



## 2500 HP Frac Pump Unit w/ 3512C Diesel Engine

### 1.0 General Unit Specification

This technical specification covers the construction and design requirements for a **2500 HP Trailer-Mounted Frac Pumping** unit capable of performing general pressure pumping well service operations in ambient conditions of 32°F (0°C) to 120 °F (49 °C) without cold weather assistance gear.

All specifications as listed in this Revision are subject to change or clarification as requested by the customer.

### 1.1 Unit Operational Limits

The unit, as specified with a Gardner Denver GD2500Q Quintuplex pump and 4.5" plungers , will be capable of pumping the following pressures and rates:

- Maximum working pressure: **12,400 PSI**
- Maximum working rate: **21.6 BPM**

### 1.2 Unit Dimensions & Permitting

The unit dimensions (excluding the customer supplied tractor) will be within:

- Length: 44'-0" (14 meters)
- Width: 8'-6" (2.6 meters)
- Height: 12'-0" (4.1 meters)
- Weight: 68,000 lbs (24,384 kgs)

The unit/tractor combination will comply with all US & TX DOT regulations for unit dimensions, but may exceed the standard 80,000 lbs vehicular weight allowed depending on customer tractor



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utilized. Axle loading will be properly distributed to allow overweight/oversize permitting in the continental United States (should it be necessary) and compliance with US Federal Bridge Law.

The unit systems are detailed as follows:

## 2.0 Equipment Systems

### 2.1 Trailer Specifications

The trailer will be a heavy duty, mobile, multi-purpose platform that will include the following features and compliances:

- Single drop trailer frame
- US and TX DOT Compliant for On-Road Transportation
- Steel Beam/Frame Construction (at minimum) w/ frame members built on 35" centers
- Heavy duty 2" King Pin with 3/8" Bolster Plate mounted to receive a 52" tall fifth-wheel hitch
- Standard tractor air "glad-hands" and electrical connectors accessible at the front of trailer
- Sealed electrical wiring and protected air-lines
- Three Axle spread w/ 25,000 lb rated axles and 25,000 lb rated Monopivot Air-Ride Suspensions
- 16 ½" x 7" S Cam Brakes w/ ABS system installed on rear axle
- Twelve (12) 11R22.5 Tires
- Twelve (12) 8.25 x 22.5, 10-Hole, Hub Piloted Wheels
- Holland Mark V Heavy Duty Landing Gear, manual 2-speed gearbox crank
- DOT compliant vehicle lighting and conspicuity marking
- Heavy duty Rubber Mud-Flaps installed on rear axle spread
- Heavy Duty Diamond-Plate Fenders
- No-slip fiberglass gating work platform on back of trailer frame w/ step-up assistance rail and step



## 2.2 Power Units/Drivetrains

### 2.2.1 Primary Drive Engine

Installed on the trailer frame will be one (1) 3512C Caterpillar Tier 2 Diesel Engine rated at 2500 BHP @ 1900 RPM. It will be mounted to allow ease of access to oil-fill ports, filters, and service points. This engine will be accessorized and installed to drive the down-hole pumping process as follows:

- 24 VDC ECM and electronics
- 24 VDC 75 Amp Alternator
- SAE 0 Flywheel housing
- Hydraulic Starter powered by tractor mounted wet-kit
- Spin-on Fuel Filtration System
- Spin-on Water Filtration System
- Spin-on Lube Oil Filtration System
- CAT standard safety derates included in Engine Calibration
- Caterpillar supplied heavy duty air cleaner assembly w/ restriction indicators
- Dual carbon steel mufflers w/ spark arrestors and carbon steel rain caps
- Heavy duty muffler brackets suitable for rough terrain
- Stainless steel flex connector from turbo exhaust connection to muffler intake
- Integral shell and tube transmission cooler tied into Jacket Water system
- TH55-E70 Caterpillar Transmission mounted to flywheel housing with the following gear ratios:
  - 1<sup>st</sup> Gear - 6.25 : 1
  - 2<sup>nd</sup> Gear - 4.59 : 1
  - 3<sup>rd</sup> Gear - 3.38 : 1
  - 4<sup>th</sup> Gear - 2.48 : 1
  - 5<sup>th</sup> Gear - 1.83 : 1
  - 6<sup>th</sup> Gear - 1.36 : 1
  - 7<sup>th</sup> Gear - 1.00 : 1



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- Reverse - (Blocked)
- Spin-on Transmission Oil Filtration System
- Heavy duty GWB 390.65 output connection
- Output brake option built into transmission
- “Wishbone” style transmission cradle mount for proper weight distribution
- One-piece heavy duty GWB-type driveshaft assembly
- Horizontal 3-point mount Radiator/Cooling Assembly with sections for the following:
  - Engine Jacket Water System
  - SCAC (Separate Circuit After Cooler) System
  - Hydraulics Cooling Core (Air to Oil)
  - Power End Lube Cooling Core (Air to Oil)
  - Fuel Cooler Core (Air to Fuel)
- Coolant Fill line for the Radiator Assembly will be accessible from ground level

