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**Meeting Paper**



**Inflatable Packers and Applications  
in Salt Dome Storage Cavern Wells**

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*by*

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# TAM INTERNATIONAL

Inflatable Packers

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## INFLATABLE PACKERS AND APPLICATIONS IN SALT DOME STORAGE CAVERN WELLS

Inflatable packers can offer many unique applications for zonal isolation in open and cased holes that cannot be accomplished with conventional packers. Inflatable packers are commonly thought of as open-hole tools; However, they can prove most helpful in cased holes as well. This presentation will describe the packers, packer selection criteria for successful use and applications for storage wells.

The Inflatable packer consists of one or more inflation elements and tooling containing valve mechanisms for inflation and deflation. The inflation element is the critical part of the tool and a careful element selection process is required for each application.

There are basically two different types of inflation elements. Tam International manufactures both. They differ in their pressure containment reinforcement structure. These elements are capable of differential pressure containment in excess of 5,000 PSI and in some special cases, up to 20,000 PSI. Both styles of elements have advantages and disadvantages.

Various environment specific elastomers are available for element construction. These elastomers are hydrocarbon resistant and blended to facilitate high expansion ratios in difficult bottom hole conditions.

Packer element construction consists of fully reinforced elements of two different varieties.

Woven steel cable reinforcement provides for an element that is capable of withstanding differential pressures to 5000 PSI. This element achieves a chemical and mechanical bond of cover to cable containment that enables multiple inflation cycles without leaving the cover in the hole. The cable-reinforced element is clearly the choice for multi-set applications.

Steel slat reinforcement provides for higher expansion ratios, higher differential pressures containment and higher operating temperatures and enhanced self-anchoring.

Element selection is determined by the following:

1. The expansion ratio or the hole ID divided by the packer OD. This calculation primarily determines the type of elastomer required for the temperature.
2. The differential pressure capability of the element for the hole ID is determined by this chart. Higher expansion ratios decrease the available working pressure of the element.
3. The exposure of the element to well-bore fluids.

We place these elements on tooling to create a wide variety of packers including external inflate, surface controlled packers, single set production and injection packers, open and cased hole bridge plugs, multi set single and straddle packers, open hole casing annulus packers, permanent bridge plugs and cement retainers.

Applications for these tools in salt dome storage wells includes the following:

- In cased hole-  
Through tubing retrievable bridge plugs, multi set single and straddle packers for mechanical integrity testing. The inflatable packer element offers superior sealing ability in badly corroded tubulars.  
Near surface retrievable plugs for wellhead removal or repair.

An interesting inflatable application occurred a few years ago. A section of 16" casing collapsed just below the wellhead. The pipe was so badly egged that it could not be pulled through the 20", welded

hanger. An inflatable packer was run into the collapsed section of the tubing and by inflating the packer the ovality of the pipe was reduced enough to be recovered. This process required multiple inflation cycles and about four days to complete.

- In open hole-  
Zone isolation for stage cementing above the packer. Permanent or retrievable bridge plugs for abandonment or temporary isolation of the cavern from the casing. Open hole plug for cementing an added casing string.

Retrievable, inflatable plugs may be set in the well bore or in the casing to temporarily seal the cavern, while remedial operations are being performed above the plug. Safety considerations include the placement of sand and cement above the retrievable plug. The cement is drilled and the sand is circulated off the top of the plug prior to retrieval. The retrieval of the plug is accomplished by using the appropriate retrieval tool for the plug. The retrieval tool is engaged on the packer fishing neck, the choke in the packer is expelled and pressure from drill pipe to annulus below the packer is equalized. Deflation of the packer is then accomplished by hydraulically shearing open a drain, or by rotation of the top sub or by application of an over-pull, to shear the drain open.

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