Part 1 General

.1 The product provided shall be a six inch portable priming assisted centrifugal pump driven by a liquid cooled diesel engine. Pump unit to include a liquid level control system. Pump unit shall be suitable for mounting on a trailer for over the road use. Model of pump shall be Gorman Rupp PA6A60-4045T or approved equal.

.2 The primary purpose of the pump shall be for wastewater treatment plant use, lift station emergency standby, or pump station bypass.

.3 The pump manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

.4 Performance Criteria

.1 Pump must be designed to handle trash or debris up to 3" diameter solids. Pumps shall have 6" discharge connection. Each pump shall be selected to perform under following operating conditions.

Capacity (USGPM)	780
Total Dynamic Suction Lift (FT)	17 ft
Maximum Repriming Lift (FT)	ft
Total Discharge Static Head (FT)	24 ft

.2 Pump Performance Certifications

.1 Solids Handling Capability

.1 All internal passages and impeller vanes shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted.

.2 Upon request from the engineer, manufacturer's certified drawings showing passage size shall be submitted for approval.

.2 Dry Run Capability

.1 Pump can be run dry at maximum speed with no damage to seals.

.2 Seal lubricating oil temperatures should be checked to not exceed seal manufacturer's maximum continuous rating.

.3 Positive Suction Pressure Capability

.1 Liquid to be used for this test shall be water.

.2 Pump and priming system is to be operated with a positive suction pressure while allowing no water to discharge from the priming system.

.3 Reprime Performance

.1 Consideration shall be given to the service anticipated in which the unit will operate unattended on an open sump. This could result in the liquid level in the sump dropping below the suction pipe entrance causing a loss of prime or reaching the automatic shutdown level. In either case, when the sump level is again restored needing pumping, it will require the pump to reprime itself automatically. Such occurrence shall be considered normal.

.2 Pump must demonstrate an automatic reprime of 25 vertical feet at the minimum operating condition point. Reprime lift is defined as the static height of the pump suction above the liquid. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Additional standards under which reprime tests shall be conducted are:

.1 Liquid to be used for reprime test shall be water.

.2 Angled seat flap discharge check valve shall be installed.

.3 Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90^{o} elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.

.4 Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle. No water should be discharged from the priming system to the environment during priming or operation.

.5 Upon request from the engineer, certified reprime performance test results, prepared by the manufacturer and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

.4 Manufacturer’s Warranty

.1 The Gorman Rupp Company (herein "GR") warrants that its Prime Aire® Series pumps shall be free from defects in material and workmanship for a period of twenty-four (24) months from the date of purchase by the original end user when installation is made and use and maintenance is performed in accordance with GR’s recommendations. Wear and tear resulting from use and items normally consumed in use are not covered.

Part 2 Products

2.1 MANUFACTURER

.1 The specifications and project drawings depict equipment and materials manufactured by the Gorman-Rupp Company which are deemed most suitable for the service anticipated. It is not intended, however, to eliminate other products of equal quality and performance. The contractor shall prepare his bid based on the specified equipment for purposes of determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials.

.2 After execution of the contract, the contractor may offer substitutions to the specified equipment for consideration. The equipment proposed for substitution must be superior in construction and performance to that specified in the contract, and the higher quality must be demonstrated by a list of current users of the proposed equipment in similar installations.

.3 In event the contractor obtains engineer's approval for equipment substitution, the contractor shall, at his own expense, make all resulting changes to the enclosures, buildings, piping or electrical systems as required to accommodate the proposed equipment. Revised detail drawings illustrating the substituted equipment shall be submitted to the engineer prior to acceptance.

.4 It will be assumed that if the cost to the contractor is less for the proposed substitution, then the contract price shall be reduced by an amount equal to the savings.

2.2 PUMP DESIGN

.1 Pump shall be horizontal, priming assisted centrifugal type, designed specifically for pumping trash or debris. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 – GENERAL of this section.

.2 Pumps that require liquid to be maintained in the pump casing to enable priming will not be considered.

.3 Pump shall have a 6″ discharge connection.

