

Specification 5100-273e
March 2006
Superseding
Specification 5100-273d
September 1997

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SPECIFICATION FOR
PUMP, ENGINE-DRIVEN

1. SCOPE.

1.1. Scope. The engine-driven pumps described in this specification are designed for use in wildland firefighting operations. The pumps consist of a gasoline-driven engine, a centrifugal or positive displacement type pump, mounting frame, engine controls, spark arrester, priming system, and other components. The thread series designations for the inlet and outlet connections are 1-1/2 inch 9 NH or 2-1/2 inch 7-1/2 NH.

2. APPLICABLE DOCUMENTS.

2.1. Government Documents. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issue of these documents are those in effect on the date of the invitation for bids or request for proposals (See 6.2).

USDA Forest Service Standard

5100-01 - Spark Arresters for Internal Combustion Engines

5100-190 - Threads, Gaskets, Rocker Lugs, Connections, and Fittings, Fire Hose

USDA Forest Service Specification

5100-105 – Suction Hose Strainer

5100-107 - Fire Hose Connections and Fittings

Beneficial comments, recommendations, additions, deletions, and any pertinent data that may be used in improving this document should be addressed to: USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198 by using the Specification Comment Sheet at the end of this document or by letter.

Federal Standard

FED-STD-595 –Colors

Federal Acquisition Regulation (FAR) Paragraph 23.403, Recoverable Materials

Copies of Federal standards and test methods are available from General Services Administration, Federal Supply Service Bureau, Specification Section, Suite 8100, 470 East L'Enfant Plaza SW, Washington, DC 20407.

Copies of USDA Forest Service Specifications and Standards are available from USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

2.2. Nongovernment 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 in effect on the date of the invitation for bids or request for proposals.

Society of Automotive Engineers (SAE)

J 512 -Automotive Tube Fittings

J 1349 - Engine Power Test Code, Spark Ignition and Compression Ignition - Net Power Rating

Address requests for copies to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

American National Standards Institute

ANSI S1.4 – Specification for Sound Level Meters

Address requests for copies to the American National Standards Institute, 25 West 43rd Street, New York, NY 10036

American Society for Quality (ASQ)

ANSI/ASQ Z1.4 -Sampling Procedures and Tables for Inspection by Attributes

Address requests for copies to the American Society for Quality, P.O. Box 3005, Milwaukee, WI 53201-3005.

ASME International

ASME B40.100 Pressure Gauges and Gauge Attachments

Address requests for copies to ASME International, Three Park Avenue, New York, NY 10016

2.3. Order of Precedence. In the event of 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. Qualified Products List Number. The bidder shall possess a currently valid notice of qualification with associated Qualified Products List (QPL) number obtained in accordance with 4.1. The date of issue on the QPL number shall precede the date on the invitation for bids.

3.2. Construction. The term pump or pump unit, when used hereafter, shall refer to a pump and engine combination.

3.2.1. Engine. The engine shall be gasoline-powered, with a magneto-type or electronic ignition system. Spark plugs shall be provided with protective caps. The engine shall be capable of using any commercially available gasoline and operating with standard lubricating oils as recommended by the engine manufacturer.

3.2.1.1. Engine Controls. Suitable controls for engine throttle, choke, ignition, and starting shall be provided. The engine shall be fitted with a positive speed control governor such that if the load on the engine should decrease suddenly, the engine shall be prevented from overspeeding.

3.2.1.2. Spark Arrester Exhaust System. A spark arrester exhaust system shall be furnished. The spark arrester shall be qualified in accordance with USDA Forest Service Standard 5100-01.

3.2.1.3. Fuel System. A fuel system with a fuel tank shall be included with the engine. The fuel tank shall be integrally mounted with a gravity feed fuel system. The fuel tank shall be provided with fuel lines, fittings, and a fuel filter. A three-way cock shall be provided for connection to an auxiliary fuel tank. Pumps weighing more than 200 pounds shall be furnished with a fuel pump. Connections and fittings for the auxiliary fuel system shall be 1/4 inch inside diameter conforming to SAE J 512 automotive flare type. The fuel cap shall be located in an easily accessible area with the filler neck positioned away from the exhaust system.

