

US ARMY TACOM-ARDEC
BATTLEFIELD MAINTENANCE SYSTEM ENGINEERING TEAM
DESCRIPTION FOR PURCHASE

FUEL INJECTION PUMP TEST STAND SYSTEM

National Stock Number 4910-01-465-4537

1 SCOPE

1.1 This Description For Purchase describes the requirements for the Fuel Injection Pump Test Stand (FITS) system, which is used to test and calibrate diesel engine fuel pumps in accordance with the pump manufacturer's specifications. The FITS system shall meet all performance requirements of this document and the contract.

2 APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Other Government documents, drawings, and publications. The following other government documents, drawings, and publications form a part of this Description For Purchase to the extent specified herein.

US DEPARTMENT OF LABOR, OCCUPATION SAFETY & HEALTH
ADMINISTRATION (OSHA)

29 CFR Part 1910 - Occupational Safety and Health Standards

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-0001).

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document (s) form a part of this Description For Purchase to the extent specified herein. The issues of the document(s) which are indicated as DOD adopted shall be the issue listed in the current DODISS and the supplement thereto if applicable.

AMERICAN GEAR MANUFACTURER'S ASSOCIATION (AGMA)

- AGMA 390.03 - Gear Handbook Volume 1 Gear Classification, Materials and Measuring Methods for Unassembled Gears
- AGMA 20000-A88 - Gear Classification and Inspection Handbook – Tolerances and Measuring Methods for Unassembled Spur and Helical Gears (Including Metric Equivalents)

(Application for copies should be addressed to the American Gear Manufacturer's Association, 1500 King Street, Suite 201, Alexandria, VA 22314.)

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

- ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Forms)
- ASME B1.13M - Metric Screw Threads - M Profile
- ASME B1.21M - Metric Screw Threads - MJ Profile

(Application for copies should be addressed to The American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th Street, New York, NY 10017)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 112211 - Glossary of Gear Terms - Part I: Geometrical Definitions
- ISO 54 - Cylindrical Gears For General Engineering and For Heavy Engineering, Modules and Diametrical Pitches of.
- ISO 4008/1 - Road Vehicles - Fuel Injection Pump Testing - Part I: Dynamic Conditions
- ISO 4008/2 - Road Vehicles - Fuel Injection Pump Testing - Part 2: Static Conditions
- ISO 4010 - Calibrating Nozzle, Delay Pintle Type
- ISO 4113 - Road Vehicles - Calibration Fluid For Diesel Injection Equipment

(Application for copies of ISO documents should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- SAE J967 - Calibration Fluid For Diesel Injection Equipment

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- MG 1 - Motors and Generators

(Application for copies should be addressed to the National Electrical Manufacturers Association, 2101 L Street NW, Washington, DC 20037.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this Description For Purchase and the references cited herein, the text of this Description For Purchase shall take precedence.

3 REQUIREMENTS

3.1 Performance verification. When specified, the contractor shall furnish one or more Fuel Injection Pump Test Stand (FITS) systems for performance verification inspection. The systems submitted shall meet the requirements of this Description For Purchase (DFP). The performance verification sample may be either a preproduction model, or an initial production item, that meets the requirements of this DFP. In either case, the approved performance verification sample and the production items shall be in accordance with the terms of the contract. Approval of the performance verification shall not relieve the contractor of the responsibility to furnish equipment in accordance with the requirements of this DFP. All items supplied under this contract shall be identical to the performance verification sample.

3.2 Requirements. The FITS System shall include current state-of-the-art technologies in the drive motor system, the computer control, and the display systems. The software shall be current state-of-the-art, Windows or real time operating system that provides the necessary control, display requirements, self-diagnostic testing (see 3.4.11), operator controlled FITS systems troubleshooting, operator self-training, and a modem for interface with Personal Computer (PC) systems. The chiller shall have a non-ozone-depleting type refrigerant.

3.3 Design.

3.3.1 Fuel injection pump test stand (FITS). The FITS system shall test the following pumps, with the appropriate adapter kit, in accordance with the pump manufacturer's specifications, without damage to the pumps or the fuel injection pump test stand. In the case of Caterpillar pumps, the engine on which the pump is used is listed, in lieu of the pump.

<u>Caterpillar</u>	<u>AMBAC</u>	<u>Stanadyne</u>	<u>Robert Bosch</u>	<u>Lucas CAV</u>
D333C(1673)	APE6BB100	D	PES3A	DPA
D343TA(1693)	APE6BB90Q	DB and DB2	PES6A	3249F010
D342(1674)	PSB6A90EH	DC	PES6P	3248F391
3406B	PSB4A110EH	JDB	PES5MW	3241F940
3208	PSB12BT	DB2829YL4267	PES6MW100	
3306	PSU2/4A-80E-9328			
3406	1006A100A			
3408				
3306B				

Cummins
PT (all types)

3.3.2 FITS operational requirements. The test stand shall test fuel injection pumps that deliver up to 400 cubic millimeters/stroke/cylinder at full load, at 550 revolutions per minute, in accordance with the injection pressure criteria of ISO 4008/1. The contractor shall provide working interface kits. The test stand shall drive pumps either clockwise (CW) or counterclockwise (CCW). The FITS system shall be capable of testing the specified pumps. The FITS system shall operate, when equipped with all the required instrumentation, controls, and pump coupling device(s), utilizing the appropriate adapter kits. The test stand shall be floor mounted, of rigid metal frame construction, and designed IAW ISO 4008/1 and 4008/2 with the exception of the calibration fluid temperature control (see 3.4.2 and 3.4.6.9) and the calibration fluid measuring system (see 3.4.10). The mounting configuration of the test stand for each pump and its adapter kit shall meet, or exceed, the stability requirements of para 5.1.6 of ISO 4008/1. Adapter kits shall be complete with all hardware required to successfully operate the related pump in accordance with the pump manufacturer's instructions. Internal voltage reduction, to operate specific electrical circuits, shall be incorporated as applicable. Pressurized fluid systems shall be configured to withstand pressure to prevent component damage, degradation, rupture and failure. The FITS system shall be furnished with a container with an organizing method for storage of all of the master accessories that are provided with the stand. Each component shall be separately identified. The organizing method shall retain the components in position to provide for rapid inventory, to prevent contact between different components, to protect sensitive components and to maintain the position of the accessories under rough handling and shipping conditions. The material used for the organizing method shall be resistant to diesel fuel, calibration fluid, automotive oils, greases, lubricants, acids, bases, coolants and cleaning agents. The retention features shall securely hold the items in place so that if the container is dropped the accessories shall be retained in position and undamaged. Each contoured feature shall allow easy removal of the accessory and shall include as necessary, pick holes, cut outs, recessed areas, or protrusion of accessories above the organizing liner.

3.3.3 Safety and health requirements. The fuel injection pump test stand shall comply with the general safety and health requirements promulgated under 29 CFR Part 1910, OSHA Standards that are applicable to the stand itself. Safety devices shall be provided for all parts presenting safety hazards.

3.4 Components. At a minimum, the test stand shall consist of the following components:

- a. Main drive assembly (see 3.4.1).
- b. Calibration fluid supply system (see 3.4.2).
- c. Lubrication oil system (see 3.4.3).
- d. Pump coupling device (see 3.4.4).
- e. Instrumentation system (see 3.4.5).
- f. Control System (see 3.4.6).
- g. Interconnect system (fuel lines, lube oil lines and connections) (see 3.4.7).
- h. Injector mounting rack (see 3.4.8).
- i. DC voltage supply (see 3.4.9).
- j. Fluid measuring system (see 3.4.10).
- k. Self-diagnostic system (see 3.4.11).
- l. Hour meter (see 3.4.12).

- m. Bedplate (see 3.4.13).
- n. Regulated air supply (see 3.4.14).
- o. Software for self-training and fault diagnostics (see 3.4.15).

3.4.1 Main drive assembly. The main drive assembly shall be capable of driving all pumps listed in 3.3.1 in accordance with the pump manufacturer's test criteria. The main drive motor shall be a direct drive, single shaft, speed controlled, electronic-type motor. The main drive motor shall drive all pumps from 50 up to 5,000 rpm with an acceleration/deceleration rate of no less than 200 rpm/second (sec). The acceleration/deceleration rate shall be variable and adjustable by the operator. Speed droop shall not exceed 5 percent when the output load is increased from zero to maximum. The motor shall conform to the requirements of NEMA MG-1. The FITS shall meet the requirements specified when operating from 3 phase, 60 Hz, 208/220 volts plus or minus 10 percent, and 3 phase, 50 Hz, 380 volts plus or minus 10 percent power sources.

3.4.2 Calibration fluid supply system.

3.4.2.1 Calibration system requirements. The pump calibration fluid supply system shall utilize SAE J967 (ISO 4113) fluid. The calibration fluid system shall supply fluid to the injection pump at a rate of no less than 140 gallons per hour (gal/hr), with a pressure of no less than 60 pounds per square inch gage (psig) and a calibration fluid temperature of 38 degrees C to 49 degrees C. The test stand shall have a method of determining the volume of calibration fluid in the reservoir without removing panels.

3.4.2.2 Reservoir. The calibration fluid shall be stored in a closed reservoir with a capacity large enough to test the pumps listed in paragraph 3.3.1 in accordance with manufacturer's test plans. The reservoir shall have a filler, drain valve, and a magnetized sludge trap readily accessible without requiring disassembly. The reservoir shall permit easy access to the heater for removal. The fluid shall be filtered thru a 10-micron primary filter and a 3-micron secondary filter; both located in the fluid exit line outside of the reservoir prior to input to the fuel injection pumps. The filter ratings shall be based on a differential pressure of 4 inches of mercury across a new filter at a 2 gallons per minute (gpm) flow rate. The filters shall be the spin-on type.

3.4.2.3 Waste fluid reservoir. The waste fluid shall be collected separately and deposited in a waste fluid reservoir mounted within the machine. The reservoir shall have a capacity of no less than 4 gallons. The waste fluid reservoir shall be capable of being drained from the exterior of the test stand without removing machine panels.

3.4.2.4 Calibration fluid system temperature requirements. With the test stand at ambient temperatures of 0 degrees C to 49 degrees C, the temperature of the calibration fluid shall be thermostatically controlled and adjustable between 38 degrees C and 49 degrees C, with an accuracy throughout the temperature range of plus or minus 1 degree C. This will require heating and cooling. The cooling system shall be closed loop, requiring no continuous access to a source of water or drain: initial system fill and periodic minor addition of fluids to maintain the proper level in the cooling system notwithstanding. The cooling system shall have the capacity to limit the calibration fluid temperature to no more than 41 degrees C, while the FITS system is

testing the largest capacity pump of paragraph 3.3.1. The surrounding air temperature, during the test, shall be no less than 38 degrees C, with the pump operating on a 40 minute cycle of 10 minutes on and 30 minutes off, for a total test period of four hours. Ozone depleting refrigerants shall not be used. The cooling system shall prevent heater burnout due to lack of fluids.

