

Capabilities in Rock Testing



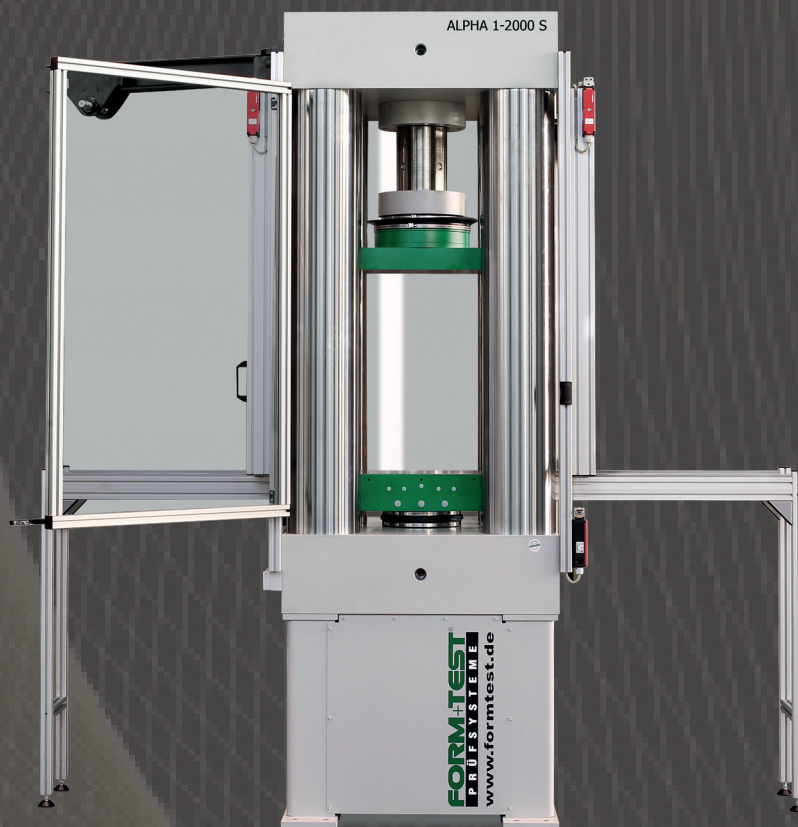


Introduction

In many fields of modern industry, such as resource depletion or CCS technologies or just simply ahead to building projects, the exact composition of the soil and its properties must be must known. The analysis of the mechanical behaviour must consider the main loading parameters. Taking into account non-neglectable depths not only a linear load is relevant, but a hydrostatic pressure must be considered. This loading situation leads to a triaxial state of stress which must be reproduced by the test equipment. FORM+TEST developed matching triaxial test systems of various load capacities.

The main components of such systems are

- load frame
- pressure cell
- measurement devices
- accessories



Area of use:

- axial and triaxial rock testing
- geomechanical investigations
- compression tests and extension tests

Test fields:

- Institutes of geotechnology
- Tunnel and bridge building
- Resources depletion
- CCS technologies

Specimens:

- Cylindrical rock specimens of varying dimensions

Standards:

- DIN EN ISO 17892-7
- ASTM D 7070 and D7012
- ISRM I+II and related fracture mechanics tests
- DGGT recommendations
- BTS and CTS

Application:

- determining geomechanical values such as uniaxial compressive strength, tensile strength, elasticity and Poisson's ratio
- triaxial test with and without strain measuring, direct longitudinal strain measuring and lateral strain measuring
- triaxial multi-stage tests to investigate post-failure behaviour
- high-precision volume and pore pressure and in-situ measurements
- stabilising or intermittently increasing surface pressure is possible

Accuracy:

- in accordance with DIN EN ISO 7500-1 and DIN EN 12 390-4, class 0.5 (1)



