

GLÖTZL Baumeßtechnik

SPECIAL INSTRUMENTATION

in mining for deformation in rock and backfilling

- **CONVERGENCE MEASURING INSTRUMENTS** Type: **SKE**
- **MULTIPLE ROD EXTENSOMETER** Type: **TEX 16**
- **SETTLEMENT MEASURING DEVICE** Type: **SSME**

Art.-Nr: 63.01

These measuring instruments have been developed for an application under extremely difficult conditions in an underground large-scale test in the „Schachtanlage Asse“ in connection with the „Institut für Tieflagerung*)“ in Braunschweig.

Requirement was the interpretation of all components for:

- Rock pressure up to 20 MPa
- Centrifugal backfilling with max. grain size $\leq \varnothing 60$ mm
- Alkaline solutions up to 160 °C
- Temperatures up to 160 °C

Interpretation of test

The test TSS thermal simulation of routing bearing is carried out for investigation of thermomechanical effects for direct final disposal of flame-cut LWR fuel elements.

In two parallel routes each three dummies of Pollux containers have been electrically heated. After assembly of containers and measuring instruments

the routes have been treated with salt fines in centrifugal procedure.

Instrumentation with deformation measurement

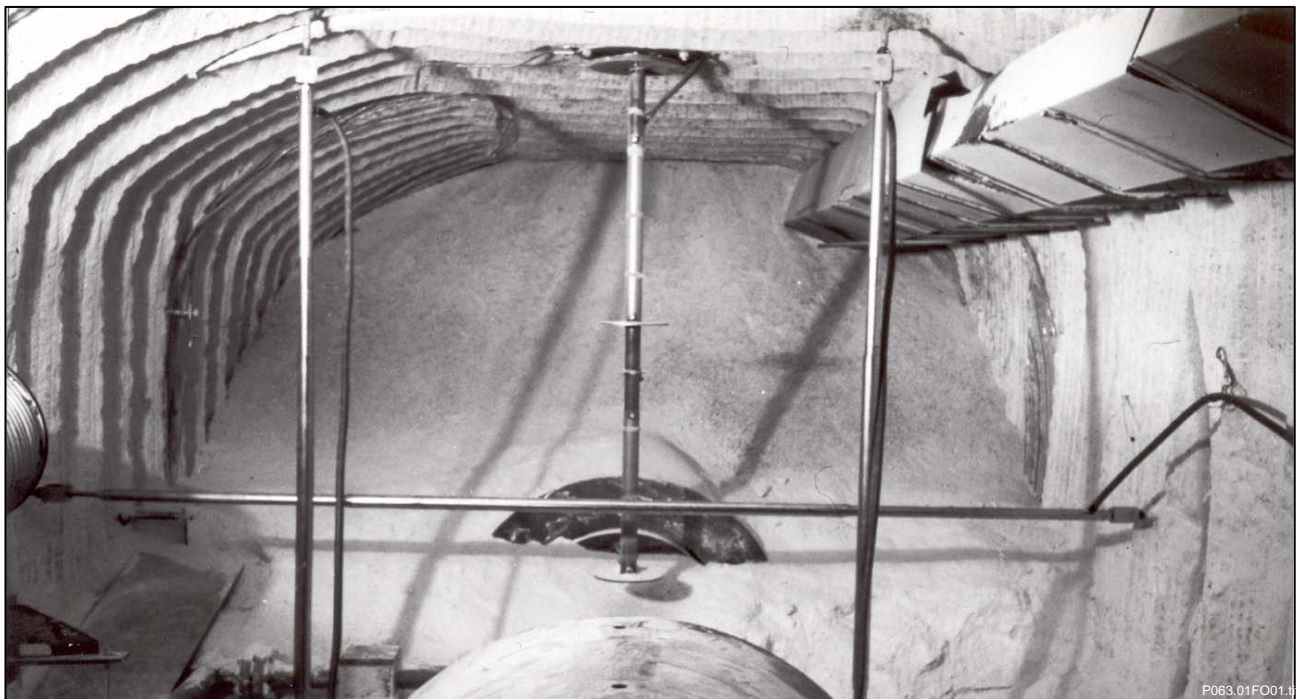
The settlements of the centrifuged backfilling under own weight und later on by convergence pressure are recorded by settlement measuring instruments as distance changes of up to four discrete points in the backfilling referred to the roof ridges.

