plated or tinned to provide a corrosion resistant connection.

3.9 Workmanship. The pump shall be free of burrs, rust, scratches, chips, sharp edges, loose or defective connectors, cracked insulation, faulty soldering, or other defects that may adversely affect the operability, serviceability, or appearance of the pump.

4. VERIFICATION

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

- a. First article inspection (see 4.4 and 6.2).
- b. Conformance inspection (see 4.5).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.2.1 through 4.2.7.

4.2.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO/IEC DIS 17025 applicable.

4.2.2 Atmospheric conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following atmospheric conditions:

- a. Air temperature: $77^{\circ}\text{F} \pm 20^{\circ}\text{F}$ ($25^{\circ}\text{C} \pm 6^{\circ}\text{C}$).
- b. Barometric pressure: 28.5+2, -3 inches of mercury (725+50, -75 millimeters of mercury).
- c. Relative humidity: 50 ± 30 percent.

4.2.3 Operating voltage. The operating voltage of the pump shall be 27.5 ± 0.1 V dc.

4.2.4 Test fuel. Fuel used for testing shall be in accordance with grade 2-D S15 of ASTM D975.

4.2.5 Test apparatus. The inspection apparatus shall include a fuel tank or tanks suitably equipped to mount the pump within the test fluid with the fuel inlet at least 2 inches (51 mm) below fluid level the following details shall apply:

- a. Means shall be provided within the apparatus to re-circulate test fuel and to control test fuel temperature at any point between -65°F and 160°F (-53°C and 71°C).
- b. The apparatus shall include an electrical source, ranging from 0 to 32 V dc, to operate the pump.
- c. The electrical source shall maintain any voltage setting and shall not drop more than 0.5 volts in 1 millisecond (measured with an oscilloscope) when the pump is energized.
- d. Monitoring devices shall also be included to determine gph flow rate, psig of pressure generated by the pump, and electrical loads.
- e. The pressure gauge tap shall be located in a 0.5 inch (12.7mm) (nominal) inside diameter discharge line, 6 to 8 inches (152 to 203 mm) from the discharge fitting on the pump.
- f. The pressure gauge reading shall be 0 psig with pump stopped and fuel lines full.

4.2.6 Tolerances. Unless otherwise specified, all tolerances of the test apparatus shall be ± 10 percent.

4.2.7 Mounting position. All tests shall be conducted with the pump in its normal mounting position in which the longitudinal axis of the pump is vertical.

4.3 Responsibility for compliance. All items shall meet all requirements of sections 3 and 4. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.3.1 Lot records. Manufacturers shall keep lot records for 3 years minimum. Manufacturers shall monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these fuel pump assemblies. The records, including as a minimum, an attributes summary of all quality conformance inspections conducted on each lot, shall be available to review by customers at all times.

4.4 First article inspection. Unless otherwise specified (see 6.2), five randomly selected pumps, properly marked with identifying information, from the first 20 pumps produced under the production contract shall be subjected to a first article inspection. The pumps shall be inspected and tested as specified and in the order listed in [table I](#).

TABLE I. First article inspection.

Inspection	Requirement paragraph	Test paragraph	Pump sample
Visual inspection	3.7, 3.8, 3.9	4.6.1	1
Coupling capability (static)	3.5.8	4.6.12	
Pressure and flow test	3.5.1	4.6.3	
Flow through	3.5.7	4.6.9	
Pressure and flow test	3.5.1	4.6.3	
Dry operation	3.5.3	4.6.5	
On-off cycling	3.5.8	4.6.10	
Pressure and flow test	3.5.1	4.6.3	
Vibration resistance	3.6.4	4.6.18	
Shock resistance	3.6.3	4.6.17	
Fuel resistance <u>1/</u>	3.6.6	4.6.20	
Coupling capability (dynamic)	3.5.11	4.6.13	2
Pressure and flow test	3.5.1	4.6.3	
Pumpdown	3.5.2	4.6.4	
Low temperature operation	3.6.1	4.6.15.1	
High temperature operation	3.6.1	4.6.15.2	
Fungus resistance	3.6.5	4.6.19	
Temperature shock	3.6.9	4.6.23	
Coupling capability (static)	3.5.10	4.6.12	3
Pressure and flow test	3.5.1	4.6.3	
Endurance	3.5.9	4.6.11	
Electrical continuity	3.5.12	4.6.14	
Coupling capability (dynamic)	3.5.11	4.6.13	4
Pressure and flow test	3.5.1	4.6.3	
Vapor separation	3.5.6	4.6.8	
Contaminated fuel	3.6.7	4.6.21	
Corrosion resistance	3.6.8	4.6.22	
Humidity	3.6.10	4.6.24	
Explosion-proofness	3.6.2	4.6.16	
Coupling capability (static)	3.5.10	4.6.12	5
Pressure and flow test	3.5.1	4.6.3	
Electromagnetic compatibility	3.5.4	4.6.6	
Dielectric strength	3.5.5	4.6.7	
Hermetic sealing	3.4.1	4.6.2	

1/ Applicable only to pumps utilizing elastomeric components in contact with fuel.