3.4.3 Lubrication oil system. The lubrication oil shall be stored in a closed reservoir; with a capacity large enough to test the pumps listed in paragraph 3.3.1 in accordance with manufacturer's test plans. The reservoir shall have a filler and drain valve accessible without requiring disassembly. The lubricating oil system shall utilize SAE 30 lubrication oil. It shall also be capable of supplying lubricating oil at flow rates up to 55 gal/hr, at a pressure of 75 psig plus or minus 1 percent, throughout the flow range. The test stand shall have a means for determining the volume of lubricating oil in the reservoir, without removal of panels. The reservoir shall have a thermostatically controlled electrical heating device, which will operate simultaneously with the lubrication oil supply pump. The device shall maintain the lubrication oil at temperatures between 67 degrees C and 73 degrees C in an ambient temperature range of 0 degrees C to 49 degrees C, with no injection pump being driven. The reservoir shall permit easy access to the heater for removal. The lubrication oil shall be filtered thru a 10 micron, in line, spin-on type filter located in the exit line outside of the reservoir.

3.4.4 Pump coupling device. The coupling device, and drive, shall allow for connecting all of the pumps specified in 3.3.1 to the test stand, utilizing the appropriate adapter kit. The coupling shall be directly attached to the driveshaft, incorporating a pilot to assure concentricity and alignment.

3.4.5 Instrumentation system. Instrumentation shall be provided to indicate the calibration parameters specified by the various manufacturers for all pumps specified in 3.3.1. Indications shall be provided that are easily read by an operator with 20/20 eyesight, standing at a distance of five feet. The readouts shall indicate when a specific parameter is outside of the test plan limits, to allow the operator to readily recognize when adjustments need to be made. Analog type gauges shall be provided where the indication of the rate of change is an advantage in testing of fuel pumps. The instrumentation system shall have the capability to simultaneously monitor from 1 to 12 pump outlets. It shall also include a microprocessor controlled graphical and digital type display, in combination with a printer to document salient data. The instrumentation system shall include automated testing capability and an industry standard Personnel Computer (PC), with a Windows or real time operating system. The software provided with the PC, and the instrumentation system, shall be capable of being updated. All time base instrumentation shall be of the crystal type. All dial type gages shall be of a size that can be easily read from the operators normal position when controlling the machine and making adjustments to the fuel pumps. The indicators shall minimally consist of the following.

3.4.5.1 Visual display monitor. The following data shall be visually displayed simultaneously on a readout screen.

- a. Flow rate for each pump outlet, displayed graphically and digitally (with a digital indication of vertical scale).
- b. Average flow rate of all pump outlets, displayed digitally.
- c. Horizontal lines displaying upper and lower delivery limits.

- d. Number of pump outlets being monitored.
- e. Units of measure.
- f. Digital display of the drive shaft RPM (see 3.4.5.2).
- g. Digital display of the calibration fluid temperature (see 3.4.5.3).
- h. Digital display of the lubrication oil temperature (see 3.4.5.4).
- i. Digital display of the calibration fluid pressure and vacuum (see 3.4.5.5).
- j. Digital display of the transfer pump pressure (see 3.4.5.6).
- k. Digital display of the housing fluid pressure (see 3.4.5.7).
- l. Digital display of the lubrication oil pressure (see 3.4.5.8).
- m. Digital display of the injection pump gallery pressure (see 3.4.5.9).

3.4.5.2 Driveshaft speed. The indicated speed range shall be no less than 50 rpm to 5,000 rpm, and shall be displayed digitally on the screen. This measurement shall be accurate to plus or minus one rpm, and updated once per second.

3.4.5.3 Calibration fluid temperature. The calibration fluid temperature display shall indicate temperatures within a range of no less than 38 degrees C to 49 degrees C, and shall be accurate to $\pm 1^{\circ}\text{C}$ or less. The temperature indicating transducer shall be located in proximity to the panel outlet.

3.4.5.4 Lubrication oil temperature. The lubrication oil temperature display shall indicate temperatures within the range of no less than 38 degrees C to 71 degrees C, and shall be accurate to plus or minus three degrees. The temperature shall be measured in the pump supply line, behind the bulkhead connector on the panel.

3.4.5.5 Combination display. A combination vacuum and pressure display shall indicate no less than 0-30 inches of mercury vacuum, when the suction mode is used for calibration fluid supply, and shall also indicate no less than 0-100 psig for calibration fluid pressure supply. The accuracy of this display shall be plus or minus one percent of reading, or plus or minus 0.5 psi, whichever is greater.

3.4.5.6 Transfer pump pressure display. A display shall indicate transfer pump pressure of no less than 0 to 150 psig, with an accuracy of plus or minus one psig.

3.4.5.7 Pump housing fluid pressure display. A display shall be provided to indicate injection pump housing fluid pressure. The display shall indicate pressures in the range of no less than 0 to 30 psig, with an accuracy of plus or minus one psig.

3.4.5.8 Lube oil pressure display. A pressure display shall indicate the lube oil pressure. The display shall indicate a pressure range of no less than 0 to 100 psig, with an accuracy of plus or minus one psig.

3.4.5.9 Injection pump gallery pressure. A display shall indicate an injection pump gallery pressure range of no less than 0 to 150 psig, with an accuracy of plus or minus one psi. Should the injection pump gallery pressure be identical to the pressure measured in paragraph 3.4.5.5, separate gallery pressure readout would not be required.

3.4.5.10 Printer. The FITS system shall incorporate a printer, for providing hard copy reports. At a minimum, the printer shall be of such size, and type, that will provide a legible and permanent record of the following data:

- a. Pump speed.
- b. Pump outlet number, along with corresponding individual outlet delivery rate and average rate of deliveries.
- c. Unit of measure.
- d. A header that allows space for the;
 1. Operator's name,
 2. Pump type and serial number,
 3. Date to be entered.

3.4.5.11 Pressure phasing. A pressure indication shall be provided for the pressure-phasing mode, indicating no less than 0-1000 psig, in 20 psig increments, with an accuracy of plus or minus 1 percent of full-scale value.

3.4.6 Control system. The control system shall be furnished with an industrial grade, dirt resistant keyboard, for inputting data into the system, an industrial grade modem and Ethernet card, for interfacing with other computers both on-site and off-site. The control system shall provide all control functions, as listed in 3.4.6.1 thru 3.4.6.11. All controls shall be located for ease of operator usage. All controls shall be legibly marked for identification and function. At minimum, the controls shall consist of those delineated in 3.4.6.1 thru 3.4.6.11.

3.4.6.1 Main drive start button. The main drive start button shall be console mounted and shall be limited to starting the main drive motor. Speed control interlocking shall be provided, as required, to preclude damage to the test stand and injection pumps during start-up.

3.4.6.2 Main drive stop switch. A main drive stop switch shall be furnished to deactivate the main drive motor.

3.4.6.3 Speed controller. The speed controller shall provide for infinitely variable speed range control from 50 to no less than 5,000 rpm. The speed controller shall operate through the computer system and shall clearly indicate the direction of the driver as either CW or CCW. An interlock shall be provided to prevent start-up or change of direction at other than zero speed.

3.4.6.4 Emergency stop buttons. Two emergency stop buttons shall be provided, one on either side of the control panel, allowing for easy operator access. Either button shall be capable of removing electrical power from the main motor, and prevent restart until the emergency stop button is reset. A braking system shall be provided to bring the pump shaft to 0 RPM in approximately 5 seconds after the electric power is cut off.

3.4.6.5 Calibration fluid pump start switch. A switch shall be provided to start and stop the calibration fluid pump and simultaneously turn on and off the fluid reservoir temperature controls. A second switch shall be provided, if a separate high pressure pump and drive motor is utilized, for timing and phasing.

3.4.6.6 Pressure control valves. Separate control valves shall be available for calibration fluid supply and pressure phasing.

3.4.6.7 Lubrication oil pump start switch. A switch shall be furnished to activate and deactivate the lubrication oil pump if a separate drive motor is used.

3.4.6.8 Lubrication oil pressure control valve. A control valve shall be available for varying the lubrication oil supply pressure.

3.4.6.9 Calibration fluid temperature controller. An adjustable calibration fluid temperature controller shall be included. The temperature controller shall be capable of automatically maintaining the calibration fluid temperature at any set temperature between 38 degrees C and 49 degrees C plus or minus one degree C. An indication shall be provided when the calibration fluid control temperature has been obtained.

3.4.6.10 DC voltage controller. A voltage controller shall be furnished to vary the DC voltage from 0 to no less than 24 VDC.

3.4.6.11 Stroke count controller. A stroke count controller shall be furnished to preset the number of strokes counted (pump drive shaft turns) at no less than 25, 50, and 100 strokes, and shall contain a start of count control switch to initiate count.

3.4.7 Interconnect system.

3.4.7.1 Calibration fluid supply and return connections. The calibration fluid supply and return lines shall be capable of supplying calibration fluid at a pressure of no less than 100 psig, and returning calibration fluid to the supply reservoir, as well as furnishing a vacuum for testing the suction of pumps which require vacuum for their operation. The calibration fluid supply lines shall be flexible type hose, capable of dissipating pressure surges created by the metering action of the injection pump, and preferably should be transparent for observation of flow. The panel shall have no less than one calibration fluid supply line, and no less than three calibration fluid returns. These connectors shall be either Hansen Coupling Div, Tutthill Corp part number 3-S20, or Foster Mfg. Co., Inc. part number 38MS, or equivalent in form, fit and function.

3.4.7.2 Lubrication oil supply and return connections. The lube oil supply system shall supply lube oil at pressures of no less than 100 psig. The panel connector for lube oil supply shall be a Hoffman Engineering Co., Inc. part number MA2-BC, or equivalent in form, fit and function. A 5/8-inch OD metal tube shall be provided, as a nipple, in the drain tray for connecting the pump lube oil return and returning the lube oil to the reservoir.

3.4.7.3 Pressure phase and back leakage connections. Calibration fluid supply and return lines and connections shall be provided to allow checking the pressure phasing as part of the injection pump timing procedure and injection pump leak off return (back leakage) to the flow meter. The high pressure phasing supply line(s) and connection(s) shall be capable of withstanding a pressure of no less than 1000 psig. A calibration fluid return line shall be provided to the reservoir and to the flow meter for measuring back leakage. The flowmeter shall have a range of no less than 10-570 cc/min., and an accuracy of two-percent full scale at a fluid temperature of 49 to 51 degrees C. The connectors for the high pressure phasing supply shall be

a Hansen Coupling Div, Tuthill Corp, part number 1-Hil series 1-HK or equivalent in form, fit and function. The connectors for the calibration fluid return line to the reservoir and flow meter shall be a United Technologies Automotive Components Div part number 870 x 8 or Aeroquip Corp, Industrial Div. part number 2239-6-8S or equivalent in form, fit and function. The connectors for the calibration fluid back leakage to the flowmeter shall be Parker Part No. 22BH-4-4 or equivalent in form, fit and function.