The horizontal and vertical convergences of the backfilling routes are measured with convergence measuring instruments of especially stable construction type. For control of the deformation field in the rock in the surrounding area of 30 m multiple rod extensometers are used with submerged extensometer heads.

For the computable temperature compensation, the temperatures at all instruments are recorded.

Recording of measured data

The tubings of all transducers are led through the backfilling into one conduit to the measuring room in which the measured values are recorded by an automatic measuring and recording unit.

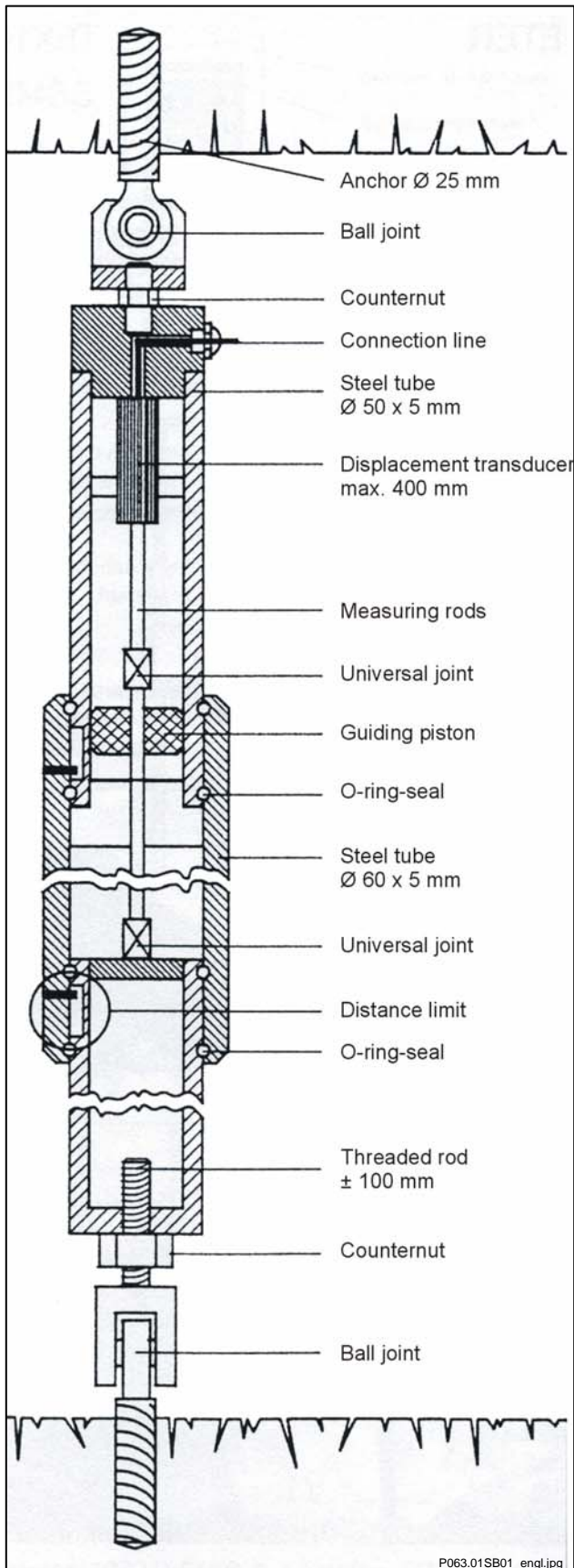


*) An institute of the „GSF-Forschungszentrum für Umwelt und Gesundheit“ in Munich

HEAVY STATIONARY CONVERGENCE EQUIPMENT

SSKE 40

The heavy stationary convergence measuring equipment consists of solid steel tubes shiftable into each other. The movement of these parts is recorded by displacement transducers and registered as electrical signal.