3.2.1.4. Ember Separator. The inlet to the air filter shall be equipped with a means of separating water and burning embers from the air intake system such that burning particulate matter larger than 0.039 inches in diameter cannot reach the air filter element.

3.2.1.5. Starter System. A manual rope starter shall be furnished. A 12 volt DC electric starter system may be furnished in addition to the manual rope starter. A suitable guard shall be provided around any exposed drive belts or chains. The electrical system shall be moisture and weather proofed.

3.2.1.6. Engine Lubrication. The lubrication system shall be adequate to lubricate the engine for a minimum of 12 hours of continuous operation without servicing. The engine oil fill pipe shall be readily accessible and easily serviceable.

3.2.2. Pump. The pump shall be centrifugal or positive displacement type with components as indicated below.

3.2.2.1. Pump Connections and Fittings. The pump inlet and outlet shall be externally threaded with a 1-1/2 inch 9 NH or 2-1/2 inch 7-1/2 NH thread series designation. Hose caps with rocker lugs, described in Forest Service Specification 5100-107, shall be furnished and installed on the pump inlet and outlet connections. They shall be adequately secured to the pump with minimum No. 12 single jacket brass chains or other type of equal strength and flexibility to prevent loss of the caps. Threads and rocker lugs shall be in accordance with USDA Forest Service Standard 5100-190. Drain plugs shall be provided on centrifugal pumps that have an inlet and outlet above the centerline of the pump.

3.2.2.2. Seal or Packing Gland. A mechanical shaft seal or pump packing gland and packing shall be provided in order to prevent leakage. It shall be able to endure a minimum 100 hours of operation with no leakage.

3.2.2.3. Pump Lubrication. A system of lubrication shall be provided and be sufficient to properly lubricate the pump for a minimum 12 hours of continuous operation.

3.2.2.4. Pressure Gauge. The pump shall be equipped with a pressure gauge with a range of 0 to at least 100 psi higher than the pump shutoff pressure. Gauge graduation shall be in divisions of not more than 25 pounds per square inch gauge (psig). The accuracy of the gauge shall be a minimum of Grade B in accordance with ASME B40.100.

3.2.2.5. Pressure Relief For Positive Displacement Pumps. If the pump is a positive displacement pump, a method shall be provided for controlling pressure through an automatic relief valve. The device shall be capable of operating over a range of 90 to 300 psig discharge pressure. See 3.10.3.1.

3.2.2.6 Priming Device. An automatic method shall be provided to prevent the loss of vacuum through the priming device when the primer is not being operated.

3.2.2.6.1 The priming device shall have a manual method to shut the priming device off preventing the loss of vacuum (preventing backflow) and preventing outflow when the priming device is not in use.

3.2.2.6.2 If the automatic method prevents flow in both directions, a separate manual method shall not be required.

3.2.3. Frame and Carrying Handles. The pump unit framework shall include carrying handles. Carrying provisions for one person shall be included for pump weight classes up to 80 pounds; two persons in single file for pump weight classes up to 130 pounds; and four persons double file for pump weight classes above 130 pounds. Removable or collapsible handles, when used, shall be provided with position locking mechanisms.

3.2.4. Accessories. If special tools such as a packing gland wrench and grease gun are required, they shall be supplied with the pump unit. A metric tool kit shall be supplied by the manufacturer if metric fasteners are used.

3.3. Material. Where more than one type of material is used in various components, there shall be no incompatibility between materials which may cause corrosion. All pump materials including fittings and adapters shall be of a material appropriate for an air-water atmosphere.

3.3.1. Paint. Exposed surfaces of the pump unit to be painted shall be cleaned thoroughly of grease and other foreign material with a high quality surface preparation reducer. Pump exposed surfaces not to be painted are plastic, glass, rubber, chrome, and brass surfaces. Heated exhaust parts may be painted. Bare metal parts shall be coated with at least two coats of a high quality primer. Exposed galvanized surfaces shall be thoroughly washed with a surface etching solution then primed with a suitable galvanizing primer. Finish coating shall consist of two coats of top quality commercial gloss enamel red (color 11105) or green (color 14260) in accordance with Federal Standard 595, or as specified on the contract or purchase order. Painting shall be accomplished by spraying or powder coating wherever practical. There shall be no runs, inadequate coverage, peeling, flaking, bubbling, or other defects causing inferior coatings.

