

## Goodman Jack

### Applications

The Goodman Jack is used for in-situ investigations of the deformability of rock masses. It is designed to be used in 3" (76 mm) boreholes.

Two models are available: a twelve-piston model for use in hard rock, and a three-piston model for determining the consolidation-time properties of soft rock, soil, and stiff clays.



Goodman Jack for Hard Rock



Goodman Jack for Soft Rock



### Operation

The Goodman Jack is coupled to the drill rod and inserted into the borehole, along with its hydraulic lines and signal cable.

When the jack is in position, a hand pump is used to activate the pistons within the jack. The pistons push a curved bearing plate against the borehole wall, producing a uniform, uni-directional stress field.

The applied pressure is measured with a pressure gauge, and the deformation of the rock is measured by two linear variable differential transformers (LVDT). The indicator displays the LVDT readings.

After the test, the bearing plates are retracted and the jack is withdrawn from the borehole.

The modulus of deformation is calculated using formulae derived empirically from in-situ testing. Then correction factors are applied, using factors that were developed by laboratory testing.

The Goodman Jack conforms to ASTM standard D4971-08.

### References

- Goodman, R.E., Van, T.K., and Heuze, F.E., The Measurement of Rock Deformability in Bore Holes, Symposium on Rock Mechanics, May 1968, University of Texas, Austin, Texas.
- Heuze, F.E., Suggested Method for Estimating the In-Situ Modulus of Deformation of Rock Using the NX-Borehole Jack, Geotechnical Testing Journal, December, 1984.
- Heuze, F.E. Heuze and Amadei, B., The NX-Borehole Jack: A Lesson in Trial and Error, International Journal of Rock Mechanics, Vol 22, No.2 1985, Pergamon Press Ltd.

**HARD ROCK JACK**

**Number of Pistons:** 12.  
**Max Bearing Pressure:** 64,000 kPa (9,300 psi).  
**Maximum Force:** 703 kN (158,100 lbf).  
**Borehole Size:** 76 mm, 3" nominal.  
**Minimum Diameter:** 70 mm (2.75").  
**Maximum Diameter:** 83 mm (3.25").  
**Linearity:** ±0.5% for range of 73.7 to 78.7 mm (2.9 to 3.1"), ±1% for range of 72.4 to 80 mm (2.875 to 3.15").  
**Maximum Hydraulic Pressure:** 69,000 kPa (10,000 psi).  
**Operating Temp:** -32 to 60 °C (-25 to 140 °F).  
**Temp. Coefficient:** ±(0.04% Reading + 0.02% FS) per °C. ±(0.02% Reading + 0.01% FS) per °F.  
**Dimensions:** 70 x 445 mm (2.75 x 17.5").  
**Weight:** 15 kg (33 lb).

**SOFT ROCK JACK**

**Number of Pistons:** 3.  
**Max Bearing Pressure:** 38,200 kPa (5,540 psi).  
**Maximum Force:** 419 kN (94,200 lbf).  
**Borehole Size:** 76mm, 3" nominal.  
**Minimum Diameter:** 70 mm (2.75").  
**Maximum Diameter:** 83 mm (3.25").  
**Linearity:** ±0.5% for range of 73.7 to 78.7 mm (2.9 to 3.1"), ±1% for range of 72.4 to 80 mm (2.875 to 3.15").  
**Maximum Hydraulic Pressure:** 69,000 kPa (10,000 psi).  
**Operating Temp:** -32 to 60 °C (-25 to 140 °F).  
**Temp. Coefficient:** ±(0.04% Reading + 0.02% FS) per °C. ±(0.02% Reading + 0.01% FS) per °F.  
**Dimensions:** 70 x 445 mm (2.75 x 17.5").  
**Weight:** 15 kg (33 lb).

**DISPLACEMENT INDICATOR**

**Display:** Dual LCDs with 3-digit signed values.  
**Operating Time:** 10 hours with fully charged batteries.  
**Battery Charger:** Internal from 115/230 VAC or 10-15 VDC.  
**Temp. Coefficient:** ±(0.015% Reading +0.001% F.S.) per °C. ±(0.008% Reading +0.0006% F.S.) per °F.  
**Operating Temp:** -18 to 49°C (0 to 120 °F).  
**Resolution:** 0.01 mm with Metric Indicator. 0.001" with English Indicator.



**Dimensions:** 280 x 230 x 180 mm (11 x 9 x 7").  
**Weight:** 5 kg (11 lb).

**HAND PUMP**

**Hydraulic Pump:** Enerpac P-84.  
**Maximum Pressure:** 69,000 kPa 10,000 psi.  
**Pressure Gauge:** 50 psi (345 kPa) resolution with accuracy of ±0.5% FS.  
**Dimensions:** 690 x 180 x 150 mm (27 x 7 x 6").  
**Weight:** 13 kg (29 lb). Hose and cable add 10 kg per 15 m (22 lb per 50').

**PART NUMBERS**

**Goodman Jack, Hard Rock . . . . . 52100100**  
 Hydraulic borehole probe for in situ tests in hard rock. Includes two LVDT displacement transducers, waterproof electrical connector, two self-sealing hydraulic quick-connectors, and threaded BX adapter.

**Goodman Jack, Soft Rock. . . . . 52100200**  
 Hydraulic borehole probe for in situ tests in soft rock. Includes two LVDT displacement transducers, waterproof electrical connector, two self-sealing hydraulic quick-connectors, and threaded BX adapter.

**Displacement Indicator**  
**English Unit . . . . . 52102700**  
**Metric Unit . . . . . 52102710**  
 Portable instrument for indicating displacement of the instruments bearing plates. Two illuminated LCDs for reading both LVDT sensors simultaneously. Includes 6-foot jumper cable, rechargeable internal battery, and cable for 110-volt AC operation.

**Electrical Cable Assembly . . . . . 52100500**  
 Shielded, multi-conductor cable, waterproof connectors on each end, 15 m (50').

**Hydraulic Hose Assembly . . . . . 52100600**  
 High Pressure Hydraulic Hose, 1/4-inch (6.4 mm.) I.D., double steel wire braid, SAE 100R2 Type A, with self-sealing quick-connectors each end, 50 ft (15 m).

Note: Operation of Goodman Jack requires two hydraulic hoses, one for expansion and one for retraction of pressure plates.

**Hydraulic Pump, Model P-84. . . . . 52100700**  
 Two-stage, 10,000 psi (70 MPa), with selector valve.

**Hydraulic Tee Assembly . . . . . 52100800**  
 Includes three self-sealing quick-connectors for easily connecting hydraulic hose, pressure gauge and hydraulic pump.

**Pressure Gauge, Model 200 . . . . . 52100900**  
 Bourdon-type, 4.5" diameter gauge with accuracy of 0.5% and twin tip pointer to eliminate reading errors. Range: 10,000 psi (70 MPa). Other ranges available on request.

**Hydraulic Oil, HF-101 . . . . . 52102400**  
 Note: Carriers require surcharge and separate documents for air shipments of hydraulic oil.

**Carrying Case, For Jack . . . . . 52101500**  
 Wooden carrying case for shipping and storage of Goodman Jack and accessories.

**Carrying Case, For Pump . . . . . 52101501**  
 Wooden carrying case for shipping and storage of pump and accessories.