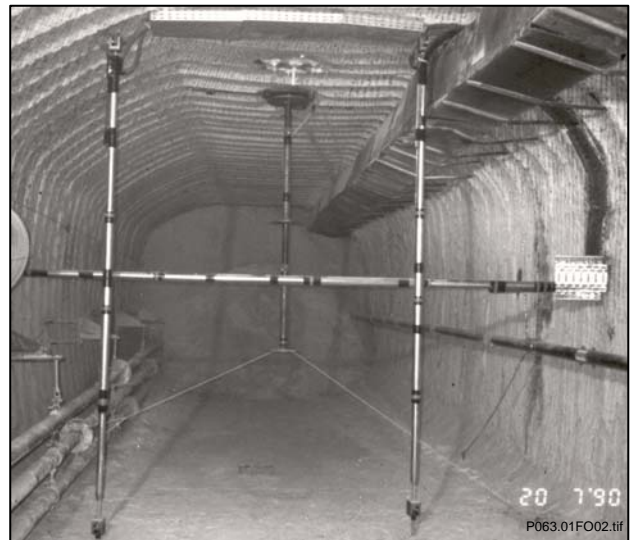
All movable parts are protected by O-ring seals against penetration of fluids and pressure-tight constructed dependent on requirement.

The anchoring is done optionally by anchors solidified in the rock or dowelled anchor plates.

The measuring equipment is protected against pre-loading caused by movements of the rock by ball joints between anchor and measuring instrument.

By the threaded rod at one side of the instrument the basic length and also the basic alignment of the displacement transducer can be adjusted.

The stability of the equipment is ensuring the functional security also in case of penetration of the centrifugal set and at static pressure of the backfilling material.



Technical data:

Measuring lengths: 2/2.5/3/3.5/4/4.5/5/5.5 and 6 m

Adjusting range: +/-0.25 m

Material: Steel ST 52

Temperature ranges

Standard: -30 up to +70°C

Extended: -10 up to +105°C

Maximum: -10 up to +180°C

Measuring ranges for displacement transducers
40/100/200 and 400 mm

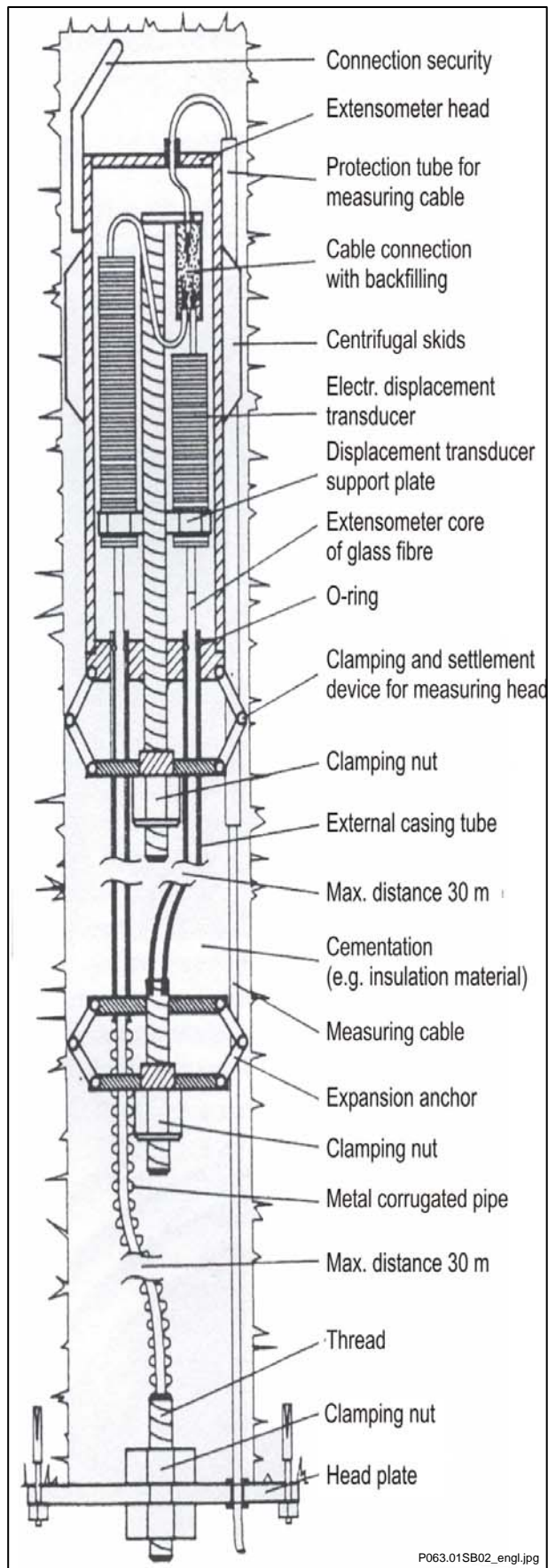
Measuring signals see data sheets of displacement transducers