3.3.2. Recoverable Materials. The contractor is encouraged to use recovered materials to the maximum extent practicable, in accordance with paragraph 23.403 of the Federal Acquisition Regulation (FAR), provided all performance requirements of this specification are met.

3.4. Pump Unit Weight. Prior to performance testing, the weight shall be measured and the weight class number shall be determined. See 3.10.3.9. The pump unit shall be weighed as assembled with all component parts, including lubricating oil, except fuel and water. Pump units may not exceed 400 pounds.

3.5. Workmanship. Pump units shall conform to the quality of product established by this document. The occurrence of nonconformities shall not exceed the applicable acceptable quality levels. There shall be no nonconformities that affect use, appearance, or serviceability.

3.5.1. Extruded Components. Extruded sections shall be free from laps, sharp die marks, cracks, and other defects.

3.5.2. Cast Components. Cast parts shall be fine-grained, free from blowholes, pinholes, pits, porosity, hard spots, shrinkage, cracks, or other defects.

3.5.3. Welding. All welds to include welds on the pump frame shall be thoroughly fused together with strength equal to or stronger than the adjacent material. All excess welds and splatters shall be cleaned.

3.5.4. Holes. Punched holes shall be used in lieu of drilled holes only when the punched holes are dimensionally equivalent to drilled holes. In addition, the material shall not become distorted from the punching process.

3.6. Threads, Waterways, Gaskets, Gasket Recesses and Rocker Lugs. Threads, waterways, gaskets, gasket recesses, and rocker lugs shall be in accordance with USDA Forest Service Standard 5100-190.

3.7. Surface Treatment. Aluminum alloy threaded surfaces shall be hard-coated in accordance with USDA Forest Service Standard 5100-190.

3.8. Marking. Markings shall be in accordance with USDA Forest Service Standard 5100-190. In addition, a durable decal or corrosion resistant metal nameplate shall be permanently attached to the pump. The decal or nameplate markings shall include the model and name of the manufacturer, the month and year of manufacture in numeric form (example, 10/05 for October 2005), the minimum number of personnel required to safely transport the pump unit in accordance with 3.2.3, and the pump performance in gallons per minute (gpm) at 150 psig.

3.9. Surface Finish. The finish for all coupling surfaces, to include threaded surfaces, shall be in accordance with USDA Forest Service Standard 5100-190.

3.10. Performance.

3.10.1. Calibration of Equipment. In accordance with 4.7.2.1, before performance testing begins, the pump pressure gauge and all test equipment shall be calibrated.

3.10.2. Engine.

3.10.2.1. Over-speed Control. When tested in accordance with 4.7.3.1, the engine shall not over-speed.

3.10.2.2. Governor Speed Range. When tested in accordance with 4.7.3.2, the governor speed range shall be the difference between full and minimum throttle and shall be at least 2/3 of the maximum revolutions per minute (rpm).

3.10.3. Pump Tests.

3.10.3.1. Pressure Relief. When tested in accordance with 4.7.4.2, the discharge pressure shall not increase more than 30 psig from its pressure relief setting.

3.10.3.2. Priming. When tested in accordance with 4.7.2.2, the pump shall be capable of the following:

3.10.3.2.1. The pump priming system shall develop a minimum vacuum of 17 inches Hg when tested in accordance with 4.7.2.2.1.

3.10.3.2.2. The pump priming system shall have a maximum loss of 10 inches Hg in 5 minutes when tested in accordance with 4.7.2.2.2.

3.10.3.2.3. The pump unit shall be capable of establishing prime and pumping water within 30 seconds at a 10-foot lift when tested in accordance with 4.7.2.2.3.

3.10.3.3. Drafting. When tested in accordance with 4.7.2.3, the pump unit shall be able to draft at a 17-foot lift at a 2,000-foot density altitude.

3.10.3.4. Preendurance Maximum Performance. When tested in accordance with 4.7.4.3, the preendurance maximum performance curve shall be plotted. Each of the points on this curve shall be corrected to standard sea level. Using these corrected points, a second curve shall be plotted. From this corrected curve, the maximum pump power, p_1f_1 , shall be established.

