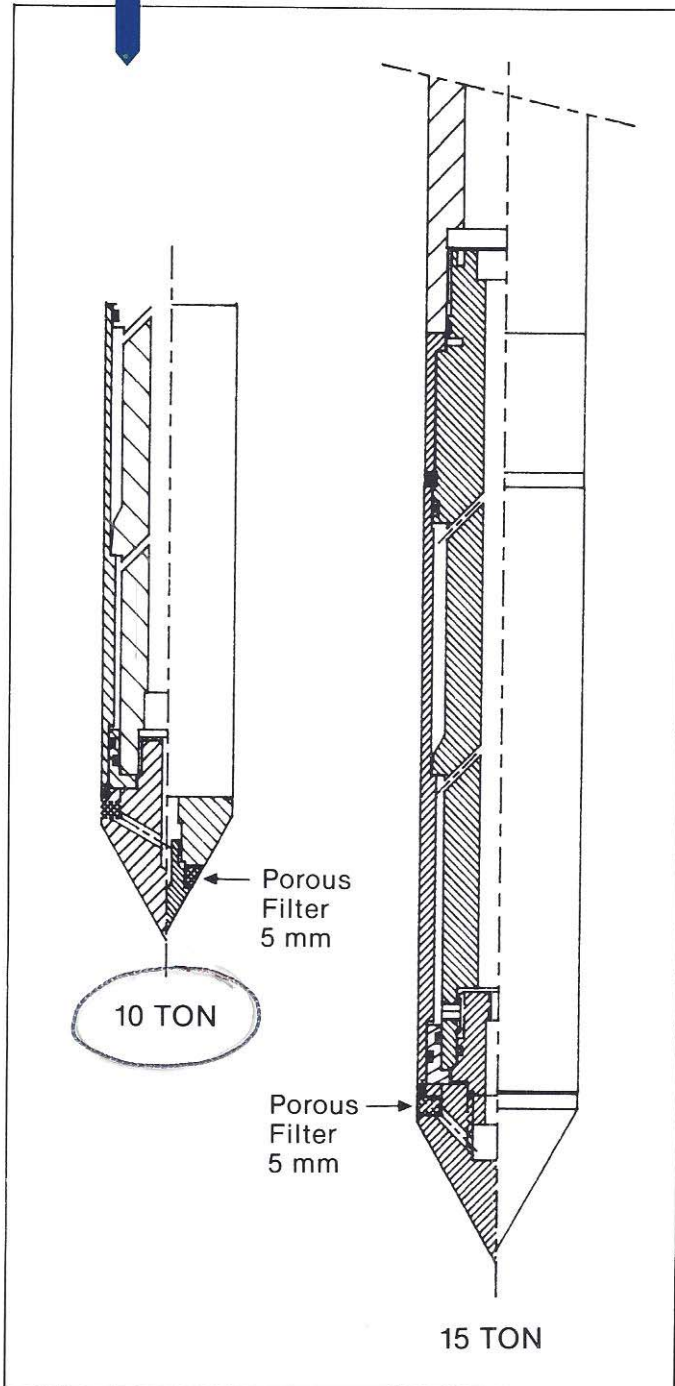


Electronic Subtraction Cone 10 and 15 Ton

Full range of one through five channel
capacity and six channels total

TEMPERATURE COMPENSATED



The electronic subtraction 10 and 15 ton cones have been developed to address the accuracy, sensitivity and durability problems inherent in other cone designs, with a resolution of 6.5 and 10 lbs. respectively. The unit consists of a single element strain gauge transducer, eliminating mechanical coupling effects, and with cone support electronics packaged directly behind the transducer. Both the cone tip, local friction element and pore pressure element are field replaceable by the operator in approximately five minutes. The cones are configured with one through five channel capacity with six channels from which to choose.

CONE CHANNELS:

- **TIP**
- **LOCAL FRICTION**
- **PORE PRESSURE**
- **TEMPERATURE**
- **INCLINATION**
- **SEISMIC**
- **RESISTIVITY MODULE CAN BE ADDED**

There are two possible locations for pore pressure; one on the tip or one directly behind the tip.