GLASS FIBRE ROD EXTENSOMETER

TEX 16

EXTENSOMETER as special model

- Application**
- in ranges with higher temperatures
 - in unconsolidated border region



Construction of extensometer

Pressure-tight measuring head for max. 4 displacement transducers, diameter 120 mm, necessary borehole diameter 180 mm. The measuring head at the deepest point of borehole as well as the anchors are fixed by means of expansion device.

By positioning of the measuring head in regions apart from the heated routes the influence of temperature to the electronics in the measuring head is minimized.

If the joint is only less suitable for the installation of an extensometer anchor by unconsolidation, the anchoring of the head at the deepest point of the borehole ensures that at least the reference to all further anchor points will not be lost.



The preadjustment of the displacement transducers is done by expansion anchors by which also the compound of anchor-rock is ensured. These works are carried out by settlement rods from borehole mouth to any installation direction.

The completion at the borehole mouth is an attached anchor plate for the longest resp. the last anchor. Through this plate also the necessary injection and aeration lines as well as the electric measuring cable are led.

The measuring rods consist of high-tensile glass fibre rods in a casing tube which can be selected for temperate range up to 80°C of PVC material and for higher ranges of a metal corrugated pipe.

Technical data:

Measuring lengths:	up to 50 m
Material:	Steel St 52
Temperature ranges:	
Standard:	up to 70 °C
Max. range:	up to 130 °C
Measuring ranges for displacement transducers	
	40 / 100 / 200 and 400 mm
Measuring signals see data sheets of displacement transducers	
Diameter of measuring head:	Ø 120 mm
Necessary boring:	Ø 180 mm