3.10.3.5. 100-Hour Endurance Performance. When tested in accordance with 4.7.4.4, the pump performance rating, p_2f_2 , shall be determined by establishing a curve at 85 percent of the corrected curve. The pump performance rating, p_2f_2 , shall be the pressure and flow rate at which the 100-hour endurance test is run.

3.10.3.6. Pressure Gauge Calibration Check at 25, 50, 75 and 100 Hours. When tested in accordance with 4.7.4.5, calibration of the pump pressure gauge shall be checked at 25, 50, 75, and 100 hours during the 100-hour endurance performance test. Calibration shall not be off by 10

percent or more of the indicated pressure. If calibration is off by 10 percent or more, the pressure gauge shall be replaced and the previous 25 hours repeated. See 4.1.2.1.

3.10.3.7. Postendurance Performance. When tested in accordance with 4.7.4.6, the postendurance maximum performance curve obtained after subjecting the pump to the 100-hour endurance test shall not be below the pre-endurance maximum performance curve.

3.10.3.8. Pump Performance Rating. The pump performance rating shall be established as that condition at which the 100-hour endurance test is run (p_2f_2).

3.10.3.9. Pump Designation Code. After weighing the pump according to 3.4, completing inspection according to 4.5, and establishing pump performance rating according to 4.7, the pump unit shall be assigned a designation code indicating pump type, weight class, and performance rating.

- a. Design Type. Assign a letter "C" or "P" to indicate the design or type of pump: C for a centrifugal pump or P for a positive displacement pump.
- b. Weight Class Number. From the weight determined from 3.4, a weight class number shall be assigned using table 1 below.

Table 1—Weight to weight class conversion

Dry Weight	Weight Class Number
61 to 80	080
81 to 130	130
131 to 175	175
176 to 200	200
201 to 300	300
301 to 400	400

- c. Performance Rating Code Number. From the performance rating determined from 4.7 (p_2f_2), a pressure group number shall be assigned using table 2 below (pressure, p_2); and a capacity group number shall be assigned using table 3 below (flow, f_2)

Table 2—Pressure performance rating code number

Pressure Range psig	Pressure Group Number
150 to 199	15
200 to 249	20
250 or more	25

Table 3—Pumping capacity performance rating code number

Pumping Capacity gpm	Capacity Group Number
8.0 to 10.9	08
11.0 to 14.9	11
15.0 to 19.9	15
20.0 to 24.9	20
25.0 to 29.9	25
30.0 to 34.9	30
35.0 to 39.9	35
40.0 to 49.9	40
50.0 to 59.9	50
60.0 to 69.9	60
70.0 to 79.9	70
80.0 to 89.9	80
90.0 to 99.9	90

d. Example. A centrifugal type pump weighing between 131 and 175 pounds and capable of operating continuously with a flow of 17 gpm at 200 psig discharge pressure, shall be designated as “C-175-20/15.”

3.10.4. Sound Level.

3.10.4.1. Hearing Safety Label. A warning label shall be permanently attached to the equipment and clearly visible to the operator. The label shall indicate that hearing protection is required within 13 feet of the equipment.

3.10.4.2. Maximum Sound Level. When tested in accordance with 4.7.5, the average of the four sound level measurements shall not exceed 90 dBA at 13 feet.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES.

4.1. Qualification Testing.

4.1.1. Manufacturer Submission for Qualification Tests. The prospective contractor shall provide, without cost to the Government:

- a. Two complete sets of assembly drawings and specifications.
- b. One sample pump unit with performance data and operating and maintenance instructions.
- c. Certificates of conformance. (See 4.6).

- d. The estimated test fee.
- e. A signed collection agreement.
- f. All of the above items shall be delivered to the attention of the Specifications and Standards Project Leader at the USDA Forest Service, San Dimas Technology and Development Center (SDTDC), 444 East Bonita Avenue, San Dimas, CA 91773.

The Government shall not be responsible for the submitted test samples.

4.1.2. Qualification Test. Qualification inspection and tests shall be conducted by the Government and at the expense of the contractor at a fee to be determined by the Government. If requested by the contractor, the Government will inform the contractor of date and place of inspection and tests. The contractor may send a representative (who has been designated in writing) to be present and observe the inspection and tests, but the representative will not be permitted to be a participant. Upon completion of tests, the test sample may be retained by the Government. The Government shall not be obligated to continue testing a nonconforming item once it is known to be nonconforming or when it is considered to be in the best interest of the Government. The contractor will be informed of the nature of the failure.