.4 Materials and Construction Features:

.1 Pump casing: Casing shall be made of ductile iron. Casing shall incorporate the following features:

.1 Dual 6″ suction porting allowing for both standard axial and optional radial suction porting. Standard axial suction porting is perpendicular to the discharge porting and the optional radial suction porting is parallel to the discharge porting.

.2 Machined location on top of casing to mount priming chamber.

.3 Pump casing shall be capable of withstanding 100 psi (7kg/cm^2) operating pressure.

.2 Coverplate: Cleanout coverplate shall be cast iron. Design must incorporate following maintenance features:

.1 Retained by easy grip hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, priming chamber, seal and wearplate without removing discharge piping.

.2 A replaceable wearplate secured to the coverplate by capscrews and lockwashers shall be made for ductile iron.

.3 Two O-rings of Buna-N material shall seal coverplate to pump casing.

.4 Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

.3 Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate the following features:

.1 Sealplate and bearing housing shall be cast iron. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Two lip seals will prevent leakage of oil.

.1 The bearing cavity shall be oversized, providing for a minimum of 1.8 gallons of oil to ensure continuous operation cooling and lubrication of seals. Oil level sight gauge and a fill/vent plug shall be installed. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil with removal of the fill/vent plug.

.2 Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft.

.3 Shaft shall be stainless steel. Pump shall also have a replaceable shaft sleeve made from stainless steel to protect the shaft from wear.

.4 Bearing shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearing shall be oil lubricated from a dedicated reservoir. Pump design which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

.5 Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall have a polished face and an external O-ring for sealing to the sealplate. Elastomers shall be viton. Cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 – GENERAL of this section.

.6 Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

.4 Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

.1 Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of alignment of belts, couplings, etc. shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.

.2 There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating

assembly side of the pump shall allow for further adjustment as described above (.4.1).

.3 Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

.5 Angled Seat Flap Discharge Check Valve: Check valve casing shall be made for cast iron and the flap valve shall be molded Buna N. Removal or installation of the flap valve must be accomplished through a coverplate opening, without disturbing the discharge piping.

.6 Priming Chamber: priming chamber shall be made from cast iron and be mounted to the pump casing. Design must incorporate the following features:

.1 Priming system to have a priming valve that will ensure automatic prime and reprime while not allowing any liquid product being pumped to be bypassed to the environment. Performance criteria listed under PART 1 – GENERAL.

.2 Priming system should be capable of automatically operating under a flooded or positive suction pressure condition with performance criteria listed under PART 1 – GENERAL.

.3 Priming system shall create a vacuum on the suction side of the pump and in the priming chamber using a compressor to force air through a protectively mounted venturi. The valve system in the priming chamber should not allow compressed air into the pumping system should be venture become plugged.

.5 The pump manufacturer shall demonstrate to the engineer's satisfaction that due consideration has been given to reducing setup and maintenance costs by incorporating the following features:

.1 No special tools shall be required for replacement of any components within the pump.

.2 The unit shall be provided with a pump drain to the outside of the enclosure.

.3 Easy externally adjustable wearplate to maintain proper clearances for efficient performance.

.4 Replaceable wearplate and shaft sleeve.

.5 Oversized oil cooling capacity for seals when pump runs dry.

.6 Hard faced shaft seal for long life.

.7 Dual suction port feature, allowing for easier setup in space restricted areas.

2.3 Engine

.1 The engine shall be a four (4) cylinder four cycle liquid cooled diesel engine. John Deere model 4045DF150 "Power Tech". The engine shall heave the following minimum design characteristics:

.1 Displacement shall be 276 cubic inches.

.2 Maximum continuous BHP shall be 76 @ 2500 RPM.

.3 Governor shall be mechanical.

.4 Forced circulation lubrication.

.5 Dry type air cleaner.

.6 Oil reservoir shall be 9 U.S. quarts dry; 8 U.S. quarts refill.

.7 Fuel tanks shall be 84 U.S. gallons and shall be furnished with a 24 hour minimum operating time at full load. Fuel tank shall have drain line running to the outside of the enclosure.

.8 Starter shall be 12 volt.

