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TECHNICAL SPECIFICATIONS FOR TRAILER MOUNTED TWIN PUMPING UNIT MODEL YLT70-1900

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1.0 INTRODUCTION

This specification covers the elements of design, fabrication, testing and documentation of a Model YLT70-1900 Trailer Mounted Twin Pumping Unit that is capable of holding, mixing and pumping **INHIBITED** acids and other well servicing fluids into oil and gas wells. The unit is suitable for towing via a fifth wheel trailer attachment by a **CUSTOMER SUPPLIED** tandem axle Truck Tractor.

TYPICAL ONLY

This unit shall be suitable for use in ambient temperature ranges of -40 to +122 ℉ (-40 to +50 ℃). The proposed unit will include the following main components:

ITEM	QTY	DESCRIPTION
Carrier	1	Tridem (3) Axle fixed gooseneck, “single drop” trailer
Deck Engine	2	CAT C27 rated at 950HP @ 1800 RPM
Deck Transmission	2	Allison 8610 OFS
Cooling System	2	Vertical radiator with Mechanical Fan Drive
Auxiliary Gearbox	2	Fuller AT 1202
High Pressure Pumps	2	JEREH 1000QS Quintuplex Pumps (Short/Compact Version) with 3.5” plunger
Centrifugal Pump	2	6” × 5” × 11” Centrifugal Pump
Hydraulic System	1	Open Type
Pneumatic System	1	94 to 109 psi (0.65 to 0.75 MPa)
Lubrication System	1	JEREH Standard
Electrical System	1	24 V
High Pressure Manifolds	1	2” FIG 1502, 15,000 psi (103.4 MPa)
Low Pressure Manifolds	1	150 psi (1.03 MPa)
Displacement Tank	1	32 bbl (5m^3) Total Capacity, 2 Compartments with

		hydraulic paddles
Data Acquisition	1	JDAS software with data acquisition laptop

2.0 UNIT DIMENSIONS

The approximate physical dimensions of the completed unit will be as follows:

- Length: 57' 5" (16.5 m)
- Width: 10' 10" (3.30 m)
- Height: 14' 1" (4.3 m)
- Weight: 101,412lbs (46,000 kg)

NOTE:

All weights and dimensions are estimates only and subject to change upon finalization of the design process.

3.0 CARRIER

This will be a Tridem (3) axle, fixed gooseneck “single drop” trailer with fifth wheel towing attachment that will have the following **TYPICAL** features:

- Heavy duty type with steel “I” section (outer) beam main rails and cross member construction.
- Tridem (3) axle “Air Ride” type suspension, each axle rated 25,350 lb (11,500 kg)
- Cam style spring loaded air brakes with ABS system
- Brake chambers and parking brakes mounted above the axles
- Quantity twelve (12) 275/70 R22.5 radial, tubeless tires on steel rim wheels
- Two speed manually (crank) operated landing gear at the front of the trailer
- 2” (50 mm) King Pin assembly (the height of the King Pin will be 55" (1.39 m) from the ground
- Lights and reflectors that will meet DOT standard
- 12 VDC electrical system
- Air/electric QD tractor/trailer connections
- Fenders front and rear with mud flaps all round, checker plate/fiber-grate decking where applicable and rear bumper
- All required equipment mounts

4.0 FUEL SYSTEM

Installed on the Unit will be a 317 gallons (1200 liters) minimum capacity fuel system/fuel circuit. The Unit fuel circuit will include fuel water separators with drains, fuel suction and return lines will be of adequate size to minimize restriction. This fuel system shall provide diesel fuel to the two Deck Mounted Diesel Engines.

5.0 UNIT POWER SYSTEM

Power for the unit shall be provided by two Power systems that shall each include a CAT C27, diesel engine, a fan cooled radiator an Allison 8610OFS Transmission, an Auxiliary Fuller two speed Transmission and a hydraulic system. Details of these components are as follows:

5.1 Diesel Engine

These shall be CAT C27, turbocharged, 27 L (1,648 in^3) total displacement, 4-cycle, 12-cylinder V configuration, turbocharged, high speed, water cooled, direct fuel injection, electronic type diesel engines operating at up to 1800 rpm and rated at 950 hp at 1800 rpm. Each Diesel Engine shall be equipped as per the following:

- Single stage, dry type air filters with replaceable cartridges.
- Alternator 24 volt
- Electric starter
- Air Compressor
- Engine lube oil system includes an engine driven lube oil pump, engine coolant cooled lube oil cooler and replaceable pleated paper type lube oil filter elements.
- Positive emergency kill air shut off device activated on engine over speed or emergency stop.
- Shutdown system for low oil pressure, high water temp and engine over speed.
- Electronic governor/engine controller
- Engine throttle to revert to idle in case of High Pressure Pump over pressure
- J1939 CAN communications bus.