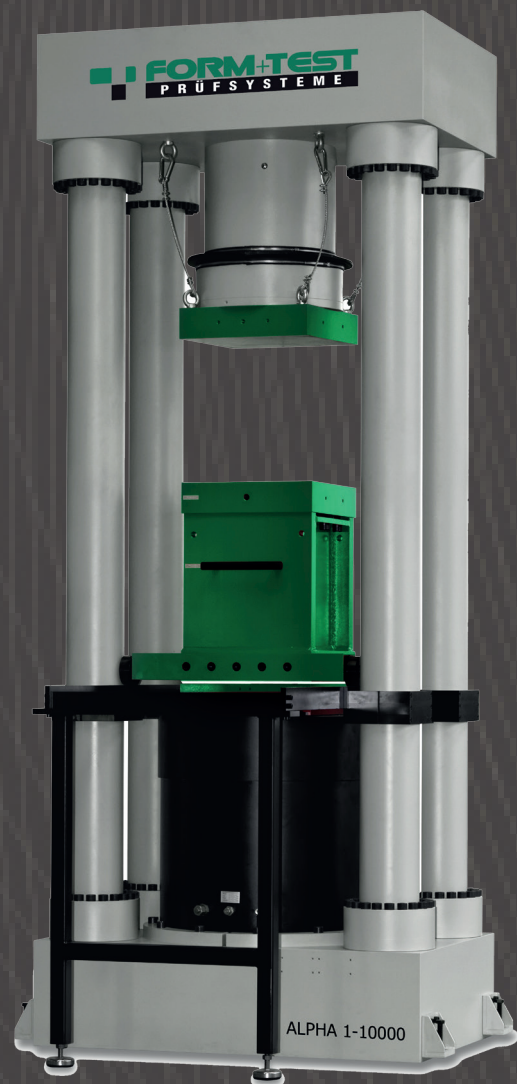
Test Frame

The load frame must be of highest stiffness to ensure high accurate results on deformation and volume measurement. FORM+TEST frames therefore are equipped with the following main characteristics. All frames and cylinders are made on FORM+TEST site. The dimensioning towards test space height and stiffness can be made as per request.

- 4-column load frame with an extremely high longitudinal and lateral stiffness to keep the material strain as low as possible for the first specimen fracture
- double-acting test cylinder
- electronic precision force transducer
- special compression plates
- protective equipment

Main Parameters:

- load capacity: 500 ... 15000 kN
- max. surface pressure: 2000 bar
- stiffness between: 5000 – 9000 kN/mm



Pressure Cell

The main part for triaxial testing is the high pressure cell. FORM+TEST has a long history of triaxial cell manufacturing. The dimensions of the cell is either linked to any given standardises test specimen sizes and the relevant measurement sensor application or given by the request of the customer.

The heating can be done by heating bands or for less electrical impact on any sensitive measurement with oil bath heating sheats surrounding the cell.

Main Parameters:

- load capacity: 500 ... 5000 kN
- inner diameter: 50 – 300 mm
- height customised
- max. surface pressure: 2000 bar
- max. temperature inside cell: 300° C



Pressure cell with 3000 mm of length and 125 MPa of pressure



Pressure cell with 150 MPa and oil heating system

MEASUREMENT APPLICATIONS

An essential parameter beside the pure load capacity is the deformation of the specimen during the test. Within FORM+TEST triaxial cells numerous measurement sensors are available.

Those comprise

- strain measurement
- temperature measurement
- volume measurement
- ultra-Sonic wave response measurement

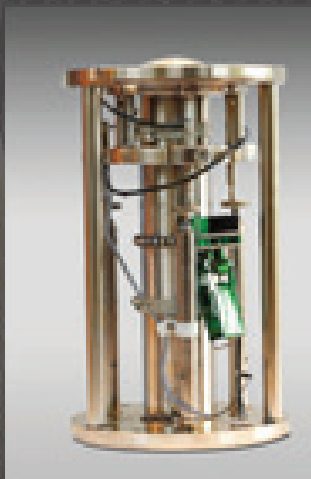
The sensor signals are safely transmitted via special electrical lead throughs which are specially sealed against the operating pressure and optimum designed for the operating temperature and the any electrical noises that may interfere.

Strain Measurement

Strain measurement will be done in axial and hoop direction with one or several sensors. The sensors can be LVDT type or strain gauge based measurement principle. If multiple sensors are applied, the software can choose between the single values or an average value which is used just for measurement or also which is integrated in a closed control loop.

Main Parameters:

- deflection 1 ... 10 mm or more
- accuracy comparable to ISO 9513
class 0.5, linearity < 0.1%
- max. operating pressure: 200 MPa
- max. operating temperature: 200°C



Axial Strain-Sensor set-up
(Source GL-Systems)



Hoop strain sensor setup
(Source Epsilontech)