4.4.1 Sampling. The unit of product shall be one pump assembly. All pump assemblies offered for delivery at one time shall be considered a lot for the purpose of inspection.

4.4.1.1 Samples for first article. The first article may be either a first production item or a standard production item from the supplier's current inventory provided the item meets the requirements of the specification and is representative of the design, construction, and manufacturing technique applicable to the remaining items to be furnished under the contract.

4.4.2 Failures. All samples must meet all of the contract requirements. Failure of a sample unit to pass any test shall be cause for rejection of the entire lot and to grant first article approval.

4.4.3 First article samples. Unless otherwise specified, after award of the contract or order, the manufacturer shall forward 1 fuel pump assembly. The sample shall be representative of the construction, workmanship, components, and materials to be used during production. When a manufacturer is in continuous production of the pump assemblies from one contract to another, submission of additional first article samples for a new contract may be waived at the discretion of the acquiring activity (see 6.2).

4.4.4 Disposition of samples. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.2).

4.5 Conformance inspection. For manufacturers that have successfully passed first article inspections and are continuously producing fuel pumps to this specification on going inspections shall consist of both the individual inspections, see table II, and the sampling inspection of 4.4.2. If first article is waived due to prior successful first article inspection the individual inspections shall be the manufactures in house inspection procedures.

4.5.1 Individual inspection. Each pump shall be subjected to the inspections and tests specified, and in the order listed as specified in table II.

TABLE II. Individual inspection.

Inspection	Requirement paragraph	Test paragraph
Examination of product	3.9	4.6.1
Pressure and flow test	3.5.1	4.6.3
Pumpdown	3.5.2	4.6.4
Coupling capability (static)	3.5.11	4.6.12
Coupling capability (dynamic)	3.5.12	4.6.13
Hermetic sealing	3.4.1	4.6.2

4.5.2 Sampling inspection. When a single procurement involves less than 100 pumps, one of the first 10 pumps produced shall be randomly selected and tested. When a single procurement involves 100 pumps or more, one of the first 10 pumps and one of each block of pumps, up to 500 pumps per block, produced thereafter shall be randomly selected and tested. Each pump selected shall be subjected to tests specified, and in the order listed as specified in table III.

TABLE III. Sampling inspection.

Inspection	Requirement paragraph	Test paragraph
Dry operation	3.5.3	4.6.5
On-off cycling	3.5.8	4.6.10
Pressure and flow test	3.5.1	4.6.3
Vibration resistance	3.6.8	4.6.18

4.6 Examinations and tests.

4.6.1 Examination of product. Each pump and its manufacturing records shall be examined to verify conformance to this specification with respect to materials, design and construction (except for hermetic sealing of the motor assembly), marking (see 3.7), grounding (3.8), and workmanship (3.9).

4.6.2 Hermetic Sealing. The pump shall be totally submerged under water in a test chamber for approximately 5 minutes. A vacuum of not less than 3 psig (21 Kpa) shall be pulled on the test chamber during this test period. The pump shall be monitored to verify no leakage, as evidenced by no stream of air bubbles.

4.6.3 Pressure and flow test (see 3.5.1). The pump shall be mounted in the test apparatus, test fuel added, and all fluid and electrical lines connected. The pump shall be operated at 18 ± 0.1 V dc and 27.5 ± 0.1 V dc. Pressure readings at various flow rates shall be made.

4.6.4 Pumpdown (see 3.5.2). The pump shall be mounted and operated as specified in 4.6.3, with the following exceptions:

- a. Test fuel discharged by the pump shall not be allowed to re-enter the tank.
- b. The pump shall be operated until performance below that specified on figure 1 recurs consistently.
- c. The fuel level shall be observed and the level at which pump delivery and discharge pressure deteriorates shall be noted.
- d. After pump delivery drops to 0 gph, the discharge line shall be closed and air pressure developed by the pump shall be measured.

