



PROFESSIONAL FLUID SERVICES, LLC.

M&D INDUSTRIES
OF LOUISIANA

POLY PLUG® PH (PAN HANDLE)

The brown dolomite in the Texas panhandle area varies in depth and the degree of losses. The dolomite section can be more than 3500 ft and losses can range from seepage to complete loss of returns. Operators use different types of LCM and concentrations to prevent losses while drilling vertical wells. Directional wells require a different solution. Directional tools do not work well with the LCM used to seal the dolomite section. The typical LCM is a combination of cotton seed hulls and very coarse fiber when losses are large.

Noble Energy looked for a solution that would seal the dolomite section, reduce the LCM type and concentration to allow directional tools to work efficiently and not require cement or an added casing string. Engineering decided TO use a cross-linked polymer gel with a combination of solids to seal the dolomite section. With the dolomite section sealed, directional drilling could be done with a minimum of small sized LCM and a minimum of time fighting lost circulation and cleaning tools.

Noble Energy contacted M&D Industries and Professional Fluid Services about their Poly Plug® PH product. Poly Plug® PH is a cross-linked polymer gel with a combination of solids in a sack that can be mixed with standard rig equipment and personnel. Poly Plug® PH is designed for shut off treatments into dolomite/carbonate structures.

The dolomite section is drilled with a mix of LCM in the mud. Once through the dolomite section drilling operations stop. Poly Plug® PH is then spotted across the entire dolomite section. Sufficient extra gel is available to allow squeezing the gel into the formation and across the entire zone. After squeezing and allowing the gel to set, the open hole is cleared and the lower direction portion of the well is completed.

The volume of Poly Plug® PH used varies with the height of the dolomite section but the procedures are about the same. After mixing, the Poly Plug® PH is displaced through an open ended drill pipe as a balanced pill while on bottom. The drill pipe is pulled above the gel and the gel is squeezed into the formation. Squeeze pressures as high as 500 psi are possible with the cross linked Poly Plug® PH gel. The well is shut in allowing the pressure to bleed off to the formation. After several squeezes to allow good penetration into the formation and time for the gel to set, the LCM is screened out of the system and the drill string pulled out of the hole.

The new BHA (motor and direction tools) is picked up and RIH. Prior to drilling ahead, a FIT test is performed and once achieved, the well is completed with standard tools and practices.

Noble Energy has found that the procedure saves costly rig days, allows the well to be put into production sooner and provides extra days within their drill program to drill additional wells if desired with both days and money saved.

Operator: Noble Energy, Denver Colorado



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Poly Plug® PH concentrations used are from 1 sack per bbl to 1 sack per 2.5 bbls of mix water. The consistency of the cross-linked plug will range from a solid plug to a rubbery plug that will move and flex with the pump rates. Penetration into the thief zone will not be hindered with any concentrations.

The volume pumped should be enough gel to cover the dolomite thief zone plus the volume to squeeze and still have the dolomite completely covered. There may be one major thief zone with smaller loss zones throughout the dolomite. Add about 40 bbls of gel to the volume required to cover the dolomite.

1. Clean pits and add recommended volume of clean water. Use 90% of the expected volume to allow for volume increases and air entrainment at the start of the mix. The reduction in volume also allow you to add water while the extra LCM is added. It is possible to add 10 – 15 ppb or more LCM without problems.
2. Add recommended volume of Ultra Seal® XLR Retarder. The Retarder is in Blue 5 Gal Pails. Call for recommendations.
3. Allow to mix for 30 minutes. While mixing the retarder and water, move the required number of sacks of Poly Plug® PH and LCM to the mixing area.
4. Add the Poly Plug® PH through the hopper as quickly as possible without a build up of dry or partially hydrated product in the hopper throat.
5. After more than half the Poly Plug® PH has been added the extra LCM can be added.
6. Any additional quantity of LCM may be able to be added directly to the Pit with a water hose to help mix the fibers. Adding the LCM through the hopper is usually slow particularly if coarse fiber is used.
7. Once the products have been added let the slurry circulate for 30 minutes to 1hour to allow the polymer to yield and further even out the mix.
8. Discuss spotting operations with rig site personnel. RIH open ended to the where you want the plug spotted. Open ended will allow you to spot a balanced plug and pull up out of it more easily reducing contamination problems and a reduction in strength. Leave some volume in the drill pipe prior to POOH into the casing.

Once in the Poly Plug® PH pill has been squeezed in place let the plug set for 8 to 12 hours



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SPOTTING RECOMMENDATIONS:

The goal is to squeeze the gel past any LCM across the thief zone and into the actual thief zone. In this way the LCM on the surface and the LCM deeper in the thief zone are linked together by the cross-linked gel. The gel also adheres to the formation surface and further strengthens the complete plug.

1. After the thief zone is covered and you have pulled up above the gel to your safe distance begin to down squeeze on the gel.
2. Monitor pressures and volumes. The individual rig may or may not be able to pump small volumes. On some rigs it is necessary to turn the pump on and off and watch pressures carefully.
3. The volume squeezed before pressure is seen will vary.
4. As the pressure increases the pump rates can be varied as needed.
5. When a satisfactory pressure is reached. Many try for 300 - 500 psi but in some cases the formation will not allow that high a pressure.
6. Shut in the well and let the psi bleed off to the formation. Time will increase the gels and viscosity.
7. Pressure up again to the same pressure and bleed off again. Repeat as needed until only a few strokes return the pressure to your original set pressure.

If possible shut in the well and allow the pressure to be maintained on the pill while it is setting.

Concerns:

Penetration of the Poly Plug Gel into the thief zone may be limited if large sized or large amounts of LCM are used.