3.4.7.4 Transfer pump pressure connector. The connector for the 0 to 150 psig transfer pump pressure indicator shall be a Hoffman Engineering Co., Inc. part number M1-M-C or equivalent in form, fit and function.

3.4.7.5 Pump housing fluid pressure display connector. The connector for the 0 to 30 psig pump housing fluid pressure display shall be a Hoffman Engineering Co., Inc. part number M1-M-C or equivalent in form, fit and function.

3.4.7.6 Connectors for final stage filter. The connector for calibration fluid both to and from the final filter shall be either a Hansen Coupling Div, Tuthill Corp part number 3-S20 NK or a Foster Mfg. Co., Inc. part number 38 MS or equivalent in form, fit and function.

3.4.7.7 Cummins supply connection. The Cummins calibration fluid supply shall be a male connector for 3/4 I.D. clear PVC pressure tubing.

3.4.7.8 DC voltage control connectors. The connector for the 0 to 24 VDC voltage control shall be a Concord Electronics Corp part number 01-1532-1-0200 or equivalent in form, fit and function.

3.4.7.9 Connector for regulated air supply. The connector for the regulated air supply shall be a Hoffman Engineering Co., Inc. part number MAI-BC or equivalent in form, fit and function.

3.4.8 Injector mounting rack. The injector mounting rack shall be capable of mounting from 1 to 12 holders and injectors. The rack shall accommodate, as a minimum, the injectors required for testing all of the pumps listed in 3.3.1, in accordance with manufacturer specifications. The injector mounting rack shall afford access to the pump from both sides and the front of the test stand; i.e., shall be movable to the right or left side of the machine as viewed from the machine front. The lateral position of the injector mounting rack shall be adjustable right or left of centerline of the pump drive. A 5'-5" tall operator shall be able to insert and remove injectors, attach pressure lines, and reach all operating controls while standing on the floor and without overreaching.

3.4.9 DC voltage supply. A variable, fully rectified, DC voltage supply shall be furnished, providing amperages up to no less than 7 amps and voltages up to no less than 24 VDC. The DC supply shall maintain the selected voltage within plus or minus 3 percent over the range of 5 to the greatest voltage and plus or minus 0.15 volt below 5 volts. A meter shall be furnished to indicate output voltages and shall be accurate within plus or minus 1 percent of full-scale value. An electrical receptacle shall be provided on the control panel for connection of injection pump solenoid valves or other components.

3.4.10 Fluid measuring system. The fluid measuring system shall be accurate to one cubic millimeter/stroke or less, or to within 2 percent of the true flow rate, whichever is greater.

3.4.11 Self diagnostic system. The test stand shall incorporate the capability for self-diagnostics of electronic systems. The self-diagnostics system may be integral within the test stand, or may be accomplished by a separate indicator. The self-diagnostics system shall also contain the capability for self-evaluation, i.e., shall indicate its own proper functioning as well as indicating an internal fault. The fault indication shall provide, as a minimum, a starting point that will enable an electronic technician, with the aid of the FITS system technical manual, to isolate faults.

3.4.12 Hour meter. A total time-lapse hour meter shall be provided, indicating total operating time of the main drive motor for maintenance purposes.

3.4.13 Bedplate. The test stand shall be equipped with a bedplate for aligning and clamping injection pump mounting brackets. The bedplate together with any mounting brackets or adapters provided by the manufacturer to locate the injection pump to be tested shall be so constructed that misalignment at the coupling between the axis of the driveshaft and the axis of the driven shaft shall not exceed the requirement of ISO 4008/1. Provisions shall be provided for draining any bedplate slots.

3.4.14 Regulated air supply. The test stand shall have a filtered, compressed air supply regulated from 0 to 30 psi gage (psig), when connected to shop air.

3.4.15 Software for self-training and fault diagnostics. Software shall be provided to teach a new operator how to operate the system and perform successful tests without the presence of an in-person instructor. The software shall also provide diagnostic and trouble shooting functions, allowing the operator to check the test stand systems and determine the source of the problem. Operator training and trouble shooting programs shall be provided by a CD-ROM system. The software shall allow off-site contractor personnel to view the system parameters and assist the operator in effecting a solution.

3.5 Design and construction. All components shall conform to the requirements listed herein. All components shall be readily accessible for adjustments, replacement, repair, setup, operation, and maintenance without the need for special tools. The machine shall be complete so that when installed and connected to the specified power source, it can be used for its intended operation. The FITS system shall be constructed in such a manner as to allow the individual components to maintain the required performance and accuracy, and function when operated at its maximum capacity. The monitor shall be protected by an oil and break resistant, transparent screen. Components shall be designed and constructed for ease of maintenance. Electronic devices shall incorporate the use of plug-in type circuit boards. Where practical, each circuit board shall be limited to a single function. Each circuit board shall include test points in addition to the self-diagnostics specified in 3.4.11.

3.5.1 Interchangeability. All parts shall be manufactured to specific standards permitting replacement or adjustment without modification of the FITS system or any of its parts.

3.5.2 Material. Materials not specifically designated herein, or in the contract, shall be of a quality commensurate with commercial practice within the injection test stand industry, shall

be suitable for the intended purpose (in the design of the end item), and shall meet all requirements specified herein. Materials shall be free from defects that would adversely affect the performance or maintainability of the individual components or the overall assembly. When dissimilar metals are used in contact, suitable protection against galvanic corrosion shall be applied.

3.5.2.1 Reclaimed materials. The contractor is encouraged to use reclaimed materials for fabricating new parts without jeopardizing the chemical and physical properties, design integrity, and intent of the materials originally selected or specified. The reclaimed materials shall have been reprocessed, remanufactured, or recycled in a manner that shall restore them to the same chemical composition and physical properties as the materials originally selected for use. The use of reclaimed parts “as is”, or rebuilt from scrap, or other used equipment shall not be permissible.

3.5.3 Welding, brazing and soldering. Welding, brazing and soldering shall be employed only where those operations are included in fabrication of the original design. These operations shall not be employed as repair measures for defective parts.

3.5.4 Fastening devices. All screws, pins, bolts, and similar parts shall be installed with means for preventing loss of tightness. Such parts shall not be swaged, peened, staked, or otherwise permanently deformed, unless the design so directs and the deformation will not prevent maintenance or replacement.

3.5.5 Surfaces. All surfaces of castings, forgings, molded parts, stampings, and welded parts shall be cleaned and free from sand, dirt, fins, sprues, scale flux, and other harmful or extraneous materials. External surfaces shall be smooth. All edges shall be either rounded or beveled, except where a sharp edge is required by design.

3.5.6 Threads. All threads shall conform to ASME B1.1 for Unified Inch threads and B1.13M or B1.21M for Metric threads.

3.5.7 Gears. All gears and pinions used in the test stand shall be designed and manufactured of a suitable material to meet, or exceed, the requirements of AGMA 390.03 and AGMA 2000, or ISO 54 for the metric (SI) system. The gears shall be of the proper width, size and hardness to transmit full rated torque and horsepower throughout the speed ranges.

3.5.8 Lubrication. All bearings (except sealed-for-life type), mating gears, and sliding parts shall be provided with a means for lubrication. All oil holes, grease fittings, and filler caps shall be accessible without requiring disassembly of the functional parts. Fuel Injection Pump Test Stands offered for acceptance shall be oiled, greased, and lubricated so they can be put into operation without further lubrication. Lubrication reservoirs, if applicable, shall have means for checking levels.

3.5.9 Lubrication chart or plate. A lubrication chart or plate shall be securely attached to the unit. The chart shall be placed in a transparent plastic folder, or laminated between clear plastic sheets, and permanently sealed. Suitable means for mounting on the unit shall also be provided. The chart or plate shall provide the following information:

Points of Lubrication
Service Interval
Type of Lubrication
Viscosity

3.5.10 Dials and instruments. Dials shall be permanently and legibly marked, and shall have a non-glare finish on the surface visible to the operator. Instrument faces shall be mounted on the front of the panel where the instrument readings are required for testing. Instrument faces that are used for set up purposes only shall be located adjacent to the point of adjustment (control point). Each instrument shall be marked as to its function.

3.6 Painting. Painting, and finishing shall be in accordance with the manufacturer's best commercial practice, provided the following criteria are met or exceeded. All surfaces to be painted shall be cleaned; free of any foreign matter detrimental to painting, and at least one coat of primer (or a phosphate or chromate base) and one coat of enamel, or equivalent (i.e., epoxy enamel) shall be applied. Unpainted metal and marking surfaces exposed to atmospheric conditions shall be finished to resist corrosion. The type of finish applied shall be compatible with the base metal.

3.7 Workmanship. The machine and accessories shall have a good general appearance as evidence of high caliber workmanship, shall conform to a quality of construction commensurate with the requirements specified herein, and with the best quality prevailing among manufacturers normally producing equipment of the type specified herein.

3.8 Master accessories. The test stand shall be furnished with master accessories, which are basic to all pumps listed in 3.3.1, but are not peculiar to any one pump. The master accessories shall minimally include drive hubs, a throttle arm positioner, mounting and flange bracket, hoses, and a calibration fluid viscosity kit. The viscosity kit shall consist of a viscosity cup, a thermometer suitable for checking the viscosity of the calibration fluid, and suitable instructions and/or charts. Each cup, and its calibration chart, shall bear the same unique serial number. The master accessories shall be furnished in a durable container with a hinged lid. Each container shall be partitioned to prevent movement of the contents during transportation (see 3.3.2). A list of the contents shall be attached to the interior of the lid. The list shall indicate the component location within the container. Each component shall be illustrated for ease of location either on the attached list or in a separate enclosed listing. Assembly instructions shall be included for multi-piece items that require assembly for use.

3.9 Nameplate. A corrosion resistant nameplate(s) shall be permanently attached to the machine. All lettering shall be in capitals and the numerals shall be Arabic (except the model number shall be the manufacturer's customary designation). Letters and numerals shall be of such a size as to be clearly legible. The nameplate shall show the following information:

Nomenclature
Manufacturer's Name
Manufacturer's Model Designation
Manufacturer's Serial Number
Power Input Characteristics and Rating
Contract Number

National Stock Number (NSN)
Date of Manufacture

3.9.1 Component marking. Each component shall be separately identified and keyed to an illustration. Marking of components shall be as follows:

- a. Hoses shall have the part number stamped or embossed on a metal band affixed to the hose.
- b. Components, other than attaching hardware, shall be stamped, etched, or engraved with the part number if sufficient surface is available; if form, fit, function, or mating is not affected; and if the component will not be damaged by marking.
- c. Components that cannot be stamped, engraved, or etched shall be marked by a metal tag wired to the component, by machine printed oil-resistant Mylar tape affixed to the part, or, as a last resort, by placing in a marked cloth bag.
- d. Components that are part of an assembly shall be marked with their own unique part numbers, not the assembly number. Instructions for assembly and use shall be included.
- e. Unmarked vendor components shall be marked with the contractor's part number.