4.6.5 Dry operation (see 3.5.3). The fuel pump shall be dry operated and meet the requirements of 3.5.3. The following details shall apply:

- a. The pump shall be mounted in the test apparatus, test fuel added and all fluid and electrical lines connected.
- b. The pump shall be operated at a minimum obtainable discharge pressure.
- c. While the pump is operating, the fuel tank shall be drained to a level below the pump inlet.
- d. The pump shall be continuously operated without fuel for a period of not less than 4 hours.
- e. Thereafter, the test fluid level shall be raised until the pump is again submerged to a fluid level at least 2 inches (51 mm) above the fuel inlet and the pump shall be tested as specified in 4.6.3.

4.6.6 Electromagnetic compatibility (see 3.5.4). The pump shall be tested for conducted emissions in accordance with method CE102 of MIL-STD-461 and meet the requirements of 3.5.4.

4.6.7 Dielectric strength (see 3.5.5). The fuel pump shall be dielectric strength tested and meet the requirements of 3.5.5. The following details shall apply:

- a. The pump motor housing shall be disassembled, or cut open to the extent necessary, to permit the internal ground connection to be disconnected or isolated and to permit observation of internal wiring.
- b. The motor shall be observed for a period of 1 minute while being subjected to 500 V root mean square (rms) at a frequency of 60 Hz, applied between conductor and ground.

4.6.8 Vapor separation (see 3.5.6). The fuel pump shall be vapor separation tested and shall meet the requirements of 3.5.6. The following shall apply:

a.	The test apparatus in 4.2.5 shall be modified by adding a means to return vaporized fluid to the tank through condensation.
b.	A means shall also be provided to lift or tilt the pump to allow the pump inlet to be raised above the fluid level.
c.	The pump shall be mounted in the test apparatus tank and fluid and electrical lines connected.
d.	The tank shall be filled with fresh gasoline (not previously used in high temperature testing) as specified in ASTM D4814.
e.	The gasoline shall be heated to 155°F ±5°F (68.3 ±2.8°C) and during this heating period the pump shall be operated so as to maintain delivery at 150 gph.
f.	After the gasoline reaches the specified temperature, the pump shall be lifted or tilted to the extent necessary to uncover the inlet area.
g.	The pump shall be re-submerged and the time necessary to re-establish flow rate shall be monitored.
h.	The pump shall be tilted or lifted and time monitored a total of 5 times.
i.	The pump's performance shall be measured throughout the test.

4.6.9 Flow through (see 3.5.7).

- a. The pump shall be mounted in the test apparatus, all fluid lines connected, and test fuel added.
- b. The electrical lines shall not be connected.
- c. While the pump is electrically and mechanically inert, a pressure of 1 psig (7 kPa) shall be exerted on the fuel at the pump inlet or, where a pump by-pass system is used, a vacuum of approximately 2 inches (51 mm) of mercury shall be applied at the pump outlet.
- d. The flow rate developed at the pump outlet shall be measured and be at least 60 gph.

4.6.10 On-off cycling (see 3.5.8).

- a. The pump shall be mounted in the test apparatus, all fluid and electrical lines connected, and test fuel added.
- b. The pump shall be subjected to 1,440 cycles of operation.
- c. Each cycle shall consist of 15 seconds of operating and 15 seconds of non-operating time.
- d. A time delay of 3 seconds after initiation of each cycle will be allowed prior to measurement, to permit the pump to come up to required values.
- e. The pump performance shall be measured throughout the tests.

4.6.11 Endurance (see 3.5.9).

- a. The pump shall be mounted in the test apparatus, all fluid and electrical lines connected, and test fuel added.
- b. The pump shall be operated for a total of not less than 1,500 hours in accordance with the schedule and test fuel specified in [table IV](#).
- c. Throughout the test period, the pump performance shall be measured.
- d. Following completion of the endurance test, the pump shall be pressure and flow tested (see 4.6.3).

TABLE IV. Endurance test schedule. ^{1/}

Fuel ^{2/}	Temperature	Test period (hours)
Grade 2-D S15	77°F ±10°F (25°C ±5.5°C)	1,450
Grade 2-D ^{3/}	-60°F ±5°F (-51°C ±5.5°C)	50

^{1/} Metric equivalents are given for information only.

^{2/} As specified in ASTM D975.

^{3/} Same as note 1, except that the cloud point shall be -65°F or lower.