SETTLEMENT MEASURING EQUIPMENT IN BACKFILLING

SSME

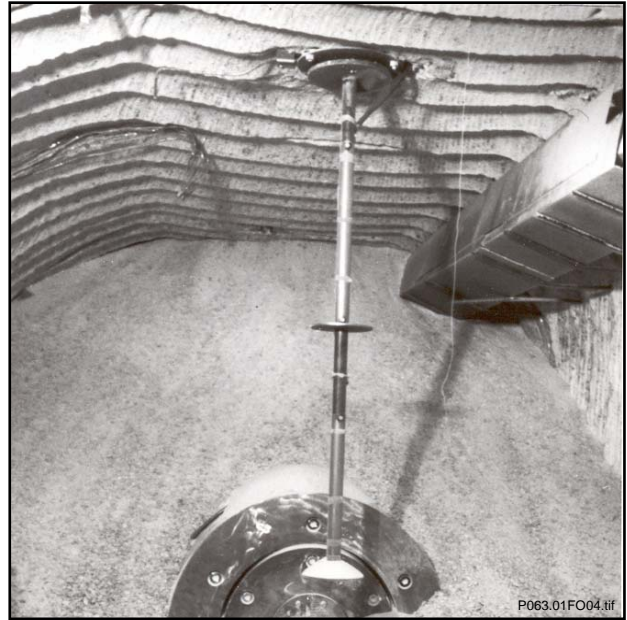
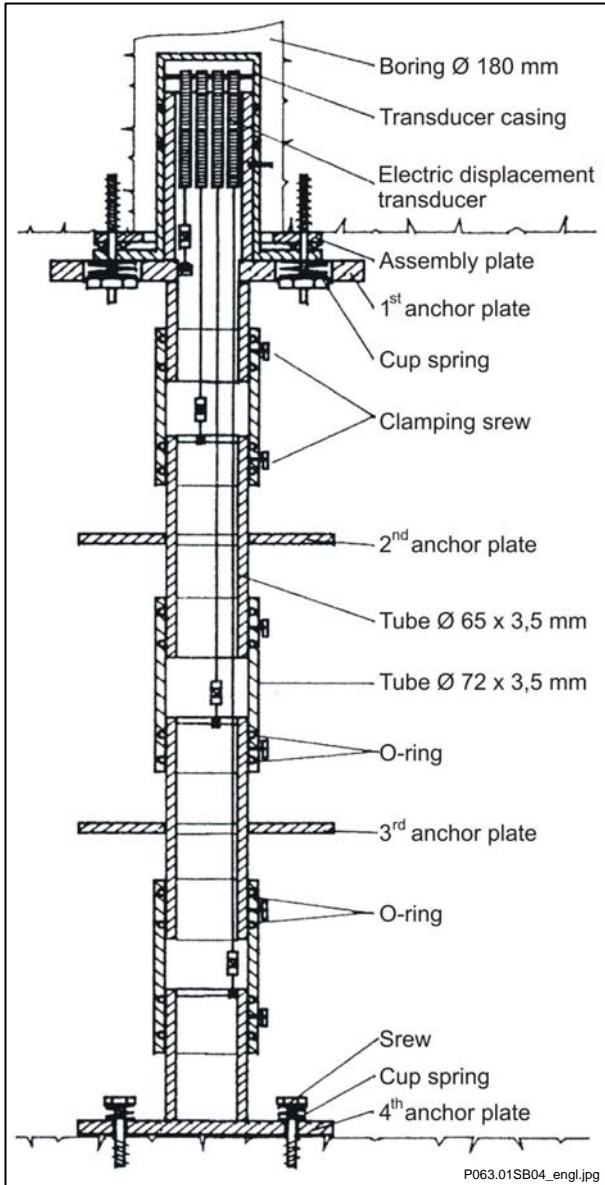
The settlement measuring equipment is a modified extensometer with anchor points in the backfilling.

All anchor plates are free movable to each other and without mutual influence.

The 1st anchor plate is used for control of settlements in the roof ridge area.

The anchor plates 2 and 3 are recording the settlements of the backfilling in two levels of the backfilling.

With the 4th anchor plate the route convergence is measured at the floor.



Technical data:

Measuring length 2.5 up to max. 6 m

Temperature ranges

Standard:	-30 up to	+70 °C
Extended:	-10 up to	+105 °C
Maximum:	-10 up to	+180 °C

Measuring ranges for displacement transducers
40/100/200 and 400 mm

Measuring signals see data sheets of displacement transducers

Measuring head:	Ø 120 mm
Necessary boring:	Ø 180 mm

Measuring lines/electric connection cables for special instrumentation

Temperature ranges	-30 up to +80 °C standard range	-10 up to +105 °C extended range	-10 up to 180 °C max. range
Temperature max. for a short time	+100°C	+120°C	+200°C
Material	PVC basis	special PVC	Silicon
Trade mark	Ölflex-100 CY	Lapptherm 120	Silflex-SiHFP
Test voltage	3.000 V	2.500 V	2.000 V
Quantity of wires	5-20 wires acc. to numbers of transducers x 0.5 mm ²		
Cable diameter	5-core 10 mm	20-core 22 mm	