



Samen Industrial Group (SIG)

**Health, Safety & Environment (HSE)**

Is the Service Company using an "Industry Recognized Brand" certified High Pressure Lines? (*Permian Treating Iron is Not" Recognized by TNK-BP at this time)
Have "All" High Pressure Treating Lines and Connections (Main Treating Line & Annulus Line) Been Pressure tested & charted to ~1000 atm, Documented & Inventoried, complete with Identification Tags attached to each High Pressure component within the last 12 months?
With the exception of "Non Pressure Union" type treating line components, are there any threaded type Main Treating and Annulus Line connections being used?
Have "All" High Pressure Treating Lines and Connections (Main Treating Line & Annulus Line) had a Magnetic Particle Inspection (MPI) or Non Destructive Test, Inventoried, Documented and available for review on the Well Site within the last 12 months?
Have "All" High Pressure Treating Lines and Connections (Main Treating Line & Annulus Line) Been Thickness Tested and conform with Manufacturers Specifications, Inventoried, Documented and available for review on the Well Site? Manufacturers thickness specification documents must also be available on the Well Site for review!
Does the Service Company have any "Needle Type Valves" in the Main Treating Line or Annulus Line?
Are all of the Discharge Hoses from the Blender to the Frac Pumpers rated >120 psi / >~9 bar working pressure and the pressure rating clearly stamped by the Manufacturer on the hose?
Is the Frac Pump 2" Prime Up Hose" and connections rated to a minimum working pressure of 1500 psi 100 bar pressure rating clearly stamped by the Manufacturer on the hose?
Are all of the Discharge Hose 4" unions from the Blender to the Frac Pumper have a double clamp or "crimped" on configuration?
Is the 2" Prime Up Hose complete with High Pressure "Pressed On" fittings on each end of the hose?
Have all of the Discharge Hoses been pressure tested to the maximum working pressure of the hose within the last 12 months?
Do the hoses have attached identification tags complete with date, inventory number and pressure to which the hose was tested too?
Has the 2" Prime Up Hose been pressure tested to the maximum working pressure of the hose within the last 12 months?
Do the hoses have attached identification tags complete with date, inventory number and pressure to which the hose was tested too?
Do all of the Discharge Hoses from the Blender to the Frac Pumpers appear to be in good condition with No "Visible" cracks in the Rubber or Outer Lining of the hose?
Are all of the Discharge Hoses from the Blender to the Frac Pumpers "Clearly" identified as Discharge Hoses so they do not get mixed up with the Blender Suction Hoses?



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If pumping Acid or Hydrocarbons, do all of the discharge hoses have good quality "Hose Covers" that cover the entire length of the hose including the Figure 206 - 4" Hammer Union and do not have rips or holes in the cover?
Has the Service Company tried to achieve the TNK-BP requirement of being >15 meters away from the wellhead with both the nearest Frac Pump and Annulus Pumper?
Was the Frac Team and all 3rd Party Contractors wearing their PPE? (Safety Boots, Glasses, Hardhat, Safety Harness, Goggles, Dust Masks, Chemical Suits, etc)
Are all elevated walk platforms (>1.3 meters) have fall protection devices installed? ( i.e. - Hand Railings )
Is there "Adequate" lighting on location if the Frac was pumped during dark hours?
Are there 2 Functioning, Calibrated Electronic Pressure Transducers (>3% of each other) on the Main Treating Line that are being recorded with the numerical pressure display visible inside the Data Van at all times during the Frac Treatment?
Did the Frac Supervisor Conduct a detailed Safety Meeting with Frac Team and TNK-BP representative prior to pumping the treatment?
Are the Crane Operators & Slingers fully certified as per the TNK-BP Load Lifting & Handling Standard? (Section 5.1 & 5.2)
Are the Cranes certified as per TNK-BP Load Lifting & Handling Standard? (Section 9 & 6.3)
Are all exposed rotating mechanical equipment been guarded or shielded? ( i.e. - Drive Shafts, Fan Blades, Pulleys etc )
Are the Electronic Over Pressure Shutdown systems fully functional and were function tested prior to the commencement of the Frac Treatment?
Has the immediate area of Pressure Operations been secured (barrier tape) to keep out unauthorized personnel?
Does the Frac Location have signs posted in relevant areas with dangers listed to warn personnel?
If pumping Hydrocarbon fluids, is all Frac Equipment including Frac Tanks been grounded to earth?
<b>Frac Equipment Requirements &amp; Procedure</b>
Correct amount of Horsepower / Rate ("Fluid End Size") available and ready to use on location as per Job Design including backup pumper?
Is the Service Company utilizing isolation valves and bleed offs valves on all Frac Pumps?
Is the Service Company using a Flanged annulus connection when connecting to the annulus? (This only applies if the Service Company supplies Wellhead Equipment)