The electronics have precision power supplies for the strain gauges, which eliminate the effects of cable resistance on the measurements. Precision strain gauge amplifiers perform the subtraction at the cone, raise the voltage levels to eliminate cable effects and electrical noise and standardize the output levels, making all cones interchangeable without adjustments of external circuitry. The cones conform to all international standards.

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CONE SPECIFICATIONS

GENERAL

- Conditioning electronics for all channels is located in cone.
- Cones are interchangeable in the field without adjustments or cable changes.
- Power ± 12 Volt to ± 15 Volt at 100 ma (max.)
- Connector 10 pin LEMO.
- Output impedance on all channels except temperature is less than one ohm in series with cable resistance (typically one or two ohms).
- Operating temperature range 0°C to 60°C.
- Storage temperature range - 40°C to 70°C.
- Strain gage channel static zero error is eliminated by computer measurement of zero force signals.
- The friction element has an equal end area to eliminate pore pressure effects.
- Tip and friction channels are temperature compensated.

TIP RESISTANCE

Full Scale Range	100 Megapascal (1020 kgf/cm ² or 1044 TSF)
Overrange	120 Megapascal without electrical saturation 300 Megapascal without damage
Cone area	10 cm ² (10 ton cones) 15 cm ² (15 ton cones)
Water Pressure Area Ratio	0.8
Linearity	0.2% FS max. 0.1% FS typical
Zero Drift	.002% FS/°C typical
Output Scale	.075 Volt/Megapascal

FRICTION

Full Scale Range	1 Megapascal (10.2 kgf/cm ² or 10.44 TSF)
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Overrange	1.2 Megapascal without electrical saturation 2 Megapascal without damage
Sleeve Area	150 cm ² (10 ton cones) 225 cm ² 15 ton cones)
Water Pressure Area Ratio	1.0 (Equal end areas)
Linearity	0.2% FS typical
Zero Drift	.01% FS/°C typical
Output Scale	7.5 Volt/Megapascal

PORE PRESSURE

Full Scale Range	35 bar (500 PSI)
Overrange	42 bar without electrical saturation 70 bar without damage
Linearity and Hysteresis	1% max

INCLINATION

Full Scale Range	10°
Overrange	12° without electrical saturation
Error	2° max
Scale	.8 Volt/degree

TEMPERATURE

Range	- 10°C to 100°C
Error	1°C max, 3°C max (at end of range)
Impedance	10K ohm
Scale	10 millivolt/°C

SEISMIC

Range	1 cm/sec max
Sensitivity	11 Volt/cm/sec
Resonance	28 ± 7 Hz (100 Hz optional)
Damping	20% critical

10 TON DIGITAL SUBTRACTION CONE

A 10 ton subtraction cone with tip, friction, inclination, pore pressure, temperature, and seismic. Manufactured from special alloy stainless steel, full scale output for the tip is 10 tons, mechanical failure is 30 tons. Internal electronics provide precision power regulation and accurate analog to digital conversion of cone channels. This completely eliminates cable length and solder joint thermocouple effects and allows calibration and identification parameters to be stored inside the cone.

Electrical Specifications

- Power: +12 Volt at 200 mA (max).
- Connector: 10 pin LEMO waterproof connector.
- Operating temperature range: 0°C to 60°C
- Storage temperature: -40°C to 70°C
- 4 channel, 24 bit A/D converter for measurement of tip, friction, and pore pressure. Minimum noise free resolution of 1 part in 65000.
- 10 channel, 12 bit A/D converter for measurement of inclination, seismic, temperature, and spare channels.
- 8 bit microcontroller with 8kb flash memory for cone identification and calibration data storage.
- 32kb non-volatile ram for data storage.
- RS-485 serial communication. Cable lengths of 1000 ft possible. CRC error checking to prevent transmission of incorrect data.
- Cones are interchangeable in the field. Cones can be calibrated in the field. All calibration data is contained in the cone.
- Compatible with vision cone and fuel fluorescence detector.