4.1.2.1. Component Part Failure. If a component part fails during the test, it may be replaced by the manufacturer, but the sample must be run until the replacement part has completed 100 hours of operation. Any component failing twice will constitute disqualification of the pump.

4.1.3. Notice of Qualification. Notice of Qualification shall be issued to the contractor upon the successful completion of qualification tests. Copies of qualification notices shall be provided to the General Services Administration. A copy shall be retained in the SDTDC file.

4.1.4. Notice of Failure to Qualify. The contractor shall be notified by letter of a failure to qualify, if the submitted pump unit does not meet the requirements of this specification.

4.1.5. Requalification. After qualification, the contractor shall notify SDTDC immediately in writing when a component or the component supplier changes in any way, when a major manufacturing process changes in any way, or when a manufacturing location changes. The need for requalification shall be determined by the Government when there are changes to the product or this specification.

4.2. General Inspection and Tests. Unless otherwise specified in the contract or purchase order, the contractor is responsible for performance of all inspection requirements prior to submission for Government acceptance inspection and tests. The contractor may utilize their own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government.

4.2.1. Inspection and Test Sites. The Government shall conduct lot acceptance inspection and tests to determine compliance with the specification. If lot acceptance and tests are conducted at locations other than the manufacturing facilities, the contracting officer will specify location and arrangements. In the case of onsite inspections at the contractor's facility, the contractor shall furnish the inspector all reasonable facilities for their work. During any inspection, the inspector may take from the lot one or more samples and submit them to an independent test laboratory approved by the Government or to a Government test facility for inspection and tests.

4.2.2. Testing With Referenced Documents. The contractor is responsible for ensuring that components and materials used were manufactured, examined, and tested in accordance with referenced specifications and standards. The Government reserves the right to perform any of the inspections or tests set forth in this section where such action is deemed necessary to assure supplies and services conform to prescribed requirements. The contractor will be informed as to the nature of the failure. The Government shall not be obligated to continue testing a defective item once it is known to be defective or when it is considered to be in the best interest of the Government.

4.3. Responsibility for Compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in this 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.

4.4. Sampling for Inspection. When inspection is performed, sampling shall be in accordance with ANSI/ASQ Z 1.4.

4.4.1. Lot. All pump units of the same type, presented together in one delivery shall be considered a lot for the purpose of inspection. A sample unit shall be one pump unit.

4.4.2. Sampling for Visual and Dimensional Examination. Sampling for visual and dimensional examination shall be S-2, with an Acceptable Quality Level (AQL) of 1.0 percent nonconforming in accordance with ANSI/ASQ Z-1.4.

4.4.3. Sampling for Lot Acceptance Tests. Sampling for lot acceptance testing shall be S-2 with an AQL of 1.0 percent nonconforming in accordance with ANSI/ASQ Z-1.4.

4.5. Inspection and Tests.

4.5.1. Visual and Dimensional Examination. When selected in accordance with 4.4.2, each sample pump unit shall be visually and dimensionally examined to determine conformance with this specification. Visual or dimensional nonconformities shall be classified as major or minor. A nonconformity not listed in table 4 shall be classified as a minor nonconformity. If the number of nonconformities in any sample exceeds the indicated AQL, the lot shall be rejected.

Table 4—Major and minor nonconformities

Nonconformity	Classification	
	Major	Minor
1. Engine and components not as required.	X	
2. Pump and components not as required.	X	
3. Frame and carrying handle not as required.	X	
4. Accessories not as required.	X	
5. Welding not as required.	X	
6. Threads, waterways, gaskets, and markings not as required.	X	
7. Materials not as required.	X	
8. Workmanship not as required.	X	
9. Painting and color not as required.		X

4.5.2. Lot Acceptance Tests. Each of the samples selected in accordance with 4.4.3, shall be tested in accordance with 4.7, to determine conformance with requirements of this specification.

4.5.3. Quality Conformance Inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with ANSI/ASQ Z 1.4. The inspection level and AQL shall be as specified in 4.4.3.

