

System for In-situ Monitoring the Stress Conditions of Pre-stressed Production Strings in Gas Storage Caverns

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1 Introduction

There are two major ways for compensating variations in the length of production strings in gas storage caverns induced by temperature and pressure changes:

- The use of travel joints. This equipment is subject to greater wear and corrosion and caused leakage in many cases after several years of operation.
- Operation of the production string under pre-stressed conditions. This solution is normally practised by UGS.

During gas storage operation significant stress variations occur in the pre-stressed gas production string (Picture 1 and Picture 2). The reason for these stress changes is twofold: technical and geo-mechanical. Technical induced stress changes result e. g. from

- substitution of brine by gas
- design of the production string and the well head
- pressure and temperature variations over a long time period of a storage cavern
- workover e. g. snubbing of the withdrawal string
- tests and measurements in the production string
- underground safety valve in operation

The effects of technical stress variations in the production string are:

- load change in the technical casing and the wellhead
- load change in the production string
- load change on the seal unit and the packer