3.10 Technical Manuals. The contractor shall provide technical manuals for the complete operation and maintenance of the fuel injection pump test stand (FITS). The technical manual shall minimally include normal operating procedures, emergency operation procedures, maintenance and repair procedures, diagrams and parts lists. Military Handbook MIL-HDBK-1221 shall serve as the guideline for the commercial manual. The following data shall be included on the front cover of the manual: National Stock Number (NSN), end item nomenclature, contract number, and commercial and Government entity code. The technical manuals shall be prepared in American English. The contractor shall insert, as the leading page of the contractor provided commercial literature, one page of Instructions for Requisitioning Parts From Commercial Sources (See Appendix A).

3.10.1 Copyright release. The contractor shall provide the Government a copyright release letter, giving the Government the right to reproduce, and use, the commercial manuals.

3.10.2 Delivery. The contractor shall provide the Government two draft paper copies of the commercial manual, for approval, sixty days prior to final publication. Two paper copies, and two compact disc (CD) copies, of the final publication shall be provided to the Government. Two paper copies and two compact disc (CD) copies of the final publication shall be over packed with each FITS machine.

3.11 Adapter kits. Each FITS system furnished under this DFP shall be furnished with the following adapter kits: Cummins pump kit per paragraph B3.2.3, B3.2.3.1, and B3.2.3.2; Stanadyne pump kit per paragraph B3.2.5, B3.2.5.1, and B3.2.5.2; AMBAC pump kit per paragraph B3.2.6, B3.2.6.1, B3.2.6.2, B3.2.6.3, and B3.2.6.4; and calibrating nozzles per paragraph B3.2.7.

4. VERIFICATION

4.1 General provisions. The inspections (examinations and tests) herein shall be performed to determine whether the item conforms to Section 3 of this specification.

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

- a. Performance verification inspection (see 4.2)
- b. Conformance inspection (see 4.3).

4.1.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified herein.

4.2 Performance verification inspection

4.2.1 Submission The contractor shall submit a performance verification sample as designated by the Contracting Officer for evaluation in accordance with the specified verification methods of Table 1. The performance verification sample shall consist of a minimum of one (1) complete FITS system (see 3.1).

4.2.2 Inspections to be performed. As determined by the Government, the performance verification assemblies, components and test specimens may be subjected to any or all of the verification methods specified (see Table 1). Unless otherwise specified, all the inspections shall be performed.

4.2.3 Rejection. If any test assemblies, test specimen or test components fails to comply with any of the applicable requirements, then the performance verification sample shall be rejected. The Government reserves the right to terminate inspection upon any failure of a test assembly, specimen or component to comply with any of the requirements.

4.3 Conformance inspection

4.3.1 Compliance. Conformance inspections shall be applied to production units being offered for acceptance under the contract. These inspections shall include all verifications listed in Table 1.

4.3.2 Inspection lot formation. Lot formation shall not exceed one month's production.

4.3.3 Sampling plan determination. Conformance verification methods are specified in Table 1.

4.3.4 Rejection. Failure of any unit to pass any verification shall be cause for rejection of the unit.

4.4 Requirements. Verify that the FITS system meets the requirements cited in paragraph 3.2.

4.5 Design

4.5.1 Fuel injection pump test stand. Demonstrate that the FITS system complies with the requirements of paragraph 3.3.1 for all of the pumps listed therein. The Government acknowledges the cost impact of demonstrating each pump listed in 3.3.1 and has compiled a list

of pumps that it deems fairly represent the family. At the contractor's option, demonstration of the pumps listed in paragraph 4.5.1.1 may be sufficient, however, it does not relieve the contractor from the full requirements of paragraph 3.3.1.

4.5.1.1 Pump family representation. This list represents pumps that are deemed, by the Government, to fairly represent the family. It is provided for use in lieu of individual pump testing, and its use is solely at the contractor's option and risk. Should the Government subject a pump, not on this list, but is listed on paragraph 3.3.1, to testing, the contractor shall be held according to the terms of paragraph 3.3.1.

4.5.1.1.1 Stanadyne DB2 pumps. Two each Stanadyne DB2 pumps, listed below.

<u>NSN</u>	<u>Pump Model</u>	<u>Where used by Military</u>
2910-01-199-2355	DB2829-4523	HMMWV 6.2 liter engine, used prior to 1990
2910-01-326-9221	DB2829-4879	HMMWV 6.2 liter engine, used after 1990
2910-01-414-1272	DB2831-5149	HMMWV 6.5 liter engine
2910-01-467-9029	DB2831-5209	HMMWV 6.5 liter detuned engine

4.5.1.1.2 AMBAC pumps. All AMBAC pumps listed below.

<u>NSN</u>	<u>Pump Model</u>	<u>Where used by Military</u>
2910-01-073-0124	PSB12BT	M60 tank and M88 recovery vehicle
2910-00-213-0108	PSB6A90EH5337A1	
2910-00-890-2548	APE6BB90Q5748B	

4.5.1.1.3 Cummins PT pump. One each Cummins PT pump, listed below. The contractor may request that another PT-style pump be substituted.

<u>NSN</u>	<u>Pump Model</u>	<u>Where used by Military</u>
2910-01-215-6721	3045423-4144	
2910-01-215-6721	3060711-4114	
2910-01-384-5304	3074599	VTA903-T600 engine
2910-01-432-0273	3088368	VTA903-T600 engine
2815-01-179-9056	3021948-3999	V903C engine, Armored Combat Earthmover

4.5.1.1.4 Robert Bosch pumps. Two each Robert Bosch pumps, as listed below.

<u>NSN</u>	<u>Pump Model</u>	<u>Where used by Military</u>
2910-01-239-8333	0 400 463 115	Water Purification Unit
2910-01-268-8757	0 403 436 109	M939, 5-Ton Truck

4.5.1.1.5 Caterpillar pumps. Caterpillar pump for the engine listed below.

<u>NSN</u>	<u>Engine</u>	<u>Where used by Military</u>
2815-01-280-9317	3306B engine	Logistics Support Vessel

4.5.2. FITS operational requirements. Provide objective evidence that the FITS conforms to the requirements of paragraph 3.3.2.

4.5.3 Safety and health requirements. Verify that the FITS complies with the applicable general safety and health requirements of OSHA Standard 29 CFR Part 1910. Further verify that safety devices are provided for all parts that present safety hazards (see 3.3.3).

4.6 Components. Examine the FITS to determine conformance with the requirements of paragraph 3.4.

4.6.1 Main drive assembly. The FITS shall be subjected to a dynamic test utilizing each of the pumps listed in paragraph 4.5.1.1 for which accessory kits are provided. Testing shall be performed in accordance with ISO 4008-1, paragraph 5.2 with the FITS operating on 3 phase, 60 Hz, 208/220 volts plus or minus 10 percent and on 3 phase, 50 Hz, 380 volts plus or minus 10 percent. Verify that the FITS main drive assembly accomplishes the following under both sources of power for all pumps tested.

- a. Drives pump from 50 up to 5,000 rpm with a rate of acceleration/deceleration of no less than 200 rpm/second (sec).
- b. Speed droop does not exceed 5 percent when the output load is increased from zero to maximum.
- c. Further verify that the motor conforms to the requirements of NEMA MG-1.

4.6.2 Calibration fluid supply system

4.6.2.1 Calibration system requirements. Demonstrate that the pump calibration fluid supply system meets the requirements of paragraph 3.4.2.1 utilizing SAE J967 (ISO 4113) fluid. Verify that the volume of calibration fluid in the reservoir can be determined without removal of the FITS panels.

4.6.2.2 Reservoir. Examine the reservoir to determine compliance with the requirements of paragraph 3.4.2.2.

4.6.2.3. Waste fluid reservoir. Examine the waste fluid reservoir to determine compliance with the requirements of paragraph 3.4.2.3.

4.6.2.4 Calibration fluid system temperature requirements. Demonstrate that the calibration fluid system has the capability of meeting the requirements of paragraph 3.4.2.4. Verify the use of non-ozone – depleting chiller refrigerant.

4.6.3 Lubrication oil system. Verify by demonstration and inspection that the lubrication oil system conforms to the requirements of paragraph 3.4.3.

4.6.4. Pump coupling device. Examine the coupling device visually, manually, and dimensionally to determine compliance with the requirements of paragraph 3.4.4.

4.6.5 Instrumentation system. Provide objective evidence that the instrumentation system satisfies the requirements of paragraph 3.4.5. Verify that the data display indicators are in conformance with paragraphs 3.4.5.1 through 3.4.5.9 and 3.4.5.11 and that the printer provides the data specified in paragraph 3.4.5.10.

4.6.6 Control system. Confirm that a Control System with an Industrial Grade, dirt resistant keyboard for inputting data into the system, and an Industrial Grade modem, for interfacing with other computer terminals, both on-site and off-site, is furnished. Verify that the Control System provides all control functions, as listed in 3.4.6.1 thru 3.4.6.11. Confirm that all controls are located for ease of operator usage and are legibly marked, for identification and

function. Confirm that the controls consist of those delineated in 3.4.6.1 thru 3.4.6.11.

4.6.6.1 Main drive start button. Verify that the main drive start button is console mounted, and is limited to the start of the main drive motor. Verify that a speed control interlocking is provided, as required to preclude damage to the FITS and injection pumps during start-up.

4.6.6.2 Main drive stop switch. Verify that a main drive stop switch is furnished, to deactivate the main drive motor.

4.6.6.3 Speed controller. Verify that the speed controller provides for infinitely variable speed range control from 50 to no less than 5,000 rpm, and that the speed controller operates through the computer system. Verify that the speed controller clearly indicates the direction of the driver, as either CW or CCW, and that an interlock, to prevent start-up or change of direction at other than zero speed, is provided.

4.6.6.4 Emergency stop buttons. Verify that two emergency stop buttons are provided, one on either side of the control panel, allowing for easy operator access. Either button shall be capable of removing electrical power from the main motor, and prevent restart until the emergency stop button is reset. Verify that the braking system provided brings the pump shaft to 0 RPM in approximately 5 seconds after the electric power is cut off.

4.6.6.5 Calibration fluid pump start switch. Verify that a switch is provided to start and stop the calibration fluid pump, and simultaneously turn on and off the fluid reservoir temperature controls. Verify that a second switch is provided, if a separate high pressure pump and drive motor is utilized for timing and phasing.