5.2 Transmission

Installed on the flywheel of the above Diesel Engines shall be an Allison 8610OFS five effective speeds Transmission. This Transmission shall be equipped as per the following:

- External transmission tube and shell type engine coolant to transmission oil cooler.
- Remote transmission oil filter
- PTO's for the hydraulic system and the High Pressure Pump Power End Lube Pump
- Neutral start
- Transmission to shift to neutral in case of High Pressure Pump over pressure
- Operational Transmission Ratios:
  - 1st –4.24:1
  - 2nd –2.32:1
  - 3rd –1.69:1
  - 4th –1.31:1
  - 5th – 1.00:1

5.3 Engine/Transmission Mounting

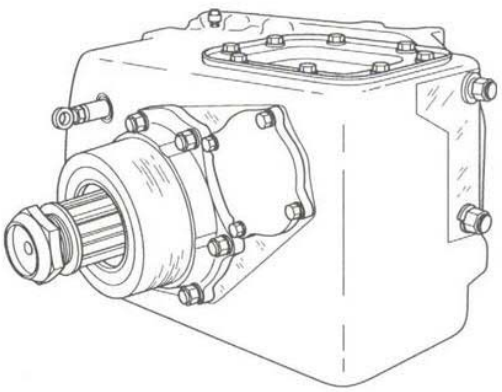
Sub frame mounted with a Transmission mounting arrangement will allow the transmission to be removed with the engine in place, and will allow access to the Transmission strainer for servicing.

5.4 Auxiliary Fuller Gearbox

Installed in-between each of the Allison Transmissions and the High Pressure Pumps will be a Fuller AT1202 (or equivalent) two speed auxiliary gear box. These Auxiliary gearboxes will have the following typical features:

AT-1202:

- Auxiliary transmission eliminates gear splitting – select 2.04 reduction for rough off-road hauls, or 1.00 direct for highway operation.
- Single shift bar control or optional 2- or 3-position air control.
- AT-1202 auxiliary is rated at 17,500 lb-ft input torque, 35,700 lb-ft output torque when in the 2.04:1 reduction ratio.
- Proven reliable performance with twin countershaft design.
- Speedometer drive provision in rear bearing cover.



Speeds: Two forward – 2.04 low, 1.00 high

Capacity:

Input: 17,500 lb.ft. Torque

Output: 35,700 lb.ft. Torque

Weight: 353 lb

Length: 16.5 in

Power Take-Offs:

- Top – SAE heavy duty type, 8-bolt.
- Bottom – SAE standard, 6-bolt.

PTO Drive Gears: Tom and Bottom – a 30-tooth 5 pitch gear turning at .933 of input speed.

Mountings:

- Front – bearing cover machined for trunnion mounting.
- Rear – Two 5/8" studs, two on each side of case.

5.5 Drive Shaft

The Allison Transmission shall connect to an Auxiliary Gearbox and the High Pressure Fluid Pump via a Spicer (or equivalent) drivelines installed as per the driveline manufacturer's recommended installation guidelines. Installed above each driveline shall be a removable metal guard with hinged access openings for access to driveline grease points.

5.6 Cooling System

Each Diesel Engine cooling shall be accomplished by a vertically mounted radiator with a coolant expansion tank, direct belt driven fan assembly. The engine radiator is capable of cooling the engine at up to 122 ℉ (50 ℃) ambient under stationary pumping applications. The Cooling System shall cool the diesel engine jacket water, the diesel engine charge cooling system and the transmission oil. The transmission torque converter pump circulates the transmission oil. The diesel engine fuel is to be cooled by an air to fuel heat exchanger mounted in the vertical cooling package.

5.7 Battery System

Installed on the Unit and installed in a lockable battery box will be a battery system that will include heavy duty maintenance free 12 VDC lead acid type batteries with battery

disconnect switch, pre wired battery cables to the two Diesel Engine 24 VDC electric power systems.

5.8 Pneumatic System

The pneumatic system will consist of an air compressor mounted on each unit mounted Diesel Engine, a common air reservoir, an air dryer, relief valves, air lubricator/ filter/ separator assembly, and required pneumatically operated devices.

The compressed air reservoir will be of adequate size fitted with drains to drain condensed water and will be a carbon steel cylindrical construction. The tank will be fitted with safety valve, tank drain and other components.

5.9 Hydraulic System

The hydraulic system for this Twin Pumping Unit shall be powered from the Allison Transmission PTO Systems and will consist of hydraulic pumps to provide hydraulic power to the Centrifugal Pumps and other Unit hydraulic systems.