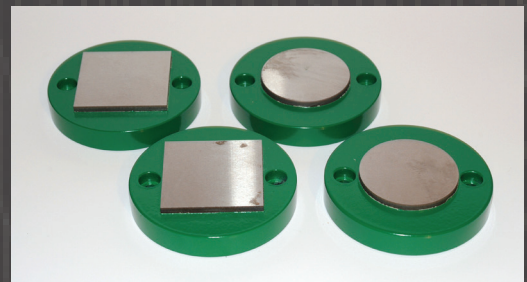
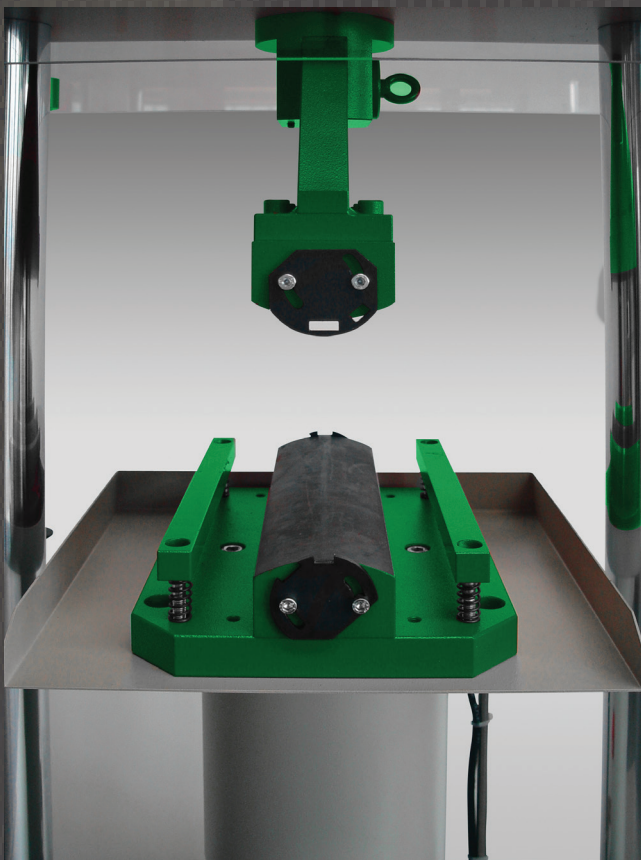
Electrical lead through (Source GL-Systems)

Accessories

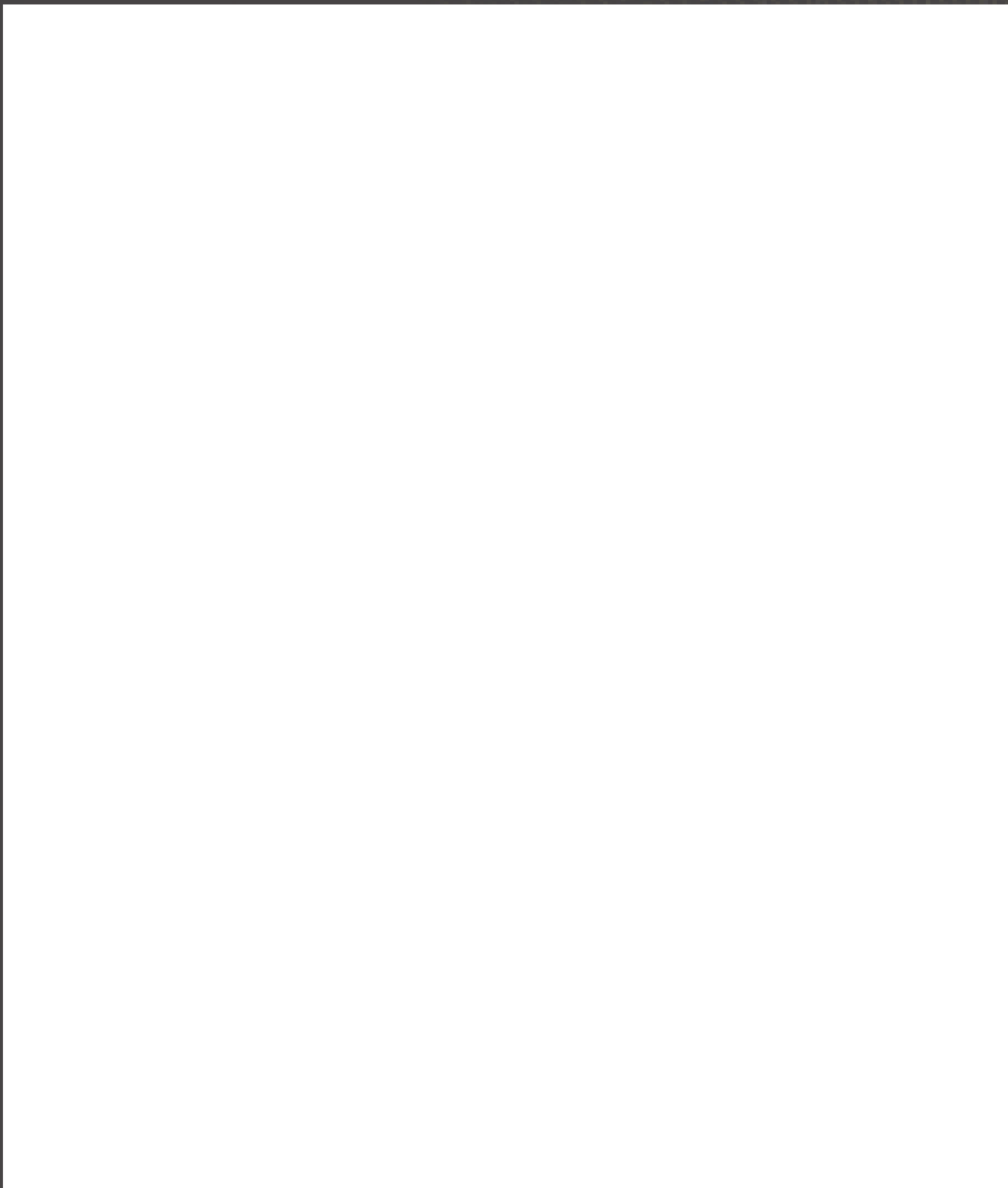
Beside the main machine components FORM+TEST is able to provide the relevant accessories ranging from compression plates with floating axle for pressure plate inserts in the triaxial cell or other relevant parts for rock mechanics such as split tensile test apparatuses or bending tables.