4.6.6.6 Pressure control valves. Confirm that separate control valves are available for calibration fluid supply and pressure phasing.

4.6.6.7 Lubrication oil pump start switch. Confirm that a switch to activate and deactivate the lubrication oil pump is furnished, if a separate drive motor is used.

4.6.6.8 Lubrication oil pressure control valve. Confirm that a control valve for varying the lubrication oil supply pressure is available.

4.6.6.9 Calibration fluid temperature controller. Verify that an adjustable calibration fluid temperature controller is included. The temperature controller shall be capable of automatically maintaining the calibration fluid temperature at any set temperature between 38 degrees C and 49 degrees C plus or minus one degree C. Verify that an indication when the calibration fluid control temperature has been obtained is provided.

4.6.6.10 DC voltage controller. Verify that a voltage controller to vary the DC voltage from no less than 0 to 24 VDC is furnished.

4.6.6.11 Stroke count controller. Verify that a stroke count controller to preset the number of strokes (pump drive shaft turns) at no less than 25, 50, and 100 strokes is furnished, and that it contains a start of count control switch to initiate count.

4.6.7 Interconnect system. Certify that the interconnect system meets the requirements of paragraph 3.4.7 and paragraphs 3.4.7.1 through 3.4.7.9 and that the interfacing hardware is present.

4.6.7.1 Calibration fluid supply and return connections. Verify that:

a. The calibration fluid supply and return lines are capable of supplying calibration fluid at a pressure no less than 100 psig, and the returning calibration fluid to the supply reservoir as well as furnishing a vacuum for testing the suction of pumps which require vacuum for their operation.

b. The calibration fluid supply lines are of a flexible type hose, capable of dissipating pressure surges created by the metering action of the injection pump and preferably should be transparent for observation of flow.

c. The panel has no less than one calibration fluid supply line, and no less than three calibration fluid returns. These connectors are either Hansen Coupling Div, Tutthill Corp part number 3-S20 or Foster Mfg. Co., Inc. part number 38MS, or equivalent in form, fit and function.

4.6.7.2 Lubrication oil supply and return connections. Verify that:

a. The lube oil supply system has supply lube oil at pressures no less than 100 psig.

b. The panel connector for lube oil supply is a Hoffman Engineering Co., Inc. part number MA2-BC, or equivalent in form, fit and function.

c. A 5/8 inch OD metal tube is provided, as a nipple, in the drain tray, for connecting the lube oil return line (returning lube oil to the reservoir).

4.6.7.3 Pressure phase and back leakage connections. Visually determine that:

a. The calibration fluid supply and return lines and connections are provided. Verify that they allow the checking of pressure phasing, as part of the injection pump timing procedure and injection pump leak off return (back leakage) to the flow meter.

b. The high pressure phasing supply line(s), and connection(s), are capable of withstanding a pressure of 1000 psig.

c. A calibration fluid return line is provided to the reservoir, and to the flow meter, for measuring back leakage. Also verify that the flowmeter has a range of no less than 10 to 570 cm³/minute (cc/min) and an accuracy of two-percent full scale at a fluid temperature of 49 to 51 degrees C.

d. The connectors for the high pressure phasing supply are Hansen Coupling Div, Tutthill Corp, part number 1-Hil series 1-HK or equal in form, fit, and function.

e. The connectors for the calibration fluid return line to the reservoir and flow meter are United Technologies Automotive Components Div part number 870 x 8 or Aeroquip Corp, Industrial Div part number 2239-6-8S, or equivalent in form, fit and function.

f. The connectors for the calibration fluid back leakage to the flowmeter are Parker Part No. 22BH-4-4, or equivalent in form, fit and function.

4.6.7.4 Transfer pump pressure connector. Verify that the connector for the 0 to 150 psig transfer pump pressure indicator is a Hoffman Engineering Co., Inc. part number M1-M-C, or equivalent in form, fit and function.

4.6.7.5 Pump housing fluid pressure display connector. Verify that the connector for the 0 to 30 psig pump housing fluid pressure display is a Hoffman Engineering Co., Inc. part number M1-M-C or equivalent in form, fit and function.

4.6.7.6 Connectors for final stage filter. Verify that the connector for calibration fluid both to and from the final filter are either a Hansen Coupling Div, Tuthill Corp part number 3-S20 NK, or a Foster Mfg. Co., Inc. part number 38 MS, or equivalent in form, fit and function.

4.6.7.7 Cummins supply connection. Verify that the Cummins calibration fluid supply is a male connector for 3/4 I.D. clear PVC pressure tubing.

4.6.7.8 DC voltage control connectors. Verify that the connector for the 0 to 24 VDC voltage control is a Concord Electronics Corp part number 01-1501-1-0200, or equivalent in form, fit and function.

4.6.7.9 Connector for regulated air supply. Verify that the connector for the regulated air supply is a Hoffman Engineering Co., Inc. part number MAI-BC, or equivalent in form, fit, and function.

4.6.8 Injector mounting rack. Examine the injector mounting rack visually, manually, and dimensionally to determine compliance with the requirements of paragraph 3.4.8. Verify that the rack can accommodate the injectors needed to test all pumps listed in paragraph 3.3.1.

4.6.9 DC voltage supply. Demonstrate that the DC voltage supply satisfies the requirements of paragraph 3.4.9. Confirm that the specified meter and electrical receptacle are provided.

4.6.10 Fluid measuring system. Verify that the fluid measuring system is of the positive displacement type and meets the accuracy requirements of paragraph 3.4.10.

4.6.11 Self diagnostic system. Certify that the FITS incorporates the self-diagnostic capabilities specified in paragraph 3.4.11.

4.6.12 Hour meter. Verify that a total time lapse hour meter is provided.

4.6.13 Bedplate. Examine the bedplate to confirm compliance with the requirements of paragraph 3.4.13.

4.6.14 Regulated air supply. Demonstrate that the FITS is capable of supplying filtered, compressed air regulated from 0 to 30 psi gage when connected to shop air.

4.6.15. Software for self-training and fault diagnostics. Provide objective evidence that the software specified in paragraph 3.4.15 is provided.

4.7. Design and construction. Verify that the design and construction is in conformance with the requirements of paragraph 3.5.

4.7.1 Interchangeability. Provide objective evidence that all parts are manufactured to specific standards permitting replacement or adjustment without modification of the FITS or any of its parts.

4.7.2 Material. Verify that materials utilized conform to the requirements of paragraph 3.5.2. Further verify that when dissimilar metals are used in contact with each other, suitable protection against galvanic corrosion is applied.

4.7.2.1 Reclaimed materials. Verify that the use of reclaimed materials is in accordance with the requirements of paragraph 3.5.2.1.

4.7.3 Welding, brazing and soldering. Certify that welding, brazing and soldering operations are conducted only during fabrication of the original design but not for repair of defective parts.

4.7.4 Fastening devices. Examine all removable fastening devices on the FITS and verify that all use some means of keeping tightness and none are swaged, peened, staked, or otherwise permanently deformed.

4.7.5 Surfaces. Examine and inspect all surfaces of castings, forgings, molded parts, stampings, and welded parts to determine compliance with the requirements of paragraph 3.5.5.

4.7.6 Threads. Certify that all threads conform to ASME B1.1 for Unified Inch threads and B1.13M or B1.21M for Metric threads.

4.7.7. Gears. Confirm that all gears and pinions used in the FITS are in accordance with the requirements of AGMA 390.03 and AGMA 2000, or ISO 54. Verify that the gears are of the proper width, size and hardness to transmit full rated torque and horsepower throughout the speed ranges.

4.7.8. Lubrication. Examine and inspect the FITS to determine that the test stand is provided with the means to comply with the requirements of paragraph 3.5.8.

4.7.9. Lubrication chart or plate. Locate the FITS lubrication chart or plate and verify that it is securely attached to the test stand. Confirm that the chart or plate is enclosed, sealed and provides the information in accordance with the requirements of paragraph 3.5.9.

4.7.10. Dials and instruments. Examine all dials to verify that they are permanently and legibly marked and have a non-glare finish on the surface visible to the operator. Examine all instruments to affirm that they are marked according to function. Verify that instrument faces are mounted or located in accordance with paragraph 3.5.10.

4.8 Painting. Verify that any necessary painting and finishing is in accordance with the requirements of paragraph 3.6.

4.9 Workmanship. Inspect the FITS to confirm compliance with the workmanship requirements of paragraph 3.7.

4.10 Accessories and manuals.

4.10.1 Master accessories. Verify that each test stand is furnished with containerized master accessories as specified in paragraph 3.8. Confirm that a list of contents with illustrated component location and any necessary assembly instructions are provided per paragraph 3.9.

4.10.2 Manuals. Verify that a comprehensive commercial literature, in American English, for the FITS system is provided. Verify that an insert, as the leading page, is provided in the commercial literature, includes one page of Instructions for Requisitioning Parts From Commercial Sources (Appendix A).

4.10.2.1 Copyright release. Verify that copyright release letters are provided, to the Government, for all commercial literature, including releases from the subcontractors. Verify that the signed copyright release letters give the Government the unconditional right to reproduce, and use, any copyrighted information, including that for subcontractor components and parts, included for use with the FITS system.

4.10.2.2. Delivery. Verify that within each FITS system, the contractor has furnished two readable copies of the contractor provided manual, and subcontractor provided commercial literature, if any. The commercial manuals/literature shall be packaged in such a manner as to prevent damage from moisture. Commercial literature includes manuals, schematics, instruction sheets, parts lists, and spare/repair parts ordering information. The contractor shall also furnish two readable copies and two CD copies of all commercial manuals/literature over-packed with the FITS system to the Government's contracting officer no later than 30 days prior to contractor's first delivery of the FITS system to the Government.

4.10.3 Adapter kits. Verify that each FITS system, under this DFP, has been furnished with the adapter kits specified in paragraph 3.11. Additionally, verify that each adapter kit satisfies the requirements of Appendix B, section 3 and has been tested in accordance with Appendix B section 4, if applicable.

4.11 Nameplate. Locate the FITS nameplate and verify that it is corrosion resistant and permanently attached to the test stand. Confirm that lettering, numerals and informational items are in accordance with the requirements of paragraph 3.9.

4.11.1 Component marking. Confirm that each component is separately identified and keyed to an illustration. Verify that components are marked in accordance with the requirements of paragraph 3.9.1 a. through 3.9.1 e.

4.12 Certificate of conformance (COC). The contractor may request, through the Procurement Contracting Officer (PCO), that the Government accept a COC, certifying that the Government's requirements, as stated herein, are satisfied. The contractor may wish to annex documents supporting his request for the Government to consider. If approved by the Government, the COC must be in the format shown in 4.12.1.

