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Monitoring Systems for the Underground Completion of Storage Caverns

- Functional Principles and Field Experience -

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Abstract

One reason to develop a monitoring system for casing- and tubing strings was caused by several damages of production strings on different locations. One reason for these damages was the exceeding of the critical axial load capacity in consequence of operation states and convergence (salt movement).

To avoid damages on casing and tubing strings, it is recommended to monitor the occurring loads while in operation. There are three independent systems for measuring and monitoring the axial loads of the completion.

1. Strain-gauges to monitor axial loads, directly mounted on the surface casing and an additional on the production string.
2. The **Tension Monitoring System (TMS)** which is connected to the well head and deviates the axial loads to load cells which are mounted on a base frame in the cellar.
3. The **Tension Control and Monitoring System (TCMS)**. To be implemented by measuring the hydraulic pressure in a Hollow-Piston Cylinder, which is directly integrated in the wellhead.

The monitoring systems provide:

- Monitoring the current load state in the casing.
- Proofment of barrier integrity.
- Early and fast recognition prior to a damage in the completion.
- Long term monitoring and accurate predictions.

Key words: well integrity, well completion, axial load, tension monitoring, gas storage, salt caverns