.9 Compressor to be gear driven directly off the engine. No belts or couplings required. The compressor shall be capable of supplying a minimum of 13 cfm of air to the priming system.

.2 Engine Autostart Control Panel to include the following features:

.1 Cold weather LCD display with backlighting.

.2 Safety shutdown switches / indicators for low oil pressure, engine overcrank and high coolant temperature.

.3 Displayed values for:

.1 Engine RPM

.2 Run Time

.3 Battery Voltage

.4 Coolant Temperature

.5 Oil Pressure

.4 Fault indication for:

.1 Low oil pressure

.2 High temperature

.3 Overcrank

.5 Engine MANUAL/STOP/AUTO key switch with key removable in any position.

.6 Warning alarm for eight seconds prior to start up.

.7 I.D. tags or equal applied:

.1 Throttle

.2 Float switch input only

.3 Circuit breaker

.4 MANUAL/OFF/AUTO

.8 10 AMP Panel Mounted Fuse

.9 Float switch connector in bottom of box adjacent to wiring harness connector.

.10 Low Battery Voltage Protection.

.3 Additional features shall include:

.1 Radiator with drain valve on bottom of radiator with hose running to outside of the enclosure.

.2 The unit shall be equipped with an **Industrial Grade Muffler** w/guard and weather cap.

.4 Because the engine shall be required to operate during emergency situations, the following minimum performance standards shall be used for engine selection:

.1 Engine speed shall be controlled by a manually adjustable, governor controlled throttle which shall maintain the preset speed over the range of expected pumping loads. This speed shall not be less than **1400 RPM** to insure adequate cooling, nor more than 1900 RPM so that internal engine wear is held to a minimum.

.2 The engine shall develop approximately 95 percent of manufacturer's published performance after a reasonable run-in period.

.3 For selection of engine size, engine performance shall be de-rated according to manufacturer's specifications to allow for decreased performance if installed at elevations more than 100 feet above sea level.

.4 For selection of engine size, engine performance shall be de-rated according to manufacturer's specifications to allow for decreased performance in an ambient temperature of 100 degrees F.

.5 Engine rating shall be further reduced to conform to engine manufacturer's recommendations for continuous service applications.

.6 Engine shall be specifically designed to operate continuously.

2.4 Control System

.1 Description

.1 The engine shall be equipped with all controls and components required for manual and automatic operation when used with the engine controls and DC level control system described herein. Such components shall include, but not limited to, the following:

.1 12 volt DC electrical system, including starter and alternator.

.2 Digital elapsed running time meter.

.3 Shutdown sensors for engine temperature, oil pressure and overspeed.

.4 Keyed switch for manual, off, or automatic operation of the engine.

.2 The electrical control components shall be provided by the pump supplier and shall be provided with the following:

.1 Indicating lights shall be LED type. LED emitting the colour Yellow shall indicate "Warning" and LED emitting the colour Red shall indicate "Fault".

.2 A four-digit elapsed time display shall be provided to indicate the total running time in "hours".

.3 Controls shall include a micro-processor based controller with 32 character two row LCD backlit display. It shall be housed in a lockable polycarbonate clear cover enclosure.

.2 Circuit details

.1 Switches or other devices shall be provided and connected to perform as follows:

.1 When manual operation is selected, the operator will be prompted to push and hold the "enter" button on the control panel to start the engine. Once started, engine shall run until "OFF" is selected, or the engine failure circuit stops the engine.

.2 Operator can stop engine if it is running, and prevent it from starting during maintenance or repair.

.3 Engine failure circuits shall stop the engine, illuminate an LED, and display on LCD display on the control panel for each of the following conditions:

.1 Engine speed exceeds maximum overspeed setting.

.2 Engine temperature exceeds safe operating temperature as specified by the engine manufacturer.

.3 Engine oil pressure falls below engine manufacturer's specified recommendations.

.4 Engine fails to start after several attempts.

.4 Operating power for the engine shall be provided by the storage battery furnished with the engine.

2.5 Battery

.1 Battery shall be 75 AMP hour industrial type with 900 cold cranking AMPS.

END OF SECTION