4.12.1 Certificate of conformance (COC). A COC is required for Military Standard and commercial items. The COC shall be supported by inspection and test data, material analysis, or certification from the raw material producer or processor, and shall be made available to the Government for specifications covering raw material, processed material, and processes. The

contractor shall make the COC available to the Government prior to or with the request to perform acceptance inspection approval by the Government. This is in addition to, and not in lieu of, any rights of the Government under this contract or law. A COC may be used as an element incident to, but shall not be used as the sole basis for, Government acceptance of contract item(s) unless so indicated in the technical documentation or contract. As a minimum, the COC shall contain the following:

- a. Name of company and date.
- b. Contract number or purchase order number, national stock number and drawing number.
- c. A brief description of the unit, including either its military or commercial model number.
- d. Complete nomenclature of supplies together with lot number or other identification. The quantity in each lot or shipment shall be given.
- e. A statement certifying that material meets all requirements of the contract. The contractor shall furnish, to the cognizant engineering activity, a proposed statement for approval.

4.13 Certified test reports (CTR) in lieu of testing acceptable. The contractor may request, through the Procurement Contracting Officer (PCO), that the Government accept a CTR in lieu of testing specified herein, or for any other testing the contractor may wish the Government to consider. If approved by the Government, the CTR must be in the format shown in 4.13.1.

4.13.1 CTR Format. If CTR is specified, the contractor shall make available to the Government a CTR for each lot of parts, assemblies, subsystems and systems by lot number prior to acceptance. This test report is in addition to, and not in lieu of, any rights of the Government under this contract or law. A CTR may be used as an element incident to, but shall not be used as the sole basis for, Government acceptance of the contract item(s) unless so indicated in the technical documentation or contract. As a minimum, the report shall contain the following:

- a. Name of company and date.
- b. Contract number or purchase order number, national stock number and drawing number.
- c. Complete nomenclature of supplies together with lot number or other identification. The quantity in each lot or shipment shall be given.
- d. All inspections and tests required by contract (i.e., material, processes, performance, functional, etc.) shall be recorded in test reports. These reports shall identify each lot submitted for acceptance by lot number, the specification or drawing, revision and date, grade or type as applicable, number of specimens tested, specified characteristics and requirements, and actual results obtained.

- e. Reports of the raw material producer's chemical, mechanical, and physical analysis.
- f. A statement, as follows, certifying that material meets all requirements of the contract:

“The undersigned, individually, and as the authorized representative of the contractor, warrants and represents that: All the information supplied above is true and accurate; the material covered by this certificate conforms to all contract requirements (including but not limited to the drawings and specifications); the inspection and test results, and the analysis appearing herein are true and accurate; and this certificate is made for the purpose of inducing payment and with knowledge that the information and certification may be used as a basis for payment.”

- g. Signature and title of certifying official.

TABLE 1 REQUIREMENTS/VERIFICATION MATRIX

VERIFICATION METHOD

- N- Not Applicable
- 1- Analysis
- 2- Demonstration
- 3- Examination
- 4- Test

VERIFICATION CLASS

- A- Product Verification
- B- Conformance

Section 3 Requirement	Verification Method					Verification Class		Section 4 Verification
	N	1	2	3	4	A	B	
3.2			X			X	X	4.4
3.3		X	X			X	X	4.5
3.3.1			X			X	X	4.5.1
3.3.2		X				X	X	4.5.2
3.3.3		X	X			X	X	4.5.3
3.4			X	X	X	X	X	4.6
3.4.1			X		X	X	X	4.6.1
3.4.2			X	X		X	X	4.6.2
3.4.2.1			X			X	X	4.6.2.1
3.4.2.2				X		X	X	4.6.2.2
3.4.2.3				X		X	X	4.6.2.3
3.4.2.4			X			X	X	4.6.2.4
3.4.3			X	X		X	X	4.6.3
3.4.4				X		X	X	4.6.4
3.4.5		X	X	X		X	X	4.6.5
3.4.6			X	X		X	X	4.6.6
3.4.6.1				X		X	X	4.6.6.1
3.4.6.2				X		X	X	4.6.6.2
3.4.6.3				X		X	X	4.6.6.3
3.4.6.4			X	X		X	X	4.6.6.4
3.4.6.5				X		X	X	4.6.6.5
3.4.6.6				X		X	X	4.6.6.6
3.4.6.7				X		X	X	4.6.6.7

Section 3 Requirement	Verification Method					Verification Class		Section 4 Verification
	N	1	2	3	4	A	B	
3.4.6.8				X		X	X	4.6.6.8
3.4.6.9			X	X		X	X	4.6.6.9
3.4.6.10			X	X		X	X	4.6.6.10
3.4.6.11			X	X		X	X	4.6.6.11
3.4.7		X	X	X		X	X	4.6.7
3.4.7.1			X	X		X	X	4.6.7.1
3.4.7.2			X	X		X	X	4.6.7.2
3.4.7.3			X	X		X	X	4.6.7.3
3.4.7.4				X		X	X	4.6.7.4
3.4.7.5				X		X	X	4.6.7.5
3.4.7.6				X		X	X	4.6.7.6
3.4.7.7				X		X	X	4.6.7.7
3.4.7.8				X		X	X	4.6.7.8
3.4.7.9				X		X	X	4.6.7.9
3.4.8			X	X		X	X	4.6.8
3.4.9			X	X		X	X	4.6.9
3.4.10			X			X	X	4.6.10
3.4.11			X	X		X	X	4.6.11
3.4.12				X		X	X	4.6.12
3.4.13				X		X	X	4.6.13
3.4.14			X			X	X	4.6.14
3.4.15		X	X			X	X	4.6.15
3.5		X	X	X		X	X	4.7
3.5.1		X	X			X	X	4.7.1
3.5.2			X	X		X	X	4.7.2
3.5.2.1		X	X			X	X	4.7.2.1
3.5.3			X			X	X	4.7.3
3.5.4				X		X	X	4.7.4
3.5.5				X		X	X	4.7.5
3.5.6		X				X	X	4.7.6
3.5.7		X	X	X		X	X	4.7.7
3.5.8				X		X	X	4.7.8
3.5.9				X		X	X	4.7.9
3.5.10				X		X	X	4.7.10
3.6				X		X	X	4.8
3.7				X		X	X	4.9
3.8				X		X	X	4.10
3.9				X		X	X	4.11
3.9.1				X		X	X	4.11.1
3.10				X		X	X	4.10.2
3.11				X		X	X	4.10.3

5. PACKAGING.

5.1 Preservation, Packing, And Packaging. Preservation, Packing and Packaging shall be in accordance with ASTM-D-3951, plus the following additional requirements. The unit package quantity shall be 1 fuel injection pump test stand with chiller, flow console and adapter kits.

5.2 Additional Requirements.

5.2.1 Interior Systems. Flush and drain the entire calibrating fluid system of the test stand with SAE J967 calibrating fluid or equivalent. Flush and drain the cooling system with a mixture that is 50 percent water and 50 percent automotive ethylene glycol antifreeze that contains a corrosion inhibitor. Any system drained shall have all drain holes sealed. Any fluid system shipped filled shall be protected against leakage of fluids during shipment.

5.2.2 Refrigerant, compressor crankcase. The compressor crankcase shall be filled to the proper level with the oil required for operation. The compressor shall be operated to ensure complete coverage of all working parts. The oil shall be left in the crankcase and a waterproof tag shall be attached stating "CRANKCASE FILLED WITH OIL REQUIRED FOR OPERATION". All openings to the interior of the compressor shall be sealed.

5.2.3 Enclosed gears and chains. If applicable to the unit, enclosed gears and chains shall have the housing filled to the operating level with the approved lubricant required by the lubrication order for operation, and shall be tagged to indicate that the housing is filled with the required operating oil. All openings shall be sealed.

5.2.4 Pipe and tubing. The ends of open pipes and tubing shall be sealed.

5.2.5 Air filters. Filters installed in their operating position are acceptable "as is". All other air filters shall be individually boxed.

5.2.6 Test stand, chiller, and console. The unit protection for these items shall be to cover all apertures. Cover all gage crystals, the entire control panel, computer monitor, corners, and all projections, with thick uncompressed cushioning material, and secure the cushioning material in place. Wrap all preserved metal surfaces with non-dusting, non-corrosive barrier material and secure in place.

5.2.7 Accessories and adapter kits. All standard accessories, master accessories, and adapter kits, shall be preserved like the basic machine and placed in its respective pocket in the containers provided. Any gages or instruments not provided space shall be cushioned and placed in a waterproof, greaseproof box.

5.2.8 Wood Products. If oak or chestnut wood products are used in the performance of this contract, these wood, or wood products, must be free of all bark.

5.2.9 Non-manufactured wood products. All non-manufactured wood used in packaging shall be heat-treated to a core temperature of 56 degrees C for a minimum of 30 minutes. The box/pallet manufacturer, and the manufacturer of wood used as inner packaging, shall be affiliated with an inspection agency accredited by the Board of Review of the American Lumber Standard Committee. Each box/pallet shall be marked to show the conformance to the International Plant Protection Convention Standard. Boxes, pallets, and wood used as inner packaging, made of non-manufactured wood, shall be heat-treated. The quality mark shall be

placed on both ends of the outer packaging, between the end cleats or end battens; on two sides of the pallet.

5.2.10 Palletization. Unless otherwise specified herein, shipments to the same destination of identical items having a total packaged displacement exceeding 50 cubic feet shall be palletized unless forklift - handling features, such as skids, are included on containers.

5.2.11 Workmanship. Workmanship shall be such that when proper procedure is followed, materials and equipment being processed shall be provided the maximum protection against corrosion, deterioration, and shall be suitable for storage to the level of packaging specified.

5.3 Packing.

5.3.1 Mechanical handling requirements. The completed unit packs, shipping container(s), and all contents, shall be capable of withstanding the handling conditions expected from forklift handling.

5.4 Marking Requirements.

5.4.1 Container marking. Container markings shall be in capital letters of equal height, shall be proportionate to the available marking space, and shall contain the following information in the order listed:

- a. NSN/NATO stock number.
- b. CAGE code of the company awarded the contract, and part number of the item as specified in the contract.
- c. Quantity and unit of issue.
- d. Level of protection and date packed.
- e. Contract or purchase order number.

5.4.2 Shipping Container marking. Markings on the shipping container shall be grouped into three distinct categories, identification markings, contract data markings and address markings.

5.4.3 Identification Markings:

- a. NSN/NATO stock number.
- b. CAGE code of the company awarded the contract, and part number of the item as specified in the contract.
- c. Quantity and unit of issue.
- d. Level of protection and date packed.
- e. Gross weight and cube.
- f. Item description or nomenclature.

5.4.4 Contract data marking. The contract data marking placed under the identification markings, shall consist of the contract or purchase order number.