Powered from the transmission that drives the LH side Quintuple Pump shall be the following:

- Two Centrifugal Pumps
- Two Agitators inside the Displacement Tank
- Five Hydraulic Plug Valves
- Air conditioner inside Control Cabin
- Three Chemical Additive Pumps
- Three Chemical Additive Tank Agitators

Powered from the transmission that drives the RH Side Quintuple Pump shall be the following:

- Two Centrifugal Pumps
- Two Agitators inside the Displacement Tank
- Five Hydraulic Plug Valves
- Air conditioner inside Control Cabin
- Three Chemical Additive Pumps
- Three Chemical Additive Tank Agitators

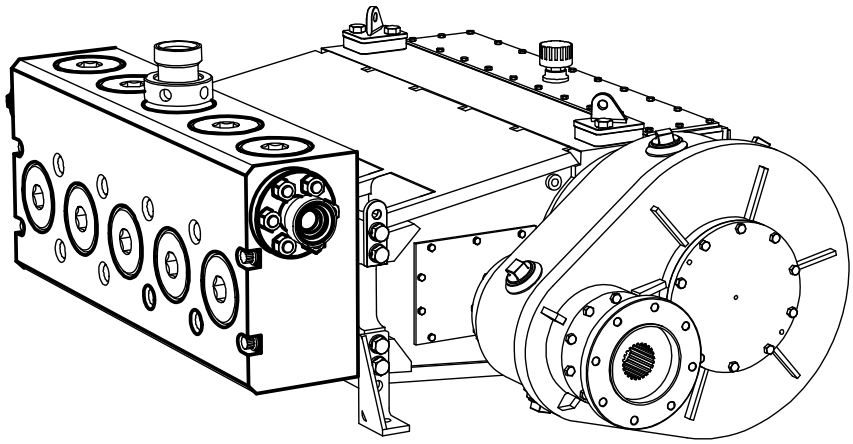
Required control valves for these hydraulic functions will be installed on the Unit Control Consol. The hydraulic tank will be of adequate size for the operation of the open loop hydraulic systems. The suction ports from the tank will be fitted with minimum 80 mesh screens located inside the tank. The suction lines coming out of the tank will be fitted with isolation valves. The tank fill port/breather will be of adequate size. This hydraulic system will include all other required accessories including a hydraulic oil cooler, hydraulic temperature and pressure gauges, control valves, relief valves, hydraulic hoses and other components.

6.0 HIGH PRESSURE PUMPING SYSTEM

6.1 Quintuple Pump

Installed at the rear of the unit in a back to back configuration will be two JEREH1000QS Quintuple Pumps.

TYPICAL ONLY



Standard features of each of these Pumps are as follows:

- Dry Sump with drain fitting for external reservoir
- Left or Right Gearbox Mounting
- Autofrettage fluid end
- Header Ring Spring loaded self-adjusting packing
- Wing guided valves
- One-piece hardened Colmonoy plungers
- Five Internal hex suction cover nuts
- One Internal hex discharge cover nuts

- One discharge cover nut with 2”, Fig 1502 WECO gauge connection and 2” Fig 1502 “Y” fitting for use with a Totco/MD Gauge Protector (for connection to Totco/MD Pressure Gauge) and an Analogue (Viatran type) Pressure Transducer (for connection to the Control System)
- One discharge cover nut with 2” Fig 1502 WECO connection for use with a 2” Pressure Relief Valves (with low pressure relief piping to the Return Manifold/Displacement tank)
- 2” 1502 WECO type discharge flange connection on each end
- Suction Manifold with Victaulic type or flange connections on each end
- The packing adopt electric lubrication device (5 ports). The system is arranged reasonably and convenient for maintenance
- Two pumps will be equipped with 3.5” diameter plungers

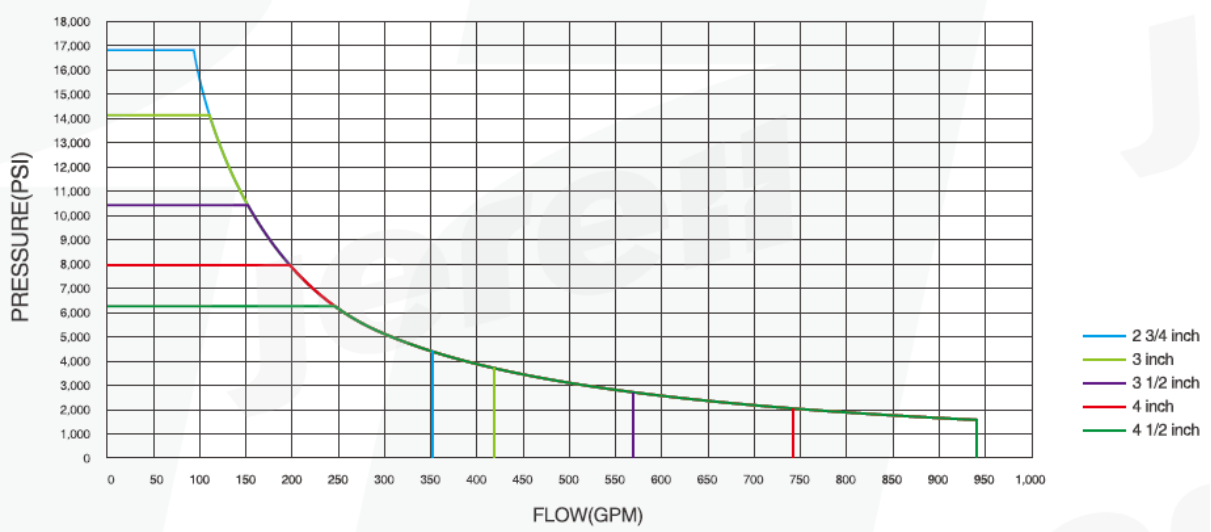
  Note:

