Abstract
The practice of venting gas via the Tubing Casing Annulus (TCA) is common in many ESP lifted wells. However, to comply with double barrier well integrity policies, until now, it has been necessary to install a vent packer and downhole annulus safety valve (DHASV).

This white paper describes a new use for field proven technologies, which can eliminates this requirement. As a result workovers are simplified, well lifecycle costs are reduced, well integrity is enhanced, ESP system reliability is improved and in some cases production will be increased.

Double barrier Integrity on Gas Vented ESP lifted Wells?
The Norsok D10 ‘Well Integrity for Drilling and Well Operations Guidelines’ describes ‘Multi Purpose Wells’ as “wells that has transport of media to or from a formation interval via the A Annulus in addition to via the tubing”. It also states: “all multi purpose wells shall have two barriers to prevent release of the A Annulus media”. Typically the primary barrier to annulus flow has been a vent packer, and the secondary barrier the production casing and the wellhead and its associated valves and seals.

Downsides of using a Vent Packer?
Vent packers require to be replaced during the frequent workovers that are an inevitability when ESP lift is used. This incurs CAPEX, their installation and removal also complicates and therefore increases the workover costs. An electrical penetrator also has to be deployed to pass the power cable through the vent packer. These also add to the cost and complexity and are common system failure locations. Finally, the vent packer can sometimes pose a restriction to gas vent rate. This can reduce gas / liquid separation efficiency upstream of the ESP causing impaired ESP performance and lower production.

VR Sense and MSAS
These technologies are now widely used in gas lifted wells, to provide a double barrier vs the escape of high pressure lift gas from the A Annulus (a more challenging duty than a gas vented ESP well). They are now also being used as an alternative to Vent Packers and DHASV’s in gas vented ESP wells.

They are installed in the threaded profiles (VR profiles), which are machined into both side outlets on all wellheads. Specifically, a Pressure / Temperature sensor ‘VR Sense’ [1] is installed in one of the VR profiles, and a ‘Master Surface Annulus Safety’ (MSAS G) valve (with similar fail safe closed functionality to a sub-surface safety valve) is installed in the other, where it is controlled via the wellhead hydraulic control panel.

They, along with the wellhead and production casing, combine to form a primary barrier envelope around the A or TC Annulus. The outer casing string and associated wellhead and valves in the first casing / casing annulus (CCA1), forms the secondary barrier envelope.

VR Sense and MSAS Benefits on Gas Vented ESP Wells
Because the MSAS and VR Sense are located in the wellhead VR profiles, ESP completion can be simplified (no vent packers / packer penetrators) reducing the CAPEX, the likelihood of ESP system failure and simplifying workovers.

Well Integrity is also improved and more easily verified. The MSAS valve can also be replaced without workover. Finally because of the large flow area of the MSAS valve the likelihood of ESP gas locking is reduced.

Well Integrity Assurance:
Double Barrier Policy Implementation (base case non vented ESP lifted wells)

Primary Barrier Envelope
• This is the first barrier that prevents flow from a source.

Secondary Barrier Envelope
Prevents flow if the Primary Barrier fails

Well Integrity Assurance:
Double Barrier Policy Implementation (gas vent ESP lifted wells)

Primary Barrier Envelope
• Add Vent Packer as annulus flow primary barrier

Secondary Barrier Envelope
No change from base case

Well Integrity Assurance:
Alternative Double Barrier Policy Implementation (gas vent ESP lifted wells)

Primary Barrier Envelope
• No need for vent packer and associated penetrator / control line.
• MSAS and VR Sense in wellhead VR Profile replace it as primary barrier

Secondary Barrier Envelope
Outer Casing / Wellhead becomes secondary barrier