4.6. Certificate of Conformance. A Certificate of Conformance shall meet the requirements of USDA Forest Service Standard 5100-190. Where certificates of conformance are required, the Government reserves the right to determine the validity of certification. These certificates shall be based on the testing of component materials and may be performed by the component material supplier. The contractor shall provide certificates of conformance for 3.3, 3.7 and 3.10.4.

4.6.1. Certificates of Conformance in Lieu of Testing. Unless otherwise specified, certificates of conformance may be acceptable in lieu of testing end items.

4.7. Performance Testing. Samples shall be subjected to the following tests to determine if the samples meet the requirements of the specification.

4.7.1. Fluid Medium. All testing requiring the use of a fluid medium shall be performed using municipally supplied potable water; this shall include, but is not limited to, pump performance testing. If the contractor does not have access to a municipal water supply, the testing shall be performed using any clear fresh water normally available for firefighting. Testing performed by the Government will be conducted using municipally supplied potable water.

4.7.2. Pump Setup. The pump unit shall be installed on a pump test stand with necessary controls to conduct pump performance tests below. If the pump unit has not been previously broken-in by the contractor, it shall be subjected to a break-in period of at least 4 hours of varying speeds and loads.

4.7.2.1. Pressure Gauge Calibration at 0 Hours. As required by 3.10.1, the pressure gauge shall be calibrated.

4.7.2.2. Priming Test. As required by 3.10.3.2, the priming capabilities of the pump shall be determined.

4.7.2.2.1. The pump inlet and outlet shall be capped. As required by 3.10.3.2.1, the pump priming system shall develop a minimum vacuum of 17 inches Hg.

4.7.2.2.2. With the pump inlet and outlet capped, a minimum vacuum of 17 inches Hg shall be established. As required by 3.10.3.2.2, the pump priming system shall have a maximum vacuum loss of 10 inches Hg in 5 minutes.

4.7.2.2.3. The pump inlet shall be connected to a 24-foot length of suction hose. The suction hose diameter shall correspond to the nominal diameter of the pump inlet coupling. The centerline of the pump inlet shall be 10 feet above the water level. As required by 3.10.3.2.3 with the pump unit unprimed and running, the pump unit shall establish prime and pump water within 30 seconds.

4.7.2.3. Drafting Test. The pump inlet shall be connected to a minimum 24-foot length of suction hose. The suction hose diameter shall correspond to the nominal diameter of the pump inlet coupling. The centerline of the pump shall be 17 feet above the water level. As required by 3.10.3.3, with the pump unit unprimed and running, the pump shall be primed and shall pump water.

4.7.3. Engine Testing.

4.7.3.1. Over-speed Control Test. As required by 3.10.2.1, the pump's over-speed control capability shall be tested. With the pump unit running at the manufacturer's recommended speed, priming shall be interrupted by breaking the pump inlet vacuum, thereby inducing engine speed increase. The engine speed shall be observed for over-speed and shut off.

4.7.3.2. Governor Test. As required by 3.10.2.2, the governor speed range shall be determined as follows.

4.7.3.2.1. Centrifugal Type Pump. The pump shall be run at full throttle at the manufacturer's recommended maximum engine speed producing the pump unit's maximum rated pressure. A small flow shall be established and maintained during the test. The throttle shall be reduced while maintaining the established flow until the pump engine speed is reduced to a minimum. The difference in engine speed between full and minimum throttle position shall be the governor speed range.

4.7.3.2.2. Positive Displacement Type Pump. The pump shall be run at full throttle at the manufacturer's recommended maximum engine speed flowing water with the discharge fully open. The throttle shall be reduced while maintaining the water flow until the pump engine speed is reduced to a minimum. The difference in engine speed between full and minimum throttle position shall be the governor speed range.

4.7.4. Pump Testing.

4.7.4.1. Suction Lift Test Condition. All pump testing shall be conducted at a 5 foot \pm 3 inch suction lift. The pump inlet shall be connected to a 24-foot length of suction hose. The suction hose diameter shall correspond to the nominal diameter of the pump inlet coupling. A suction hose strainer meeting the requirements of Forest Service Specification 5100-105 shall be used.