5.4.5 Address markings. The address markings placed to the right of the identification and contract data markings (if space is available) shall consist of the following information in the order shown.

- a. Control number or reference number (as a minimum, the Transportation Control Number (TCN) shall be provided as the single standard shipment identification number)
- b. FROM MILITARY: Name and address of consignor (DOD Activity Address Code) and in the clear address, if applicable.
- c. FROM CONTRACTOR: Name and address of the contractor (including nine-digit zip code). When supplies are shipped from a subcontractor, only the name and address of the company awarded the contract shall be used.
- d. TO: Name and address of consignee (DOD Activity Address Code (DODAAC) and in the clear address, if applicable.
- e. Piece number and total pieces (if more than one shipping container is used for the order).

5.5 Bar-coded information. In addition to the above information, the NSN/NATO stock number shall be bar-coded on the unit packs and intermediate containers. The following shall be bar coded on the shipping container. All bar coding shall use the 3 of 9 formats in accordance with AIM BC1

NSN/NATO stock number.
Contract or order number.
CAGE code of the company awarded the contract.
Contract Line Item Number (CLIN) if applicable.

6 NOTES

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

6.1 Intended use. The FITS will be used to test and recalibrate specific Fuel Injection Pumps that are a component in Diesel engines used in all types of Army vehicles.

6.2 Existing adapter kits. In addition to the basic master accessories and a set of six ADN 12SD12C injector nozzles, the A8020 FITS system was furnished with four adapter kits to test the following pumps.

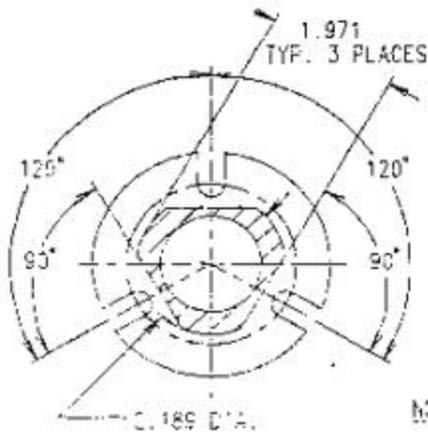
6.2.1 Cummins PT pumps. Includes flow console.

6.2.2 AMBAC pumps. PSB4A110EH5340D2, PSB6A90EH, and PSB12BT.

6.2.3 Stanadyne pumps. DB2633JT4255W; DBGFC631-19AE; DBGVC437-2AL; DBMFC433/633-11K; DBGFCC4311-24AJ, -29AJ; JDB431-AL2410; DGFCR631-10C; DCMF0629-2LQ.

6.2.4 Stanadyne pumps. DB2829YL4267.

6.3 Coupling flange. The drive shaft coupling output flange of the current FITS system is in accordance with Figure 1.

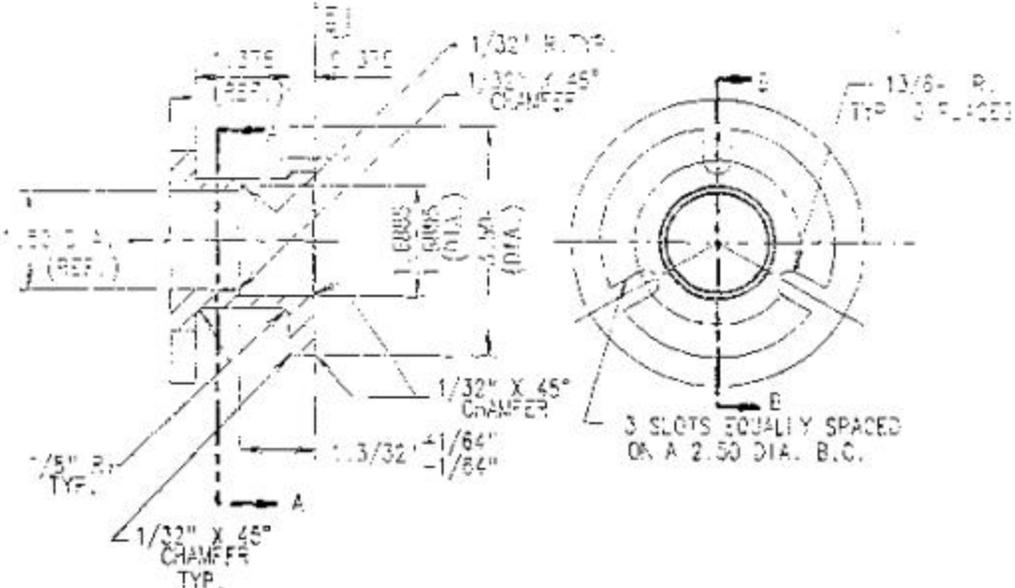


TOLERANCES:

2 PL. DEC.	± .02
3 PL. DEC.	± .005
ANGLES	± 30'

NOTE: THE 1.6885/1.6895 DIA. MUST BE PERPENDICULAR TO SURFACE \perp A TOL. $\pm .005$

SECTION A-A



SECTION B-B

FIGURE 1. PUMP COUPLING OUTPUT FLANGE DIMENSIONS

FLANGE

Appendix A

INSTRUCTIONS FOR REQUISITIONING PARTS FROM COMMERCIAL SOURCES

The supply officer shall identify the prime manufacturer of the repair part by Commercial and Government Entity (CAGE) Code Number, and requisition the repair part from the prime manufacturer. When requisitioning parts from commercial sources, it is mandatory that the following information be provided to the supply officer by the unit.

1. Commercial and Government Entity (CAGE) Code Number.
2. Manufacturer's Part Number – Exactly as listed in the commercial literature.
3. Nomenclature - Exactly as listed in the commercial literature, including dimensions if available.
4. Manufacturer's Model Number.
5. Manufacturer's Serial Number – (End Item)
6. Any additional information such as type, size, thread, frame number, and electrical characteristics.

Appendix B

ADAPTER KITS FOR FUEL INJECTION PUMP TEST STAND

B1 SCOPE

B1.1 This specification covers the adapter kits for use in testing and calibrating diesel engine pumps on the Fuel Injection Pump Test Stand (FITS). The kits shall consist of the hardware required, in conjunction with the master accessories furnished with the FITS, for mounting and mating each of the pumps listed herein to the FITS to allow for testing the pump in accordance with manufacturer's specifications.

B2 REFERENCED DOCUMENTS

B2.1 Other publications. The following documents form a part of this description for purchase to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. The issues of documents which have not been adopted shall be those in effect on the date of the cited DODISS.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION (AGMA)

AGMA 390.03 - Gear Classification Manual

(Application for copies should be addressed to American Gear Manufacturers' Association, 1500 King Street, Suite 201, Alexandria, VA 22314.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E380 - Metric Practice, Standard for

(Application for copies should be addressed to American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 54 - Cylindrical Gears for General Engineering and for Heavy Engineering-Modules and Dimetral Pitches

ISO 1122 - Glossary of Gear Terms-Part 1 Geometrical Definitions

ISO 2974 - Road Vehicles-High Pressure Pipe Fittings with 60 Degree Female Cone, First Edition

ISO 4010 - Diesel Engines - Calibrating Nozzle, Delay Pintle Type

ISO 4093 - Diesel Engines - Fuel Injection Pumps - High-Pressure Pipes for Testing

(Application for copies of ISO documents should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

SOCIETY OF AUTOMOTIVE ENGINEERS

SAE J529 - Fuel Injection Tubing

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096).

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

B2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

B3 REQUIREMENTS

B3.1 Adapter kits. Adapter kits shall be provided, as specified, for mounting and mating fuel injection pumps to the FITS. Specifically, adapter kits shall be provided for testing the commercial pumps delineated in the following paragraphs. In the case of Caterpillar, the engine that the pump is used on is listed in lieu of the pump. The kits shall be compatible with all requirements of the FITS specified in this Description for Purchase. The mounting configuration of the kits shall assure that the pump and kit mounting stability requirements of paragraph 3.3.2 are met. Each kit shall be furnished with a container with an organizing method for storage of all of the provided components. Each component of the kit shall be separately identified. The organizing method shall retain the components in position to provide for rapid inventory, to prevent contact between different components, to protect sensitive components and to maintain the position of the accessories under rough handling and shipping conditions. The material used for the organizing method shall be resistant to diesel fuel, calibration fluid, automotive oils, greases, lubricants, acids, bases, coolants and cleaning agents. The retention features shall securely hold the items in place so that if the container is dropped the accessories shall be retained in position and undamaged. Each retention feature shall allow easy removal of the accessory and shall include as necessary, pick holes, cut outs, recessed areas, or protrusion of accessories above the organizing liner. The exterior of the container shall be marked with the applicable pump(s) supported. There shall be attached to the lid interior a list of contents and its location within the container. Each kit shall include pump mounting diagrams, fuel line connection diagrams and other information required to attach and properly use the adapter kit. Tubing connections shall conform to ISO Standard 2974. Tubing shall conform to SAE J529. Assembly instructions shall be included for multi-piece items that require assembly for use.

B3.1.1 Special tools. Special tools peculiar to testing and calibrating each of the specified pumps shall be included in the kit for each pump. Common tools such as end wrenches, screwdrivers, pliers, etc. and special tools required to repair/rebuild the pumps shall not be included. If preformed fuel lines are furnished, they shall be separately identified.

B3.2 Adapter kits.

B3.2.1 Caterpillar pumps (engines) kits.

B3.2.1.1 Caterpillar master accessories consisting of master valves (Caterpillar part number 6V9470) required for use with all Caterpillar kits.

B3.2.1.2 Kit for 3208 and 3306.

B3.2.1.3 Kit for D333C(1673), D343TA (1693) and D342(1674).

B3.2.1.4 Kit for 3406.

B3.2.1.5 Kit for 3408.

B3.2.1.6 Kit for 3306B.

B3.2.1.7 Kit for 3406B.

B3.2.2 Lucas CAV pump kit.

B3.2.2.1 Kit for 3249F010, 3248F391 and 3241F940 DPA pumps (nozzles per paragraph B3.2.7 not furnished as a part of this kit).

B3.2.3 Cummins pump kit.

B3.2.3.1 Kit for PT pumps (all types).

B3.2.3.2 Flow panel (as required for above Cummins pumps).

B3.2.4 Robert Bosch pump kits.

B3.2.4.1 Kit for PES6A, PES3A, and PES5MW pumps (nozzles per paragraph B3.2.7 not furnished as a part of this kit).

B3.2.4.2 Kit for PES6P pump (6 calibrated test nozzles shall be furnished as part of this kit).

B3.2.4.3 Kit for PES6MW100 pump.

B3.2.5 Stanadyne pump kits.

B3.2.5.1 Kit for D, DB, DC, and JDB pumps (nozzles per paragraph B3.2.7 not furnished as a part of this kit).