4.6.12 Coupling capability (static) (see 3.5.10).

- a. The pump shall be mounted in the test apparatus and the tank filled with test fuel to a level of at least 2 inches (51mm) above the fuel pump.
- b. The operating voltage (see [4.2.2](#)) shall be applied to the pump and pump discharge pressure shall be adjusted to 4 psig (27.6 kPa).
- c. This voltage shall then be removed and the pump delivery allowed to return to zero gph.
- d. Within a maximum of 30 seconds after the pump delivery returns to zero, a terminal voltage of 32 V dc +0/-0.1 V dc shall be applied and the flow rate and pressure measured.

4.6.13 Coupling capability (dynamic) (see 3.5.11).

- a. The pump, without brackets and with a 12-inch (305 mm) (min.) discharge hose attached, shall be installed in the test apparatus .
- b. The tank shall be filled with test fuel to a level at least 4 inches (102 mm) above the base of the pump.
- c. The pump shall be adjusted to deliver 150 gph (568 lph) at the operating voltage (see 4.2.3).
- d. The pump shall be lifted at least 3 inches (76 mm) above the fuel.
- e. When the pump stops pumping, it shall be forcefully submerged in the fuel to approximately the same depth and the time to start pumping measured.
- f. The test shall be performed three times.
- g. In addition, the test shall be repeated three times with the vertical axis of the pump at 45° to the fuel surface.

4.6.14 Electrical continuity (see 3.5.12). The electrical resistance between the pump housing and the wire braid on the power cable, and between the 0.4375-28 UNEF-2A thread and the wire braid, shall be measured using an ohmmeter.

4.6.15 Low and high temperature operation.

4.6.15.1 Low temperature operation (see 3.6.1).

- a. The test apparatus tank shall be filled to a level at least 2 inches (51 mm) above the pump.
- b. The test fuel shall conform to grade 2-D of A-A-52557, except that the cloud point shall be -65°F (-54°C) or lower.
- c. The temperature of the tank and its contents shall be lowered to -65 ±5°F (-54°C ±2.8°C) and maintained at that temperature for at least 16 hours.
- d. The pump shall then be operated at 18 ±0.1 V dc and 27.5 ±0.1 V dc and the pressure and flow rate measured.

4.6.15.2 High temperature operation (see 3.6.1). A test tank shall be filled to a level at least 2 inches (51mm) above the pump. The tank and its contents shall be heated to a temperature of 125°F ±5°F (52°C ±2.8°C) and maintained at that temperature for at least 4 hours. The pump shall then be operated at 18 V dc and 27.5 V dc ±0.1 V dc and the pressure and flow rate measured.

4.6.16 Explosion-proofness (see 3.6.2).

- a. An unused dry pump shall be installed in the test chamber of 4.6.16.1 and an all purpose gasoline shall be vaporized and drawn into the chamber.
- b. The quantity of gasoline used shall be calculated to result in an air fuel ratio within limits of 13:1 to 15:1 (by weight).
- c. The pump shall then be operated for a period of 15 minutes.
- d. Immediately after the 15 minute pump operation, the mixture in the chamber shall be ignited to verify that an explosive mixture existed during the test period.
- e. Withdrawal of the mixture sample for explosive mixture testing in a separate vessel is an allowable alternate procedure.

4.6.16.1 Explosion test chamber. The test shall be conducted in a test chamber having the following features:

- a. A pressure release system that operates when an explosion occurs within the chamber.
- b. A hinged or removable pressure-sealed door large enough to permit installation of the pump.
- c. A means of circulating vapors within the chamber.
- d. An observation window.
- e. Cable ports with pressure-tight seals.

4.6.17 Shock resistance (see 3.6.3). The pump shall be subjected to shock testing in accordance with method 516, procedure I of MIL-STD-810 and shall meet the requirements of 3.6.3. The following shall apply:

- a. A half-sine shock pulse of 25g shall be applied, for 18 milliseconds nominal duration, once in the direction of each of the three major axes.
- b. The pump shall then be pressure and flow tested (see 4.6.3).

4.6.18 Vibration resistance (see 3.6.4).

- a. The pump shall be installed in the test apparatus and the entire system subjected to the vibration test in accordance with method 201 of MIL-STD-202.
- b. If resonance is encountered during this test, the pump shall be vibrated at the resonant frequency for a period of 6 hours along each of the three major axes, and the pump pressure and flow rate measured.

4.6.19 Fungus resistance (see 3.6.5).

- a. The pump shall be tested in accordance with class 1, method B of ASTM G21, except that incubation shall be for a single period of 90 days.
- b. The pump shall be pressure and flow tested (see 4.6.3).