### 2.2.2 Fuel System

This unit will be equipped with a diesel fuel storage and distribution system with the following specifications:

- Two (2) 200 Gallon Fuel Tanks configured as follows:
  - Polished aluminum construction
  - 26” diameter cylindrical build w/ capped ends
  - Fuel cooling core included in fuel return lines
  - 1-1/2” Drain plugs on tank ends
  - Equalizing crossover between tanks
  - Tank breather fittings
  - Filtration screen installed in fill necks
  - Fuel level sender unit
- Tank fill necks accessible from the ground for filling



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- Tanks “soft” mounted to unit via rubber lined straps and cradles

## 2.2.3 Power Take-Offs

Bolted to the front “fan drive wheel” output flange of the engine crankshaft will be a 200 HP 1610 Series short driveshaft assembly complete with U-Joints. This direct-drive “PTO” arrangement will couple to and drive a two-pump hydraulic pump stack. This engine driven pump stack will drive the radiator/cooling assembly fan circuit and a hydraulic oil cooling loop. PTO driveshaft details are:

- 12 Bolt yoked flange bolted to engine crankshaft off front of engine
- 20” Driveshaft length w/ slip joint included
- Standard yoked companion flange w/ adapter to mate to hydraulic pump shaft

Installed on the top PTO port of the transmission shall be the power-end lube gear pump.

## 2.2.5 Hydraulics System

Hydraulic power will be installed on this unit with circuits to drive the following items:

- One (1) Radiator/Cooling Assembly Fan
- One (1) Hydraulic oil cooling loop

Features of the hydraulic system to include:

- Sauer-Danfoss hydraulic components
- Pressure compensated piston hydraulic pump technology
- Closed loop circuit w/ speed and pressure controls integral w/ hydraulic pump
- Common hydraulic reservoir equipped as follows:
  - Stainless steel construction
  - Internal baffling to stabilize hydraulic fluid returns and suctions
  - Removable suction strainer assemblies, externally mounted
  - Return filtration manifold accessible for servicing



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- Level gauge visible from ground
  - Oil temperature sensor
  - Filtered fill port
  - Filtered breather cap
  - Clean out covers/manway access
- All hosing, fittings, and tubing necessary to complete the system. Hoses will be pressure rated rubber “Aeroquip” or “Gates” hydraulic hose line. All standard cleanliness and “pigging” procedures will be followed in hose construction and installation.

The installation of the hydraulics system will be performed in a clean environment. All hydraulic fluid will be filtered during the initial system fill process. The hydraulic reservoir will be installed to apply as much NPSH to hydraulic pump suctions as possible. During startup all component case drain pressures will be monitored to insure correctness of installation and health of the system.

## 2.3 Pressure Pumping Equipment

### 2.3.1 Quintuplex High Pressure Service Pump

Installed at the rear of the unit will be one (1) new Gardner Denver GD2500 Quintuplex configured as follows (Please note that we can change to a different plunger size and/or pump brand per Client preference)

- 4.5 " Plungers
- 8" Stroke
- 6" “Zoomie Style” Suction manifold
- 6.353 : 1 gear reducer ratio
- GWB 390.60 Series heavy duty input flange
- Two (2) 3" 1502 threaded female discharge flange connections
- Two (2) 2" 1502 threaded female gauge connections for pressure transducer and relief
- Power End case breather cap



### 2.3.2 Power End Lube System

A power end lube system will be installed per Gardner Denver recommendations to supply lubrication to pump power frames and power frame internals. It will meet the following specifications:

- Gear type pump supplying specified lubrication at 60 GPM max @ 150 psi to the PE Lube inlet port
- Lubrication Reservoir configured as follows:
  - Carbon Steel Construction
  - 150 gallon capacity
  - Sloped bottom w/ drain ports for easy water drainage
  - Internal baffling to stabilize gear oil returns and suctions
  - Removable suction strainer assembly, externally mounted
  - Spin-on filter manifold accessible for servicing
  - Level gauge visible from side of the unit
  - Oil temperature sensor installed in drain return
  - Filtered fill port
  - Filtered breather cap
  - Clean out covers/manway access
- Dry-Sump system
- PE Lube manifold w/ pressure and temperature senders

### 2.3.3 Plunger Lube System

An automatic plunger greasing system will be installed to lubricate the plungers of the Quintuplex pump. This will be a Bekamax type grease pump with the following features:

- Individual positive displacement pump element for each plunger
- Automatically engages when transmission is put into gear
- Automatic grease delivery protocol based on plunger cycles



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- Weather-tight enclosure
- Remote grease-fill bulkhead fittings installed to maintain cleanliness
- Grease reservoir level and grease pump operation visible from operator area
- Mounted to rubber isolated backing plate per manufacturer requirements
- Grease “catch-pan” installed under the open plungers to collect expended grease

### 2.3.4 Low Pressure Suction Manifold

Installed on the suction manifold of the downhole pump will be a 6” “Zoomie” manifold with a 6” Victaulic connection on its intake.