4.7.4.2. Pressure Relief Test. As required by 3.10.3.1, the pressure relief valve on positive displacement pump units shall be tested. With the pressure relief control set in accordance with the manufacturer's recommendations, and the pump unit running at rated performance, the pump

discharge shall be closed gradually until the bypass through the relief valve reaches full flow. The pump discharge pressure shall be observed.

4.7.4.3. Preendurance Maximum Performance Test. As required by 3.10.3.4, the pump unit shall be tested for preendurance maximum performance. The pump shall be run at the maximum speed recommended by the manufacturer. The pump discharge flow shall be reduced by increasing pressure in 25 psig increments until complete shutoff. Pressure, flow, and speed shall be recorded at each 25 psig increment. From this information, the maximum performance curve shall be plotted on a graph. The maximum performance curve shall be corrected to standard sea level conditions at 29.92 inches Hg and 60 °F in accordance with SAE J 1349. See figure 1. The maximum pump power shall be the highest value obtainable by multiplying pressure (p_1) and flow rate (f_1) on the corrected curve.

4.7.4.4. 100-Hour Endurance Performance Test. As required by 3.10.3.5, the pump shall be tested for 100 hours endurance performance. The endurance testing does not need to be continuous, but each segment of the total 100 hours shall be a minimum of 7 hours of continuous operation. After plotting the corrected curve and determining the maximum pump power, $p_1 f_1$, the endurance performance curve shall be plotted by using 85 percent of the corrected curve. For example, multiply $\sqrt{0.85}$ with each value of the corrected curve ($p_2 = p_1 \times \sqrt{0.85}$, $f_2 = f_1 \times \sqrt{0.85}$). After plotting the endurance performance curve, draw a straight line between $p_1 f_1$ and the zero point on the graph. See figure 1. The intersection of the straight line with the endurance performance curve shall be indicated as the pump performance rating, $p_2 f_2$, on the graph which shall be the pressure and flow rate values used in conducting the 100-hour endurance test.

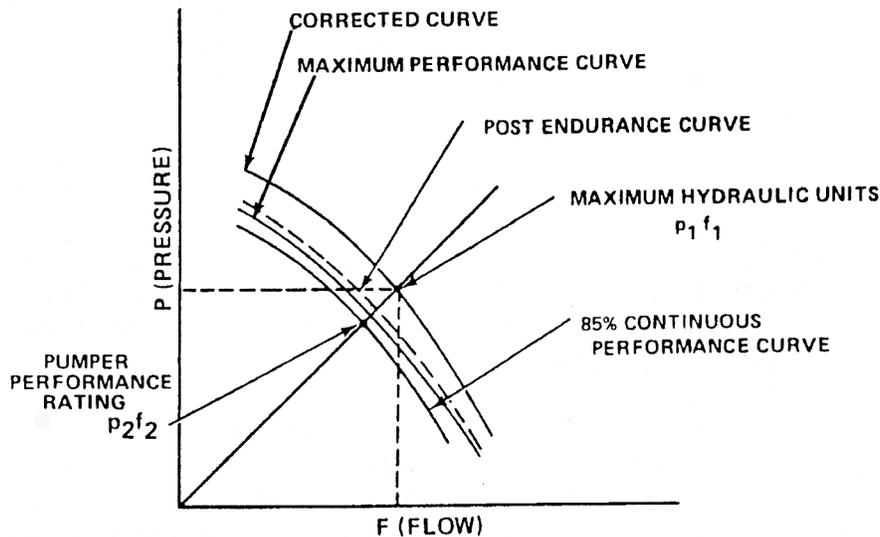


Figure 1—Pump performance curve.

4.7.4.5. Pressure Gauge Calibration at 25, 50, 75, and 100 Hours. As required by 3.10.3.6, the pump pressure gauge shall be calibrated at 25, 50, 75, and 100 hours during the 100-Hour Endurance Performance Test. If calibration is off by 10 percent or more of the indicated pressure, the pressure gauge shall be replaced and the previous 25 hours repeated. If component failure occurs and a component or components are replaced, the pressure gauge shall be recalibrated. See 4.1.2.1.