  Different sized plungers as per the Customers’ requirements may be supplied.
- Standard Intermittent Pump Performance Ratings as follows:

PLUNGER DIA	DISP.	GALLONS PER MINUTE (GPM) AT PUMP REVOLUTIONS PER MINUTE (RPM)											
		50		100		119		200		300		450	
in (mm)	Gal/Rev (L/Rev)	GPM (LPM)	PSI (MPa)	GPM (LPM)	PSI (MPa)	GPM (LPM)	PSI (MPa)	GPM (LPM)	PSI (MPa)	GPM (LPM)	PSI (MPa)	GPM (LPM)	PSI (MPa)
2 3/4 (69.9)	0.77 (2.9)	39 (146)	16838 (116.1)	77 (292)	16838 (116.1)	92 (347)	16767 (115.6)	154 (584)	10017 (69.1)	231 (876)	6678 (46.1)	347 (1314)	4446 (30.7)
3 (76.2)	0.92 (3.5)	46 (174)	14286 (98.5)	92 (347)	14084 (97.1)	109 (413)	14152 (97.6)	184 (695)	8384 (57.8)	275 (1042)	5609 (38.7)	413 (1564)	3735 (25.8)
3 1/2 (88.9)	1.25 (4.7)	62 (236)	10599 (73.1)	125 (473)	10366 (71.5)	148 (562)	10423 (71.9)	250 (946)	6170 (42.6)	375 (1419)	4114 (28.4)	562 (2128)	2745 (18.9)
4 (101.6)	1.63 (6.2)	82 (309)	8014 (55.3)	163 (618)	7950 (54.8)	194 (734)	7951 (54.8)	326 (1235)	4732 (32.6)	490 (1853)	3148 (21.7)	734 (2780)	2102 (14.5)
4 1/2 (114.3)	2.07 (7.8)	103 (391)	6380 (44.0)	207 (782)	6260 (43.2)	245 (929)	6296 (43.4)	413 (1564)	3735 (25.8)	620 (2345)	2488 (17.2)	929 (3518)	1655 (11.4)
BRAKE HORSEPOWER (HP/KW)		421/314		842/628		1000/746		1000/746		100/746		1000/746	
INPUT SPEED (RPM)		231		461		548		922		1383		2075	

Note: Based on 90% ME and 100% VE-Intermittent service only

For detailed unit performance specifications see the attached Performance Data and Curves.



6.2 High Pressure Pump Power End Lubrication System

Power end lubrication to be provided by a transmission mounted accessory drive PTO hydraulic pump.

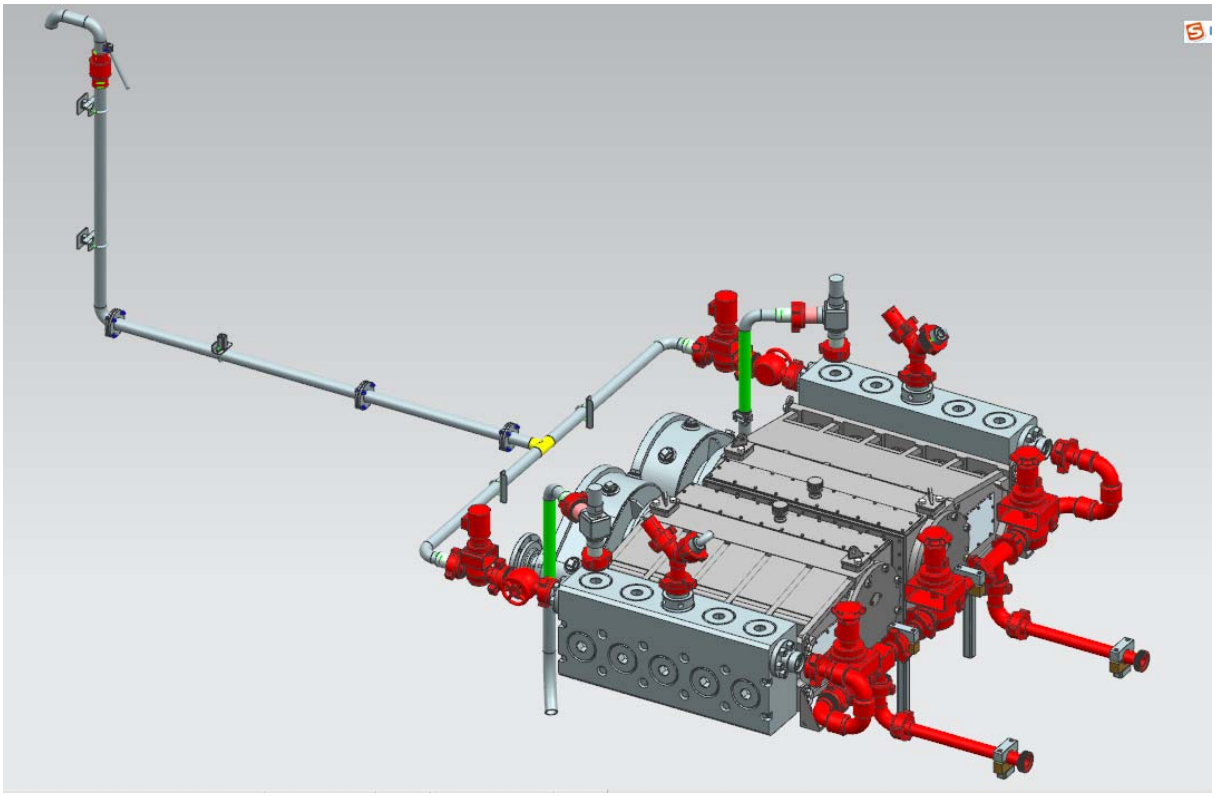
Note:

This lube system will be automatically activated whenever the diesel engine is operating to provide lubrication of the High Pressure Pump power end under all operating conditions). This lubrication system will include all required accessories including steel lubrication tanks (that will be of adequate size to hold lube oil for the a High Pressure Pump as well as provide cooling of the lube oil) with oil level indicator, valved drain, suction filters, lube oil pressure and temperature gauges, relief valve, lube oil hoses and other components.

6.3 High Pressure Piping System

This High Pressure Piping System will include a Discharge Manifold towards the rear of the Unit and a Return Manifold towards the Displacement Tanks. This high Pressure Piping System will be generally as follows:

TYPICAL ONLY



The Discharge Manifold will be an “H” type manifold, be rated 15,000 psi and will include 2” FIG 1502 Pipes, Fittings, Swivels and 2” x 2” Hydraulic Plug Valves.

The Return Manifold will include 2” x 1” Hydraulic Plug Valves for return to either of the Displacement Tanks via a manually controlled 2” low pressure (150 psi) swivel.

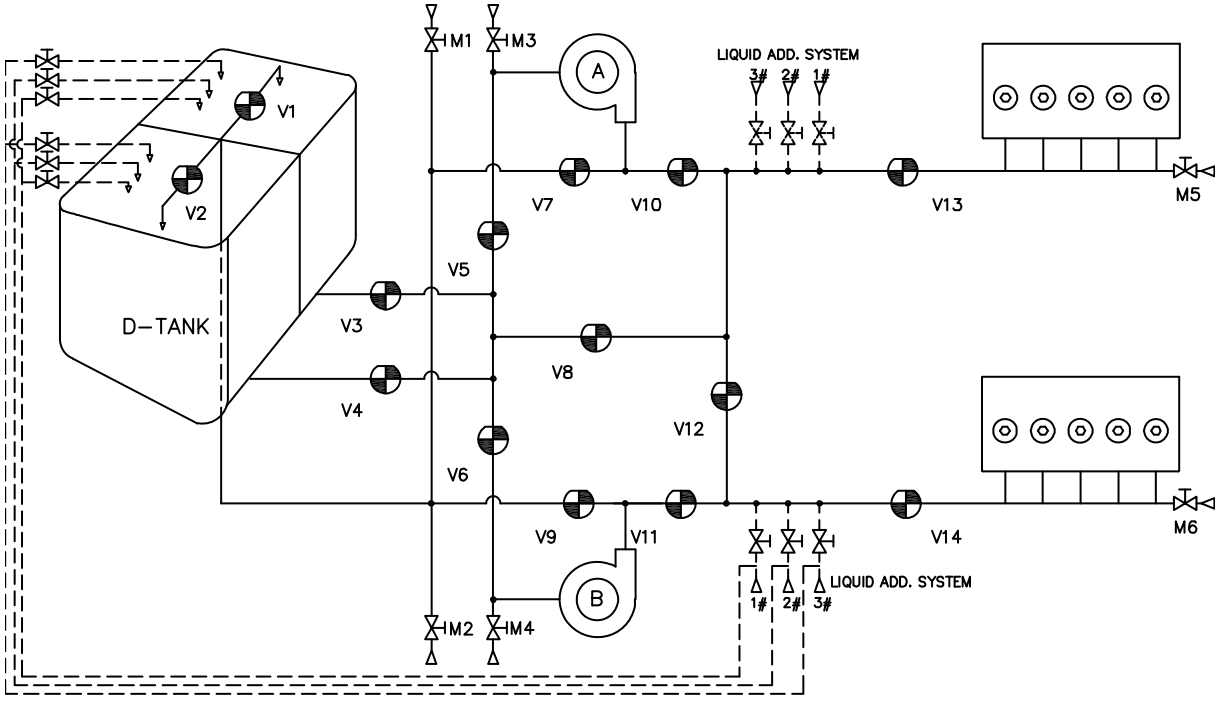
Installed on each Quintuplex Pump will be a 2” FIG 1502 Pressure Relief Valve with the discharge side of each of these Pressure Relief Valves being plumbed to discharge to the underside of the Trailer.