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Are all HP Pump Suctions, Hoses, Manifolds and Blender free of Proppant or other contaminants?
Is the Blender capable of handling Job Designed Slurry, Proppant, Liquid & Dry Additive Rates? "Minimum & Maximum" Job Rates?
Were the Liquid Additive Pumps & Dry Additive Augers (Bucket Tested) calibrated?
Are the "Primary & Backup" Liquid and Dry Additive delivery system on location recorded by the Data Van?
Did the Service Company "Record & Graph" the Calibration (Bucket) test?
Were the Liquid Additive pumps& Flow meters <7% inaccurate on the first calibration test performed?
Were the Dry Additive Augers <7% inaccurate on the first calibration test performed?
Are all Liquid Additive pumps equipped with Mass/Magnetic Type Flow Meters?
Are all "Critical" Liquid Additives being pumped have a dedicated standby backup pump ready to use?
Are there 2 Dry Additive (Breaker) Delivery Systems operational on the blender that are capable of operating at Minimum & Maximum concentrations for the Frac Treatment?
Is there a functioning Magnetic/Mass Type Flow meter measuring Slurry Discharge Rates?
Is the Magnetic/Mass Slurry Flowmeter accurate and does not flucuate >5% during the Frac Treatment?
Did the Service Company perform a "Blender Cycle Test" with all Primary & backup additve pumps and augers, operating in Automatic?
Was there A "Recorded" Loop Test performed on Blender Flow meters "prior" to pumping Main Frac if no Mini Frac was performed ? Was it <7% inaccurate?
If a Mini Frac was performed did both Clean & Slurry Flow meters show <7% discrepancy compared with the physical volume pumped out of the Frac Tank ?
Were both the Clean Fluid & Slurry Flow meters displaying <0.15 m3/min difference during the calibration period and was it recorded by the Data Van?
If Service Company was using a hydration unit, was there a functional, calibrated real time viscometer that was recorded by the Data Van?
If Service Company was using a hydration unit, was there a functional, calibrated real time Ph Meter that was recorded by the Data Van?
Is there a Densitometer on the Blender or Main Treating Line? Is it functional, calibrated & verified on Base Fluid?
Is there is a Minimum of 2 Isolation Valves Installed on the wellhead?



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Is there a Main Line Ground Wheel/Hamer Type Isolation Valve & Check Valve Installed?
Is there a method (Electronic Pressure Transducer) to "Measure & Record" Pressure off the Annulus Pump Unit? Is it functional?
Is there a centrally installed Slurry Sample Catcher complete with a double valve configuration?
<b>Fluid QAQC</b>
Were water samples collected from each Frac Tank and complete Field Water Analysis Tests performed And documented on location?
Have the Fann 50 Tests have been performed with distilled/source water, documented & complete with 10% & 20% sensitivity testing with X-Link & Breaker ?
Fann 50 results have been charted or an electronic copy is on location for review complete with Source water location , Ph & chemical lot numbers?
Does the Breaker Pump Schedule meet with the Temperature & Pump Time requirement of this Frac treatment as per the Fann 50 results?
Was a complete inventory (Mass Balance) of "ALL" chemicals and Base Frac Fluid on location conducted prior to mixing tanks?
Were all Liquid chemicals >15° Celsius without any settling when brought to location?
Was the Base Fluid Temperature >24° Celsius (Summer) and >34° Celsius for winter operations?
Personnel on Location are qualified to perform Field Frac Fluid QAQC Tests? (i.e. - Do they have problems performing the tests?)
Is there a functioning Fann 35 is on location with calibration oil or calibration weights in the Field Lab?
Is there a functioning Electronic pH meter on location complete with 3 different base calibration fluids in the Field Lab? (4.0, 7.0, 10.0)
Is there a functioning Warring or Top Drive Frac fluid blender in the Field Lab?
Is there a functioning Electronic weigh scale on location to weigh dry additives (breaker) for test samples and proppant sieve analysis in the Field Lab?
Is there a functioning "Stop Watch" on location to time test results in the Field Lab?
Is there a functioning temperature controlled Water Bath or Fann 35 Heat Cup in the Field Lab?
Is there a complete Field Water Analysis Kit in the Field Lab consisting of; Iron Testing, Chlorides testing, Hardness Testing (Calcium & Magnesium), Bicarbonate testing and Sulfate Testing?