4.6.20 Fuel resistance (see 3.6.6).

- a. Any pump using elastomeric parts that come in contact with fuel shall be subjected to fuel resistance testing.
- b. The test shall be as specified in table V.
- c. The pump shall be mounted in the test apparatus and operated for 2 hours per day, except for the first 48 hours of phase I and phase III.
- d. The pump shall be pressure and flow tested (see 4.6.3).

TABLE V. Fuel resistance test schedule. 1/

Phase		Hours	Medium 2/	Temperature
I	Soak	168	ASTM Reference Fuel B	75°F ±5°F (24 ±3°C)
II	Dry	4	Air	155°F ±5°F (68 ±3°C)
III	Soak	168	ASTM Reference Fuel B	75°F ±5°F (24 ±3°C)
IV	Dry	4	Air	155 ±5°F (68°C ±3°C)

1/ Metric equivalents are given for information only.

2/ ASTM Reference Fuel B as specified in ASTM D471.

4.6.21 Contaminated fuel (see 3.6.7).

- a. The pump shall be mounted in the test apparatus and the tank filled with contaminated test fluid composed of ASTM Reference Fuel B and the contaminants specified in table VI.
- b. The tank shall be filled to a level at least 2 inches (51 mm) above the pump.
- c. The pump shall be operated to deliver a minimum of 220 gph (833 lph) for a period of 3 hours and subsequently 25 gph (95 lph) for another period of 3 hours.
- d. The pump shall then be flushed out with clear test fluid and pressure and flow tested (see 4.6.3).

4.6.22 Corrosion resistance (see 3.6.8).

- a. The pump shall be tested in accordance with method 101 of MIL-STD-202, test condition A (96 hours), except that a 20 percent salt solution shall be used.
- b. Following completion of the corrosion resistance test, the pump shall be pressure and flow tested (see 4.6.3).

TABLE VI. Contaminated test fluid.

Contaminant	Particle size	Quantity
Iron oxide	0-5 microns	28.5 gm/400 gal
Iron oxide	5-10 microns	1.5 gm/400 gal
Sharp silica sand	150-300 microns	1.0 gm/400 gal
Sharp silica sand	300-400 microns	1.0 gm/400 gal
Prepared dirt conforming to coarse Arizona test dust (see 6.4)	Mixture as follows: 0-5 microns (12%) 5-10 microns (12%) 10-12 microns (14%) 20-40 microns (23%) 40-80 microns (30%) 80-200 microns (9%)	8.0 gm/400 gal
Lint ^{1/}	As collected	0.1 gm/400 gal
Crude naphthenic acid	As collected	0.03% by volume
Salt water (solution shall contain 4 parts NaCl to 96 parts H ₂ O by weight)	As collected	0.01% entrained

^{1/} Obtained by tumbling laundered cotton denim cloth in a tumbling machine (clothes drier).

4.6.23 Temperature shock (see [3.6.9](#)). The pump shall be tested in accordance with method 503 of MIL-STD-810 and meet the requirements of [3.6.9](#). Following completion of the temperature shock test, the pump shall be tested as specified in [4.6.3](#).

4.6.24 Humidity (see [3.6.10](#)). The pump shall be tested in accordance with method 507 of MIL-STD-810 and meet the requirements of [3.6.10](#). Following completion of the humidity test, the pump shall be pressure and flow tested (see [4.6.3](#)).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see [6.2](#)). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. 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. Fuel pumps described in this specification are intended for use in military vehicles. This fuel pump is military unique because it must be able to operate in an environment from -65°F to 130°F (-54°C to 54°C), with 25g of shock.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet and the complete PIN.
- c. When first article is required for inspection and approval (see 3.1, 4.3, and 6.).
- d. Disposition of samples (see 4.4.3 and 4.4.4).
- e. If flexible shielded cable is required and its length (see applicable specification sheet)
- f. Packaging (see 5.1).

6.3 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first article samples. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.3.1 Defense Logistics Agency (DLA) waiver of first article test. A waiver of a first article testing will only be considered by DLA when the contractor has delivered the same item within the last 3 years, has no unfavorable quality history, has not changed processes, or changed any subcontractors. DLA will not accept first article testing results outside the stated requirements.

6.4 Contaminated solid. The test dust described in ISO 12103-1, *Road vehicles -- Test dust for filter evaluation - Part 1; Arizona test dust*, may be used for fuel pump testing (see table VI).

6.5 Subject term (key word) listing.

Cadmium
Diesel
Flow
Gallons per hour
Gasoline
Motor
Naphthenic acid
Nickel
Pressure

6.6 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:

Army - AT
Navy - MC
DLA - CC

Preparing activity:

DLA - CC

(Project 2910-2023-002)

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>.