### 2.3.5 High Pressure Discharge Manifold

Installed on the 3” discharge flanges of the downhole pump will be a common wrap around “Bridle-Type” downhole discharge manifold comprised of high-pressure 3” 1502 field iron.

Other iron configurations are available upon request.

### 2.3.6 Gauge Manifold

Installed on the two (2) high pressure 2” gauge connections on the top side of the fluid end will be the following high pressure components:

- One (1) 2” 1502 Bull Plug w/ hammer nut
- One (1) Electrical Pressure Transducer w/ hammer nut

### 2.3.7 Service Platform Option

Installed underneath the downhole pump will be a roll-out service platform to allow operator access and service of the Fluid End. Details are as follows:

- 500 LB Capacity
- Installed on Fluid End Side (Curb Side) of unit beneath downhole pump



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- Steel Tubing Construction w/ no-slip fiberglass grating decking
- Single-Pin Locking mechanism for stowing the platform
- Removable handrail and ladder assembly for operator access

## 2.4 Fluid Handling System

### 2.4.3 Low Pressure Piping

The low pressure piping system of this unit will be constructed as follows:

- Standard SCH40 Pipe & Fittings, Carbon Steel
- Standard 150lb weld neck flanges
- Welding & weld testing performed per fabricator pipe welding specs
- All butterfly valves to have steel bodies, buna seals, SS stems
- All piping runs properly braced, and “broken” into manageable pieces via Victaulic Clamps

The suction/boost manifold of the Quintuplex Pump will be piped as follows:

- The suction end facing the rear of the unit will be connected to a 6” manifold consisting of a single pipe run secured to the suction manifold by Victaulic clamp. The pipe run will extend to the rear of the trailer and will bull-head into a 6” pipe manifold with two (2) 4” Figure 207 hammer union connections isolated by two (2) 4” butterfly valves, manually actuated.

## 2.5 Control System

### 2.5.1 Operator Console

Installed in the middle of the unit on the road side, between the transmission and Quintuplex pump, will be an operator console that allows the unit operator to control the unit systems. The operator console specification is as follows:

- Stainless or brushed aluminum construction



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- Weather tight
- Accessible from the ground

## 2.5.3 Controls Package

The controls package on this unit will be a Prophet Pump Controller with various remote control options depending on whether the customer intends to run a single pump, daisy chain, or a star arrangement back to the Data Van. Details of the NRG control package are available upon request.

Installed near the control console will be a mechanical gauge panel to monitor the following unit parameters.

- One (1) Fuel Level Gauge
- One (1) Engine Oil Pressure Gauge
- One (1) Engine JW Temperature Gauge
- One (1) Transmission Pressure Gauge
- One (1) Transmission Temperature Gauge
- One (1) Hydraulic Charge Pressure Gauge
- One (1) Hydraulic System Pressure Gauge
- One (1) Hydraulic Temperature Gauge

## 2.6 Cold Weather Package Option

Quoted as an option to the unit will be a diesel fired JW heater and circulation system to assist in unit operations in extreme cold weather conditions. It will consist of:

- One (1) 104K BTU/HR Diesel Fired Webasto Heater
- Two (2) Immersion Heaters in the PE Lube Reservoir
- One (1) Immersion Heater in the Fuel Tank pulling suction
- One (1) Immersion Heater in the Hydraulic Reservoir
- Coolant Collector Manifold for 3512C Engine
- Power supply kit



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- All insulated hoses and fittings required to complete the system

### 3.0 Unit Completion & Delivery

#### 3.1 Customer Paint Scheme

The unit will be painted with the industrial paint scheme as specified by the customer:

#### 3.2 Unit Lighting

The unit will be equipped with adequate work lights (qty 5) placed strategically on the unit to illuminate the unit work zones and surrounding area.

#### 3.3 General Assembly Practices

The following general procedures will be used in the design and assembly of this unit:

- All hosing or wiring in contact with any metallic surface will be protected with rub guard(s)
- All hosing or wiring in close proximity with hot surfaces (i.e. engine exhaust manifold) will be secured to a heat-shielded cable mount
- All fuel lines will be shielded, secured, and routed to avoid any rubs or contacts
- All hosing systems will be produced and recorded as system kits, and are re-producible
- All wiring systems will be produced as molded cables and recorded as system kits
- All hosing and wiring will be labeled or tagged on both ends for easy identification
- Grade 8 or Grade 10.9 marked bolting and hardware will be used for unit assembly
- Trace-able quality documents will be maintained for assembly process and components

#### 3.4 Unit Documentation

The following documentation will be provided with each unit:

- One (1) bound paper copies of the Unit Operations and Service Manual



19950 Hufsmith-Kohrville Rd ☐ Tomball, TX 77375 ☐ (281) 320-2525

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- One (1) electronic copies (on CD) of the Unit Operations and Service Manual
- A complete unit BOM/Catalog included in Operations and Service Manual for quick reference and procurement of replacement parts