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If a Liquid Slurry Gel was being used in conjunction with a Hydration Unit, did the Service Company measure the Sp.Gr of the slurry gel and adjust the ratio of Liquid Gel if required?
Did the base gel achieve >90% base viscosity before reaching 2/3 of the tubing volume? (i.e. Known Viscosity (mins) = Tubing Volume (m3) ÷ Slurry Rate (m3/min) x 0.666)
Did all of the above Field Lab equipment operate correctly and was in fact used to test today's Frac Fluid?
Were all of the TNK-BP Frac Fluid field tests performed, results documented on the TNK-BP Version 9.5 QAQC Batch Mix Fluid Form?
Did the Water in the Frac Tanks appear to be free of contaminants floating on the top of the tank prior to mixing?
Did any of the Frac Tanks required to be dumped due to unsuitable water quality to mix the Frac Fluid?
Was the Frac Fluid Batch Mixed correctly to specification the first time attempted?
Was the Frac Fluid, when gelling is complete, free of "Fish Eyes" and with no other apparent emulsions or contaminants?
Were the dry additives moisture free while being added during the Frac treatment?
Were X-Link Fluid & Slurry Samples collected during the Frac treatment?
Were Slurry samples measured for pH and temperature? Were the results recorded on to the TNK-BP QAQC Sheet?
Was a complete inventory (Mass Balance) conducted after the Frac was completed on location?
<b>Proppant QAQC Testing</b>
Is there a Service Company Tested Proppant Analysis document complete with Sieve Analysis, Crush Test results, Specific Gravity, Bulk Density with proppant "Lot" numbers on location for review?
Was the Proppant Storage Unit Clean, Inspected and there is no contamination with other Proppants?



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Was the proppant loaded through a mesh <2.54 cm? Did the Blender Hopper also have a proppant mesh <2.54 cm?
Was the Proppant Dry & Clean? No Chunks, Frozen pieces, Plastic & other foreign objects in Proppant?
Is there a set of portable Field proppant sieves on location to test proppant and was the proppant tested? Are the correct sieves in the set? (4 to 60 mesh size)proppant and was the proppant tested? Are the correct sieves in the set? (4 to 60 mesh size)
Did the proppant sieve analysis performed on location meet the API specifications (>90%) and documented?
Was a complete inventory (Mass Balance) of "ALL" proppants on location conducted prior to commencing Frac treatment?
Was a complete inventory (Mass Balance) of "ALL" proppants on location conducted after the Frac treatment was completed?
Was there a set of weigh scales to measure the weight of all remaining proppant after the Frac treatment was completed?
Was there enough separate compartments (Sand Trucks) for proppant so none had to be loaded "On the Fly"?

<b>Data Recording</b>
Did the Service Company record & display 2 Proppant Concentrations & Totals from 2 separate sources? (1 from the Densitometer and the other from Clean vs. Slurry Rate) *Note - Proppant Concentration from Auger rotation is "NOT" a measurement of density!
Did the Service Company record & display 2 Slurry Rates & Slurry Totals from 2 separate sources? * Note - Slurry Rate must include "ALL" fluids pumped down the well including X-Link solution
Did the Service company record and display 1 Annulus Treating Line Pressure?
When using the hydration unit for Frac treatment were the clean and slurry flow meters, liquid and dry additives rates recorded and displayed by the data van?
When using the hydration unit for frac job, did the service company record and display viscosity, pH and temperature?
Did the Service Company record & display 1 Clean Fluid Rate & 1 Clean Fluid Total from the Clean Fluid Flow meter?
Did the Service Company record & display "ALL" additive Concentration Rates & Totals calculated from the Clean Fluid Flow meter?