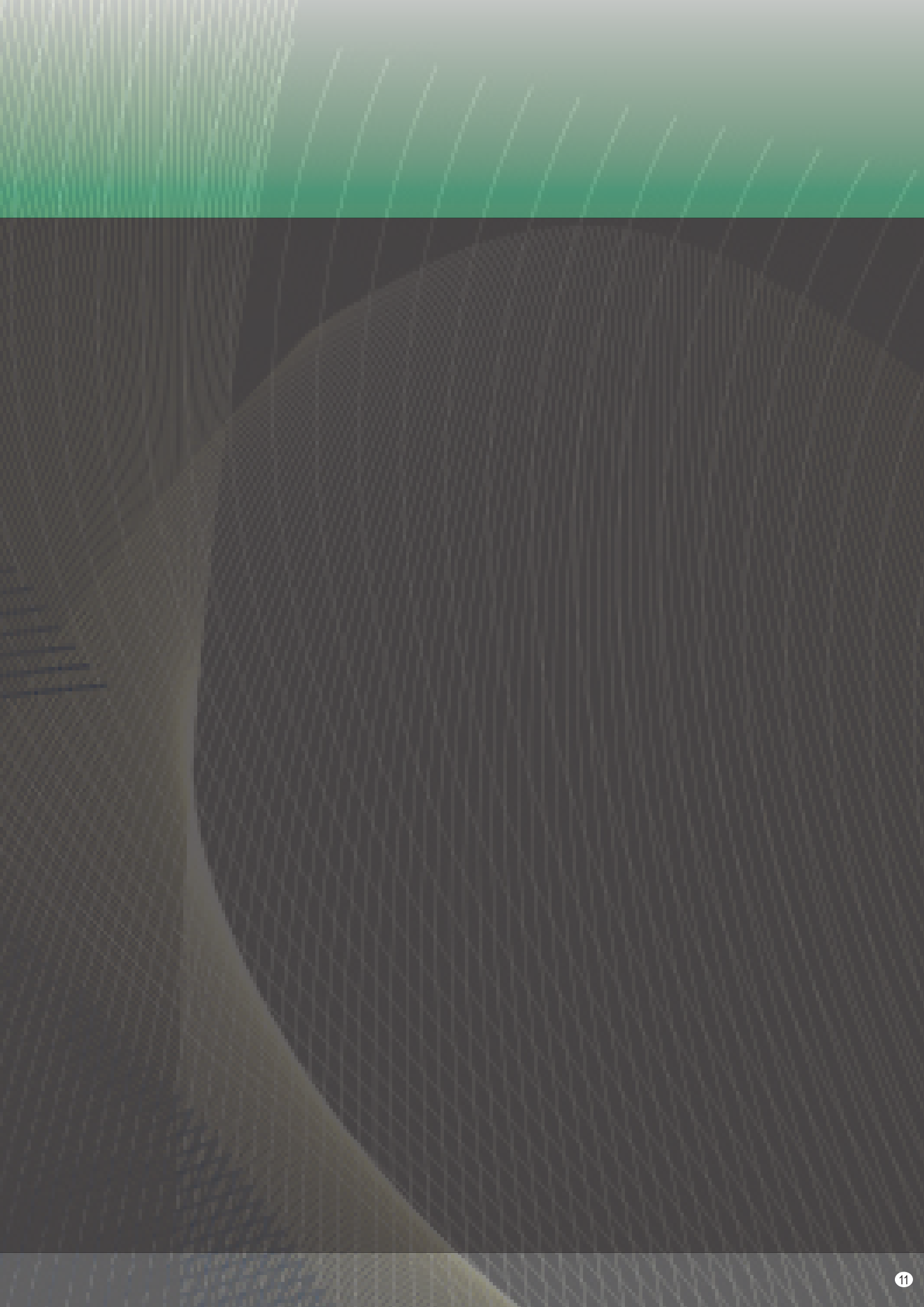
Main parameters:

- hardened components suitable for rock material
- high longevity
- dimensions customised if necessary
- max. operating temperature 200°C (when in-cell used)



Notizen







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