4.7.4.6. Postendurance Performance Test. As required by 3.10.3.7, the pump unit shall be tested for postendurance maximum performance. The pump unit shall be run at maximum speed and the pump discharge flow reduced by increasing pressure in 25 psig increments until complete shutoff. The pressure and flow values shall be corrected to standard sea level conditions and plotted on the graph then compared with the preendurance curve.

4.7.4.7. Tolerances. Unless otherwise specified, the following tolerances apply: vacuum in inches Hg = +/- .10 inch Hg, dimensions in feet = +/- 0.25 feet, density altitude elevation in feet = +/- 1,000 feet.

4.7.5. Sound Level Test. As required by 3.10.4, the pump unit shall be tested for sound level.

4.7.5.1. Test Site. The test site shall consist of a flat, smooth, outdoor area. The surface shall be covered with grass or turf not higher than 3.0 inches, pavement, bare earth, gravel, or a similar substance. In addition, the surface shall be free of snow, loose dry grass or weeds, ashes, or other substances which might interfere with the accuracy of the test. There shall be no obstructions larger than the size of a person within 50.0 feet and no obstructions at all within 13.0 feet of the pump unit under test.

4.7.5.2. Test Instruments. A sound level meter meeting the requirements of ANSI Standard S1.4, Type 1 or 2 shall be used. The A-weighted scale shall be used during the measurements with the sound level meter set to slow response.

4.7.5.3. Test Method. The pump unit shall be operated at $p_2 f_2$. Measurements shall be taken at four equally dispersed points around the pump unit with the sound level meter microphone located at a horizontal distance of 13.0 feet from the pump unit and 5 feet above the ground. The sound level meter manufacturer's instructions shall be followed for proper orientation of the microphone. Note: A free field response microphone is generally pointed towards the sound source, and a pressure response microphone is generally oriented perpendicular to a line between the sound source and the microphone.

4.7.5.4. Limit and Report. The average of the four sound level measurements shall be reported to the nearest whole decibel.

5. PACKAGING, PACKING, AND MARKING.

5.1. Packaging, Packing, and Marking. The packaging, packing, and marking shall be as specified in the contract or order.

6. NOTES.

6.1. Intended Use. The engine-driven pumps described in this specification are designed for use in wildland firefighting operations. The pumps consist of a gasoline-driven engine, a positive displacement or centrifugal type pump, mounting frame, engine controls, spark arrester, priming system, and other components.

6.2. Acquisition Requirements. Acquisition documents, such as Invitation For Bids and Request For Proposals should specify the following:

- a. Title, number, and date of this specification.
- b. Designation code of pump required (See 3.10.3.9).
- c. Color of pump required, red or green. (See 3.3.1).
- d. If certificates of conformance are acceptable in lieu of lot by lot testing (See 4.6).
- e. Packaging, packing, and marking (See 5.1).
- f. Date of the invitation for bids or request for proposals (See 2.1).

6.3. Qualification. The contracting officer should verify that the bidder possesses a currently valid notice of qualification with associated Qualified Products List (QPL) number obtained in accordance with 4.1. This QPL shall have already been obtained with a date of issue prior to the date of invitation for bids.

6.4. Notice. When Government drawings, documents, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility or any obligation whatsoever.

6.5. Preparing Activity. USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

United States Department of Agriculture, Forest Service
 Standardization Document Improvement Proposal

Instructions: This form is provided to solicit beneficial comments that may improve this document and enhance its use. Contractors, government activities, manufacturers, vendors, or other prospective users of this document are invited to submit comments to the USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, California 91773-3103. Attach any pertinent data that may be of use in improving this document. If there is additional documentation, attach it to the form and place both in an envelope addressed to the preparing activity. A response will be provided when a name and address are included.

Note: This form shall not be used to submit request for waivers, deviation, or for clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

Standard Number and Title: **Specification 5100-273e, Pump, Engine Driven**

Name of Organization and Address:

Vendor User Manufacturer

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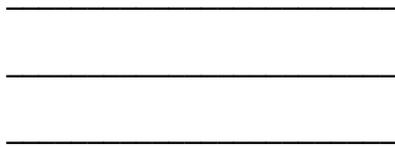
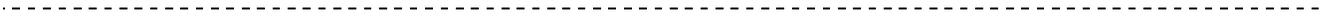
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