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Did the Service Company have the ability to record & display "Backup" additive Concentration Rates & Totals calculated from the Clean Fluid Flow meter?
Did the Service company record & display a Calculated Net, Bottom hole & Friction Pressure?
Does the Service Company have the ability to E-Mail a Data File (txt. File) from the Frac Location to TNK-BP Design Engineers?
Was there a Service Company Frac Design Engineer on this Frac Treatment?
Did the Re-design of the Mini Frac on location exceed 2.0 hours after the well was shut in and data recording was stopped?

**Well Site Execusion**

Was there a Pre job Operational meeting conducted with TNK-BP representative & Frac Team?
Were Contingency Plans discussed and documented with the Service Company Supervisor and TNK-BP Auditor for this Frac treatment?
Were the HP Pumps, Treating Lines and Hoses flushed out to a pit or Vacuum truck unit prior to priming up?
Were the HP Frac Pumps primed up in such a way that fluid was circulated from the blender/tanks to the wellhead back to the blender/tanks?
Were all High Pressure Treating Lines Pressure Tested & Recorded successfully within 2 attempts?
Did the Pressure Test hold 95% of the test pressure for >1 minute?
Was the Annulus Pressure Relief Valve set, recorded by the Data Van & Visually witnessed that is was able to release fluid at the set pressure?
Was there a Main Treating line "Check Valve Function" test conducted? Did it hold >30% of the test pressure on the first attempt?
Were the Main Treating Line and Annulus Line rigged up as per TNK-BP QAQC Version 10.0 Pumping Standards?
Did the Service Company complete "ALL" Pressure Testing of surface equipment prior to pumping down the well?
Did the Service Company utilize the ground isolation valve to monitor well pressure (Mini Frac and ISIP) when they stopped pumping?
Did the blender operate in "Automatic Mode" controlled by the onboard computer system?



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Did the Blender proppant concentration or "On the Fly" additive pumps have to be operated in Manual Mode and "Not" Automatic?
Were all of the "On The Fly Additive Rates controlled accurately from the Clean Fluid Flow meter?
Was there at any time during the treatment an "Un-planned" change (Higher or Lower ~100 kgs/m3) in Slurry Density?
Was the Automatic Tub leveling device or similar, functional (clean fluid rate ~0.2 m3/min) during this treatment?
Did the Frac Pumps achieve & maintain the specified job design slurry rates for the entire Frac Treatment?
Was the Mini/Main Frac Treatment pumped to completion without an "Un- Planned" shutdown?
Did "any" of the Frac equipment (HP Pumps, Densometer, Liquid/Dry Additive systems, Blender, Data Van, Hoses etc) fail duringthe treatment?
Did the backup equipment (HP Pumps, Liquid & Dry Additive Pumps) function properly and recorded by the Data Van when required?
Did the Service Company exceed a slurry rate of >3.5 m3/min pumping through 1 - 3" surface treating line?
Was the Frac Treatment completed to >95% (proppant placed in formation) of design after Mini Frac analysis?
Was the Screen out / Sand Off due too equipment failure?
Did the Mini Frac Screen out / Sand Off when the proppant stage entered the perforations?
If the answer to the above question was "Yes", did TNK-BP decide to Re-Perforate this well again?
Did the completion of this Frac Treatment achieve or exceed the "Target" Net Pressure gain after the Mini Frac analysis as per the Frac Design Model?
Was the Frac Treatment pumped to completion as per design? (Final Mass Balance must be compared to answer this question completely and all physical balances must be <5% inaccurate)
Was the Frac Treatment Terminated or Delayed >1.5 hours due to Service Company's lack of QAQC or Calibration of equipment at location or base, logistical failures or equipment failures?

<b>Total Audit Score</b>	
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- 1. Control of EMG designs**
- 2. Monitoring the observation safety at work**
- 3. Control of the EMG machinery and equipment**
- 4. Quality control of the process fluid**
- 5. Quality control of propant**
- 6. Quality control of recording data**
- 7. Control of execution of works**