7.0 LOW PRESSURE PUMPING SYSTEM

This Low Pressure Piping System will generally be as follows:

TYPICAL ONLY

MANIFOLD PRINCIPLE



7.1 Pumping Piping

This will be rated a minimum of 150 psi (1.03 MPa) and will include all required 6”, 5”, 4” and 3” pipe, fittings, flanges, valves and valved drain outlets at piping low points. All external connections will be Fig 206 female (thread half) union connections each with a Fig 206 cap and security chain. Where required valves will be equipped with valve extension handles or air actuators to allow easy remote operator access, installed air actuator controls will be installed on the Control Console.

All manifolds are stainless steel and butterfly valves are fluorinated

7.2 Liquid Additive System

- The system is equipped with 3 chemical additive pumping systems driven hydraulically.
- The manifold layout and installation position of the liquid additive pumps ensures the smooth additive supply. All the chemical additive systems are equipped with flow meters and control devices. The liquid additive pumps can be controlled manually and automatically. There are quick disconnects installed on both ends of the liquid additive pumps.
- Suction Type: The chemical additive pumps can suck in additive from both the chemical additive tanks at the rear of the trailer and the chemical additive tanks on the ground.

- Discharge Type: The chemical additive pumps can discharge the fluid to the displacement tank and the discharge manifold of the centrifugal pumps.
- Control Type: Manually or automatically proportional control inside the control cabin.
- All the chemical additive pumps should be acid and alkali resistant, hydraulically driven and equipped with discharge check valve and control devices.
- There are three chemical additive tanks with level meters on the gooseneck platform. The volume of one chemical additive tank is 330 gal(1500L) and the volume of the other two tanks is 165gal(750L) each. There is an agitator inside each chemical additive tank..

7.3 Displacement Tank

This will be a two (equal size) compartment open topped rectangular with sloped bottom, stainless steel tank that will be mounted crosswise on the unit. This tank will have a total operational capacity of 32 bbl (5 m^3) and will include steel gauge sticks (marked in 0.5 barrel increments on one side and in 100 liter the other side), valved overflow lines and valved drains. Installed on the tank will be a 3" valved fill line, hydraulically driven Paddles/Agitators will be installed in each of these sections.

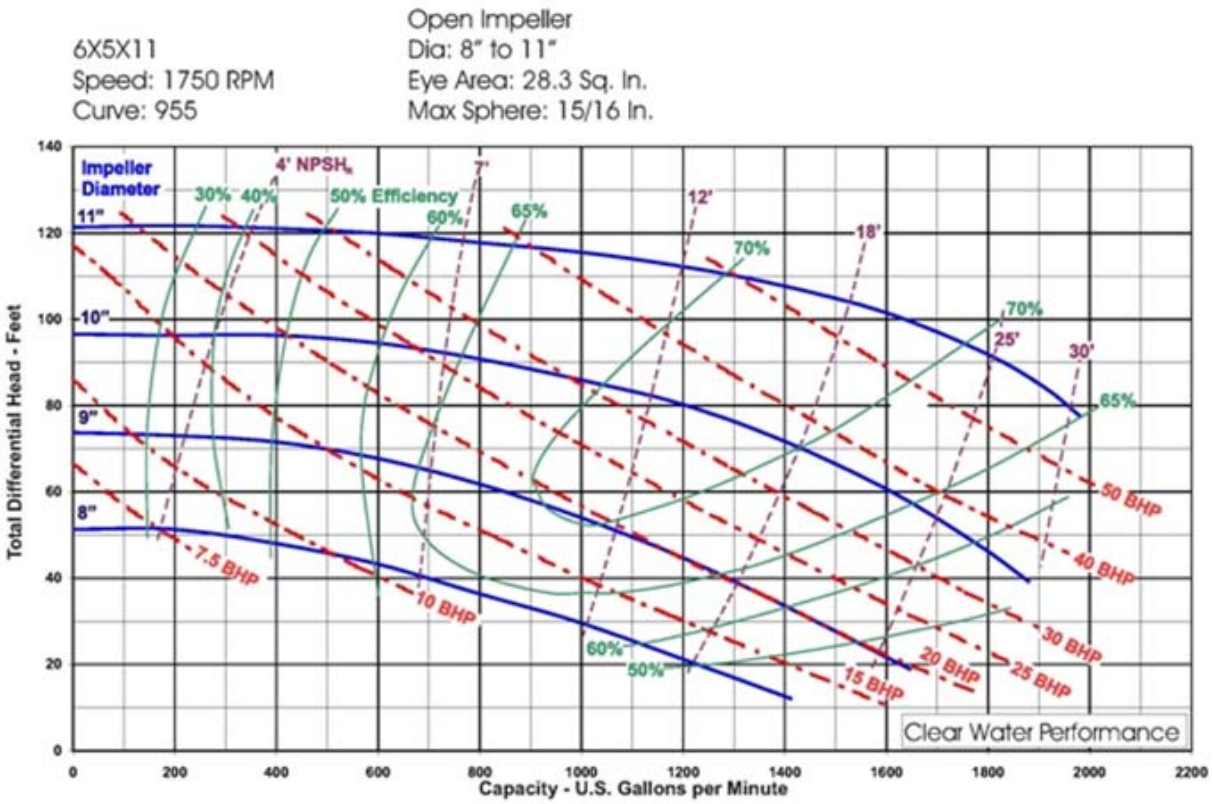
Note:

The unit is not designed for transport with fluid in the Displacement Tank.

