

Reliable, Cost Effective Downhole Instrumentation for Measuring Pump Intake Pressure



Until now, there has not been a cost effective and reliable solution available for real time pump intake pressure monitoring sensors for the land based oil and gas completion market.

Many cost effective systems that are being marketed to O&G customers were originally engineered for water wells. These products are not engineered with consideration of higher downhole pressures, the presence of natural gas, or the downhole shock and vibration that occur in a typical completion equipped with an artificial lift system.

Typically, these downhole gauges are utilizing 'epoxy' sealed cable heads to attach the instrumentation cable. Epoxy is a poor choice for pressure sealing in a downhole pump environment, as the vibration from the downhole pump has an adverse reaction on the epoxy seal. Within days of deployment, small micro fissures appear which lead to cracks where eventually fluid or gas migrates, causing the downhole pressure system to fail. Another shortcoming is the choice of instrumentation cable. Plastic shielded cables don't have the tensile strength or crush resistance that is necessary to survive the completion or forces exerted by the downhole pump. Plastic shielded cables don't have the tensile strength or crush resistance that is necessary to survive the completion or forces exerted by the downhole pump. Additionally, most plastic is permeable and it's just a matter of time before fluid invades and causes the system to short out. Most importantly, in the interest of human safety, there needs to be a SAFE wellbore exit strategy for downhole instrumentation cable.

Reliable systems have been marketed by major service companies for years. Typically this technology was developed for offshore and other prolific completions, where customers have large budgets for downhole instrumentation. These systems work perfectly well for pump intake pressure monitoring for land based systems in secondary recovery. However the system price too expensive to generate positive ROI.

GEO PSI has engineered a real time downhole fluid level monitoring system that combines the benefits of both reliability and cost effectiveness. Reliability is achieved by designing a sensor with the following characteristics:

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Leak Proof Design

The electronics inside the sensor are completely protected from fluid and gas invasion.

On one side of the sensor, the Piezo-Resistive transducer diaphragm is e-beam welded to the sensor body. On the other side, the electronics are protected by a high pressure glass feed-thru.

4-20 mA Direct Output

To make the system cost effective, the need for expensive digital surface electronic interfaces has been eliminated. The native communication language of the gauge is 4-20 mA and can be directly connected to off the shelf PLC's, Loggers, and VFD's. 4-20 mA telemetry is immune from electrical magnetic interference.

IECEx Certification

GEO PSI has engineered the first intrinsically safe pump intake pressure sensor designed for downhole oil and gas applications. To qualify for Ex ia IIB T3G certification, a variety of tests were conducted including electrical safety and mechanical pressure integrity function of up to 6,000 psi (41.3 mPa).

Metal to Metal Sealing System

Permanent downhole gauge reliability can only be achieved by utilizing stainless steel ferrules and attaching the gauge to stainless steel instrumentation cable. Geo Psi provides the same metal to metal seals that are so efficient that they are used to contain safely Hydrogen, Helium, and other small atom particles.

Miniaturization

Downhole reliability in aggressive PC Pump or ESP completion requires an electronic gauge that is engineered to withstand considerable shock and vibration. The amount of force absorbed by the electronics is a function of the surface area in contact with the force. Geo Psi utilizes modern electronic engineering techniques to make its electronics smaller and more acceptable to withstanding force than our competition.



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The sensor requires to be attached to a rugged downhole instrumentation cable with the following characteristics:

Stainless Steel Construction

Stainless Steel instrumentation cable permits the usage of metal to metal sealing system. Geo Psi's stainless steel instrumentation cable has a wall thickness of 0.030", giving it superior tensile and crush resistance. The wire is formed from raw strip material, welded together and manufactured in custom lengths of up to 35,000 feet (10,700 meters). The factory utilizes an eddy current tester and 3D profilometer to ensure that the wire maintains the correct physical form and that it maintains pressure integrity.

Encapsulated jacket option available

Depending on the completion, GEO PSI can add a 11mm x 11mm encapsulated jacket of Polypropylene, Santoprene, or Rilsan on the instrumentation cable for additional protection.

Easy to work with

For **instrumentation cable** to be practical it should be easy to work with. The 0.1575" (4mm) form is flexible enough to wrap around tubing and exit the well bore through a standard wellhead, 90° casing vent, or flow line.

Field Spliceable

In the event that the cable is breached during installation, a cost effective field splice kit is available that takes just a few minutes to assemble on the rig floor. The splice causes no compromise of tensile strength and is small enough to be re-spoiled and is safe to be re-deployed again for fluid level monitoring applications.

About GEO PSI

GEO Pressure Systems Inc. ("GEO PSI") provides DIGITAL ENERGY (real time reservoir data) that is used to increase production, improve ultimate reserve recovery, improve well optimization, and reduce operating expense.

Our primary focus is facilitating the delivery, installation, and servicing of continuous real time monitoring systems that accurately measure downhole reservoir pressure and temperature.

A GEO PSI downhole pressure sensor system is:

- Reliable
- Cost Effective
- Innovative
- Proven

Equally important is a safe wellbore exit strategy for the instrumentation cable. Our wellhead feed-thru is designed with the following characteristics:

Engineered with safety in mind

Safety should never be compromised when exiting instrumentation from the wellbore, especially in the presence of surface gas pressure. Only a metal to metal sealing system can adequately isolate the stainless steel instrumentation cable from the outside environment.

Furthermore a high pressure glass feed-thru or certified secondary barrier isolates any pressure from travelling through the conductor in the event of a downhole cable breach.

A preventative safety bleed off valve is furnished for any authorized operators or technicians servicing the wellhead.

Flexible design

The wellhead feed-thru system is modular in design and can be configured to exit through the wellhead NPT port, casing vent, or designated flow line.

Summary

Complete system hardware cost is very attractive; often less than \$10,000. Many of our customers are experiencing significant ROI, even on stripper wells that produce less than 3 BOE per day.

Australia Coal Seam Gas Success

The GEO PSI sensor and instrumentation cable has been successfully deployed in greater than 500 coal seam gas production wells in the Queensland region. Most wells are completed with 60-100 HP Progressive Cavity Pumps landed at depths between 600-1000 meters.



Other Applications

- Water Source Wells
- Shallow Observation Wells
- Rod Pump Pump Intake Pressure
- ESP Completions
- Irrigation Wells
- Municipal Water Wells and Aquifers
- Offset Frac Monitoring
- Environmental Disposal Wells

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