Mechanical Specifications

TIP

- Tip angle: 60 degree
- Tip area: 10 cm²
- Net area ratio: .8
- Tip range: 100 Mpa (1044 TSF)
- Tip mechanical overload capacity: 300 %
- Accuracy: .2 %
- Temperature compensated

SLEEVE

- Sleeve area: 150 cm²
- Sleeve capacity: 1 MPa
- Sleeve mechanical overload capacity: 200 %
- Accuracy: .2 %
- Temperature compensated
- Equal end area eliminates pore pressure effects.

PORE PRESSURE TRANSDUCER

- Pore pressure range: 7000 kPa (1000 psi)
- Pore pressure mechanical overload pressure: greater than 200 %
- Accuracy: .5 %
- Temperature compensated
- Special cones available with three pressure transducers for simultaneous measurement of U1, U2, U3.

INCLINOMETER

- Two channel inclinometer. Pitch and roll measurement provides information on cone migration.
- Uses accelerometers to measure inclination. No moving parts
- Range: 0 – 15 degrees
- Resolution: .1 degree.

SEISMIC

- Micro-machined high-resolution accelerometer.
- Capacity: +/- 2g
- True DC response
- Electronic offset eliminates effect of gravity
- Digitized in cone and transmitted over serial port. No extra wires or analog measurement required.

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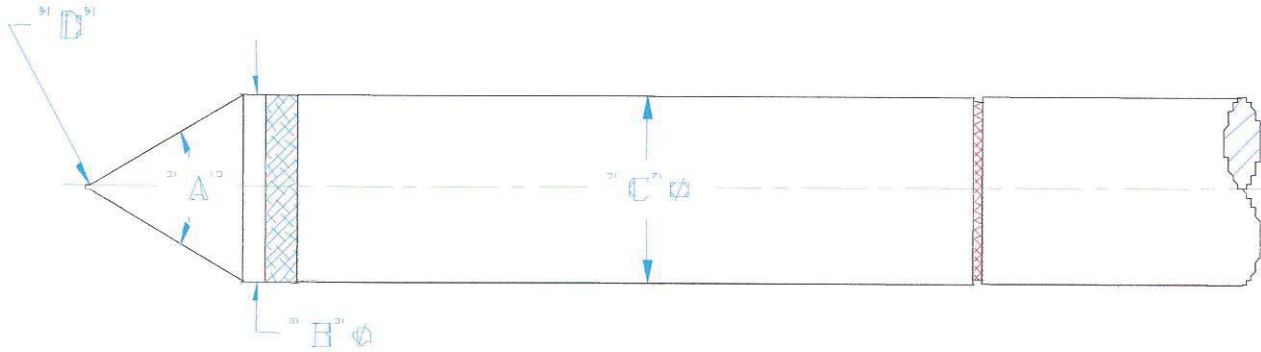
ASTM INSPECTION SHEET

DATE:

CONE SERIAL NUMBER:

INSPECTION PERFORMED BY:

GAGE SERIAL NUMBER:



10 CM² CONE

DIMENSION	"A"	"B"	"C"	"D"
ASTM MAX.	65°	1.422 in. (36.1 mm)	"B" + 0.024 in. ("B" + 0.5 mm)	0.125 R. (3.2 mm R.)
ASTM MIN.	55°	1.390 in. (35.3 mm)	"B" + 0.000 in. ("B" + 0.0 mm)	0.000 R. (0.0 mm R.)
ACTUAL				

15 CM² CONE

DIMENSION	"A"	"B"	"C"	"D"
ASTM MAX.	65°	1.732 in. (44.0 mm)	"B" + 0.024 in. ("B" + 0.5 mm)	0.125 R. (3.2 mm R.)
ASTM MIN.	55°	1.700 in. (43.2 mm)	"B" + 0.000 in. ("B" + 0.0 mm)	0.000 R. (0.0 mm R.)
ACTUAL				

ASTM Specification D3441 requires that all cone assemblies and cone penetration testing conform to the above specifications taken from the 1995 ASTM Standards Specification.