7.4 Boost/Fill Centrifugal Pumps

Installed on the unit will be two, hydraulically driven 6×5×11 Centrifugal Pumps as follows:

TYPICAL ONLY



8.0 CONTROL SYSTEM

The unit will be controlled locally from a Control Console installed in the unit mounted Control Cabin.

8.1 Control Platform and Tank Access Deck

Installed towards the rear of the Unit behind the Displacement Tank will be a carbon steel Control Platform and Displacement Tank Access Deck that will allow an operator access to both the Control Cabin and the Displacement Tank. This Control Platform and Displacement Tank Access Deck will have the following features:

- structural steel framework
- fiber-grate decking
- safety rails
- Slide style access ladder with grab handles

8.2 Control Cabin

Installed on the Control platform and Displacement Tank access deck will be a Control Cabin that will have the following features:

- A structural steel frame, aluminum skin and be fully insulated

- Access steps with a handrail
- Internal lighting will be 24 VDC LED type
- Operator seating will be installed

8.3 Control Console

Installed in the Control Cabin will be a carbon steel Control Console with a fully engraved in English stainless steel Control Panel. This Control Console will be supplied with all necessary controls and indication devices for the full and complete operation of this unit during all phases of Pumping operations.

Installed on this stainless steel Control Panel will be an Engraved and labeled copy of the Low and High Pressure Pumping Systems Piping Arrangement clearly showing the Pneumatic Operating switches/status for the Valves with Air Actuators. Also installed in this Control Console will be Siemens touch screens/PLC system with external Data Port that will store that will continuously store up to 23.14 hours of Job Data and display the following:

- Two (2) High Pressure Pump flow rate/total
- Two (2) High Pressure Pump Pressure
- Two (2) user selectable Over-Pressure Shutdown displays that will activate an instant idle (engine) / instant neutral (Transmission) situation.

At the conclusion of a Pumping operation this data may be downloaded and transferred to a PC computer/DAS unit/USB flash-drive date storage device via the external data/USB port that is installed on the Control Console for reviewing/printing after the completion of the Pumping Operation.

Control devices for the unit will be installed on the Control Console will include the following:

- Main power switch
- Two (2) Diesel Engine stop/start switches
- One (1) Diesel Engine emergency kill switches
- Two (2) Diesel Engine throttles
- Two (2) Transmission Shifters
- Two (2) Auxiliary Transmission shifters
- Two (2) PTO Controls
- Two (2) Centrifugal Pump Controls

- Light switches
- Valve actuator on/off controls
- All other required control devices

Also installed on the Control Console will be the following indication devices:

- Two (2) Diesel Engine EDM Display Modules each to provide the following information:
  - tachometer/hour-meter readout
  - oil pressure readouts
  - water (coolant) temperature readouts
- Two (2) Transmission oil pressure/temperature
- Hydraulic oil pressure
- Two (2) sets High Pressure pump lube oil pressure/temperature
- Two MD/Totco 6" Dial 0-15,000 PSI pressure gauges
- All other required indication devices

The above devices will be permanently engraved/ labeled in English

8.4 Data Acquisition System

Supplied with the Unit will be one Notebook PC Computer that will have copy of the Jereh Data Acquisition Software. Purposes from the above detailed Siemens touch screens/PLC system.

The Jereh Data Acquisition Software that will be installed on the above Notebook PC Computer will be a Data Acquisition Graphical Software suite that is suitable for Data Acquisition from Cementing Units, Acidizing Units, LN2 Nitrogen Pumpers, Fracturing, Sand Blender Units, Hydration Units, LAS, Coiled Tubing Units and other oil well service equipment. This Data Acquisition Graphical Software suite will have the following features:

- Windows based.
- Digitally records and stores in real time the various Data Inputs
- Graphically displays for charting and trending in real time the various Data Inputs
- Output/print the recorded data as Excel data sheets and printable curve diagrams
- Multiple display modes, i.e. split-screen displays, curves, digital alpha-numeric
- Unlimited theoretical number of channels
- Compatible with various third party analysis software suites

- Capable of switching between metric and imperial Unit in real time
- Real-time editing of displayed graphics and curves
- Designed for operators (easy to use)
- Updates once a second Replay jobs
- Data editing
- Adjustable Time Spans
- Local real time data and time indication
- Real-time recording
- Append and pause files during operation
- Multiple function inputs
- User-defined X-Axis
- Zoom and scroll features on graph
- Elapsed time and reset
- Process real time/replay data

Typical Inputs are as follows:

- Two (2) High Pressure Fluid Pump Flow Rates
- Two (2) High Pressure Fluid Pump Flow Totals

Typical Calculated Outputs (Math Channels):