B3.2.5.2 Kit for DB2829YL4267 (DB2829-4521) pump (8 calibrated test nozzles shall be furnished as part of this kit).

B3.2.6 AMBAC pump kits.

B3.2.6.1 Kit for PSB6A90EH, PSB4A110EH and PSB12BT pumps (nozzles per paragraph B3.2.7 not furnished). Matching sets of test nozzles for the PSB12BT and PSB6A90EH pumps shall be furnished with the kit. They are AMBAC part numbers KT-7831 (set of 16 nozzles) and KT7830 (set of 8 nozzles).

B3.2.6.2 Kit for APE6BB100 and APE6BB90Q pumps (6 calibrated test nozzles shall be furnished as part of this kit).

B3.2.6.3 Kit for 1006A100A pump with UTDS Model TSE 77200 Advance Tester, or equivalent, with magnetic pick up, cable and bracket suitable for mounting on universal flange bracket (6 calibrated test nozzles shall be furnished as part of this kit).

B3.2.6.4 Kit for PSU2/4A-80E-9328 pump (nozzles per paragraph B3.2.7 not furnished as part of this kit).

B3.2.7 Calibrating nozzles. Six each calibrating nozzles and holders in accordance with ISO 4010.

B3.3 Interchangeability. All parts shall be manufactured to specific standards, permitting replacement or adjustment without modification of parts.

B3.4 Materials. Materials not specifically designated herein shall be selected by the manufacturer and shall be subject to all requirements of this description for purchase. The manufacturer is encouraged to use reclaimed raw materials for fabricating new parts without jeopardizing the chemical and physical properties, design integrity, and intent of the materials originally selected and specified. The use of reclaimed parts as is, or rebuilt from scrap or other used equipment shall not be permissible.

B3.5 Welding, brazing or soldering. Welding, brazing or soldering shall be employed only where those operations are included in fabrications of the original design. These operations shall not be employed as repair measures for defective parts.

B3.6 Fastening devices. All screws, pins, bolts, and similar parts shall be installed with means for preventing loss of tightness. Such parts shall not be swaged, peened, staked, or otherwise permanently deformed unless the design so directs and the deformation will not prevent maintenance or replacement.

B3.7 Surfaces. All surfaces of casting, forgings, molded parts, stamping, and welded parts shall be cleaned and free from sand, dirt, fins, sprues, scale flux, and other harmful or extraneous materials. External surfaces shall be smooth and all edges shall be either rounded or beveled, except where a sharp edge is required by design.

B3.8 Threads. All threaded parts shall be made to definite standards.

B3.9 Gears. All gears and pinions shall be fabricated to either English (USA) standard inch per AGMA 390.03 or Metric (SI) per ISO-1122, ISO-54 and ASTM E380.

B3.10 Lubrication. All bearings (except sealed-for-life type), mating gears, and sliding parts shall be provided with a means for lubrication. All oil holes, grease fittings, and filler caps shall be accessible without requiring disassembly of the functional parts.

B3.11 Painting and finishing. Painting and finishing of the kits shall be in accordance with the manufacturer's best commercial practice provided the following criteria are met or exceeded: all surfaces to be painted shall be cleaned to be free of all foreign matter detrimental to painting and at least one coat of primer (or a phosphate or chromate base) and one coat of enamel, or equivalent (i.e., epoxy enamel) is applied. Unpainted metal and non-working surfaces exposed to atmospheric conditions shall be zinc plated or black oxide coated to resist corrosion.

B3.12 Workmanship. The kits shall have a good general appearance as evidence of high caliber workmanship and shall conform to a quality of construction commensurate with the requirements specified herein and with the best quality prevailing among manufacturers normally producing equipment of the type specified herein.

B3.13 Parts list. The supplier shall provide, with each kit, a list of all parts provided in the kit and an illustration of each part. The parts list shall include the prime contractor's name, nomenclature and part number and shall reference each part to the applicable illustration. The original equipment manufacturer's (vendor) part number and identification shall be included in the parts list.

B3.14 Identification marking. Each component shall be separately identified and keyed to an illustration. Marking of components shall be as follows:

- a. Hoses shall have the part number stamped or embossed on metal band affixed to the hose.
- b. Components, other than attaching hardware, shall be stamped, etched or engraved with the part number if sufficient surface is available, if form, fit, function, or mating is not affected, or if the component will not be damaged by marking.
- c. Components that can not be stamped, engraved or etched shall be marked by a metal tag wired to the component, by machine printed, oil-resistant, Mylar tape affixed to the part, or, as a last resort, by placing in a marked cloth bag.
- d. Components that are part of an assembly shall be marked with their own unique part numbers, not the assembly number. Instructions for assembly and use shall be included.
- e. Unmarked vendor components shall be marked with the contractor's part number.

B3.15 Instructional media. Each kit shall be furnished with a CD-ROM which provides by example the operation of the FITS with each kit. The media shall show the complete operation of mounting and testing of the pumps utilizing the respective kit. The media shall be full motion video, with audio explanatory, of personnel using the kit from the start of operation until completion.

B4 QUALITY ASSURANCE PROVISIONS

B4.1 Responsibility for inspection. Unless otherwise specified in the contract, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

B4.1.1 Responsibility for compliance. All items must meet all requirements of Sections B3 and B5. The inspections 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 assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective materiel, either indicated or actual, nor does it commit the Government to acceptance of defective materiel.

B4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

- (a) Product verification (see B4.2.1)
- (b) Quality conformance inspection (see B4.2.2)

B4.2.1 Product verification. When specified in the contract, product verification shall be performed on the preproduction model or initial production item specified in B3.1. Product verification shall consist of the examinations in B4.3 and the tests of B4.4. Failure of the sample to pass the examination or any of the tests shall be cause for rejection.

B4.2.2 Quality conformance inspection.

B4.2.2.1 Inspections and tests. Quality conformance inspections shall be applied to production units offered for acceptance under the contract. Quality conformance inspection shall consist of (a) and (b) as follows, and failure of any unit to pass any examination, test, or inspection shall be cause for rejection of that unit.

- (a) Product examination (see B4.3)
- (b) Packaging inspection (see B4.5)

B4.2.2.2 Sampling. Sampling for quality conformance inspection shall be performed as listed with all samples selected randomly.

<u>Inspection or test</u>	<u>Lot or Batch Size</u>	<u>Sample Size</u>
Product examination (see B4.3)	1-25	13
Packaging inspection (see B4.5)	1-25	5

The lots shall not exceed the maximum sizes indicated above. If lot size is less than or equal to sample size, 100 per cent inspection is required. Each lot shall be accepted with no defects and rejected if one or more defects are found.

B4.3 Product examination. The kits shall be visually and manually examined to determine conformance with the requirements of paragraph B3.1, the applicable portions of paragraph B3.2, and paragraphs B3.3 through B3.14. Visual examinations shall include verification of completeness of manufacture and assembly, conformance to specified standards, adequacy of markings, proper cleaning, and freedom from the identified defects. Manual examinations shall include the operation of movable parts by hand to assure proper functioning. Manual examinations shall also verify that the metal tubing can be stored inside the adapter kit case in the shape that it is used on the FITS. The examination provisions may be applied at the earliest practical point in manufacture at which it is feasible to inspect for acceptance without risk of change in the characteristic by subsequent operations. Failure of the contractor to provide objective evidence that the kit and its components have passed the examinations prescribed for them by the contractor's inspection system shall be cause for rejection. In addition, failure of the contractor to provide objective evidence that all parts a remanufactured to definite standards,

clearances and tolerances so that no replacement part will degrade the form, fit or function of the end item (see B3.3), shall be cause for rejection.

B4.4 Certificate of conformance (COC). A COC is required for Military Standard and commercial items. The COC shall be supported by inspection and test data, material analysis, or certification from the raw material producer or processor, and shall be made available to the Government for specifications covering raw material, processed material, and processes. The contractor shall make the COC available to the Government prior to or with the request to perform acceptance inspection approval by the Government. This is in addition to, and not in lieu of, any rights of the Government under this contract or law. A COC may be used as an element incident to, but shall not be used as the sole basis for, Government acceptance of contract item(s) unless so indicated in the technical documentation or contract. As a minimum, the COC shall contain the following:

- a. Name of company and date.
- b. Contract number or purchase order number, national stock number and drawing number.
- c. A brief description of the unit, including either its military or commercial model number.
- d. Complete nomenclature of supplies together with lot number or other identification. The quantity in each lot or shipment shall be given.
- e. A statement certifying that material meets all requirements of the contract. The contractor shall furnish, to the cognizant engineering activity, a proposed statement for approval.

B4.4.1 COC specification. The contractor shall COC that the requirements of paragraph B3.8 and B3.9 are satisfied. The COC shall clearly state that the threaded parts have been made to definite standards and shall identify the standard. The COC shall also state that all gears and pinions have been fabricated to definite standards and shall identify the standard. A COC shall also be furnished for the calibrating nozzles, and holders, specified in B3.2.7.

B4.5 Tests.

B4.5.1 Mounting stability test. The mounting configuration required for each type of adapter kit specified in the contract shall be tested for stability in accordance with ISO 4008/1 paragraph 5.2.4 on a Fuel Injection Pump Test Stand conforming to this Description for Purchase. Failure of the pump mounting configuration to comply with the stability requirements of ISO 4008/1 paragraph 5.1.6 within a permissible operating envelope which encompasses all combinations of speed and delivery recommended by the pump manufacturer in the test specifications for each of the pump to which the adapter kit applies shall be cause for rejection.

B4.5.2 Functional test. Each type of adapter kit specified in the contract shall be used to mount one of each type of injection pump to which it applies on a Fuel Injection Pump Test Stand conforming to this Description for Purchase. While mounted on the FITS, each pump shall be tested in accordance with the pump manufacturer's test specifications. Failure of the adapter kit to provide all necessary hardware for mounting and mating each type of pump to the

FITS, failure or leakage of any part of the adapter kit, or damage to the injection pump shall be cause for rejection.

B4.6 Packaging inspection. The kits shall be inspected before and after packaging to determine compliance with the preservation, packaging, packing, and marking requirements specified in the contract.

B5 PACKAGING

B5.1 Preservation. All adapter kits shall be stowed in the required containers for stowing all kit parts. Ferrous metal, unpainted, unfinished surfaces (threads, internal surfaces, etc.) shall be coated with preservative.

B5.1.1 Technical data. Technical data shall be packaged in a greaseproof, waterproof bag, sealed and placed in the adapter kit container. Mark container "TECHNICAL DATA ENCLOSED". If there is not enough room inside the container, then tape the packaged technical data to the top of the container with water-resistant tape.

B5.1.2 Unit package. Each adapter kit shall be placed in a snug-fitting fiberboard box to protect the container from being marred.

B5.2 Packing.

B5.3 Marking.