- Flow Totals
- Cumulative Total

9.0 ELECTRICAL WIRING & LIGHTING

- All required wiring will be installed and be properly marked and identified.
- All the circuit breakers will be located for easy access.
- All the junction boxes will be of stainless steel construction if required.
- There will be a minimum of six (6) LED work lights positioned to provide light for unit maintenance and operation

10.0 UNITIZATION & COMPLETION

Unitization and completion will include the following miscellaneous items:

- Treating Iron and Hose racks for Customer supplied Treating Iron (Customer to advise)

- One weather and dust proof lockable steel toolbox
- Fire extinguisher with mounting brackets
- Unit will be equipped with one spare carrier/tire/wheel assembly with up/down lift device for easy pick up and installation of the spare tire.
- Unit will be equipped with all required warning, emergency, flashing, hazard clearance, back up and other required lights and all required safety signs.
- Unit axle loadings will not exceed axle rated load capabilities.
- All gauges and instruments will read in either Imperial and Metric standards or in Imperial only and be labeled in English
- All instrumentation shall be weatherproof, dust proof and vibration protected.
- All equipment will be built under the Quality Standards of ISO 9001 and all latest relevant/applicable manufacturing standards.
- Prior to shipment the unit shall be fully tested (with water only) at the Jereh facilities

11.0 PAINT

The Unit will be sand blasted (where required) primed and finish painted after the completion of final testing according to the customer paint color requirements.

All corrosion resistant surfaces such as stainless steel/aluminum etc. surfaces, hoses and hose fittings will not be painted.

12.0 LUBRICATION AND FLUIDS

Lubrication fluids chart (permanent sign attached to unit) will be provided listing fluids and lubricants that the Equipment requires. The chart to state that before using any other fluid type, the relevant Operation and Maintenance Manual must be consulted. Fluids to be identified by generic name (i.e. hydraulic oil) near the fill port for each fluid. The lettering will be in English, will be black on a white or stainless steel background.

13.0 DOCUMENTATION

JEREH will furnish one (1) hard document copy and one electronic (CD) copy in the English language per unit of the Operation and Maintenance manuals. These Operating and Maintenance manuals shall contain the following:

- Lubrication schematic with service parts list.
- Hydraulic schematic with service parts list

- Pneumatic schematic with service parts list.
- Electrical schematic with wiring diagram and service parts list.
- Fuel system schematic with service parts list
- Piping schematic with parts list.
- Software manuals
- Operating/Maintenance/Parts/Service manuals

14.0 STANDARD SPARE PARTS

14.1 Standard Spare Parts for Engine

Item	Name	Qty.	Remarks
1	Air Filter Element	4pc	
2	Diesel Primary Oil Filter	2pc	
3	Diesel Secondary Oil Filter	2pc	
4	Fan Belt	2pc	
5	Engine Oil Filter Element	4pc	
6	Generator Belt	2pc	

14.2 Standard Spare Parts for Transmission

Item	Name	Qty.	Remarks
1	Transmission Oil Filter Element	4pc	

14.3 Standard Spare Parts for Hydraulic Oil Tank

Item	Name	Qty.	Remarks
1	Return Oil Filter Element	2pc	
2	Suction Oil Filter Element	2pc	

14.4 Standard Spare Parts for Power End Lube Tank

Item	Name	Qty.	Remarks
1	Suction Oil Filter Element	2pc	

14.5 Power End Lubrication Pipe Standard Spare Parts

Item	Name	Qty.	Remarks
1	Low Pressure Pipe Filter Element	2pc	

14.6 Plunger Pump Parts

Item	Name	Qty.	Remarks
1	O ring, flange end surface	4pc	
2	O ring, discharge flange	4pc	
3	Valve spring	20pc	
4	Valve insert	20pc	
5	D seal, discharge/suction cover	20pc	
6	Packing set	10sets	Including 6.1-6.8
6.1	Retainer ring	10pc	
6.2	O ring	10pc	
6.3	Retainer ring	10pc	
6.4	O ring	10pc	
6.5	Header ring	10pc	
6.6	Top adapter	10pc	
6.7	Pressure ring	10pc	
6.8	Wiper ring	10pc	
7	Pony rod seal	10pc	

15.0 Standard Tools

15.1 Common Tools Package

Item	Name	Qty.	Remarks
1	SAE Combination Wrench, 14 pc	1set	
2	Metric Combination Wrench, 14 pc	1set	
3	SAE Ball driver Allen Wrench, 12 pc	1set	
4	Metric Ball driver Allen Wrench, 9 pc	1set	

Item	Name	Qty.	Remarks
5	Adjustable End Wrench, 12"	1pc	
6	Filter Wrench, Strap	1pc	
7	Sledge	1pc	8 lbs

15.2 Plunger Pump Tools

Item	Name	Qty.	Remarks
1	Hexagon spanner	1pc	
2	Cover puller	1pc	
3	Plunger installation tool	1pc	
4	Plunger removal	1pc	
5	Packing nut wrench	1pc	
6	Cover wrench speed tool	1pc	
7	Cover installation tool	1pc	
8	Packing removal	1pc	
9	Drain tool	1pc	
10	Valve removal	1pc	
11	Valve seat puller assembly	1pc	