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## Geotechnical investigation and testing — Field testing — Part 15: Measuring while drilling

*Reconnaissance et essais — Essais de sol —*

*Partie 15: Enregistrement des paramètres de forages*

ICS: 93.020

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This draft has been developed within the European Committee for Standardization (CEN), and processed under the **CEN lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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# Contents

Page

Foreword .....	v
Introduction.....	vii
1 Scope .....	1
5 Normative references .....	1
6 Terms and definitions .....	2
4 Symbols and abbreviations.....	2
7 Equipment .....	3
7.1 General .....	3
7.2 Drilling equipment .....	4
7.3 Measuring system .....	4
7.3.1 General .....	4
7.3.2 Sensors for hydraulic pressures .....	5
7.3.3 Measuring system for penetration length.....	5
7.3.4 Measuring system for flushing medium flow .....	5
7.3.5 Measuring system for rotational speed .....	5
7.3.6 Measuring of hammering energy.....	6
7.3.7 Reflected vibrations .....	6
7.3.8 Time .....	6
7.4 Selection of measured parameters.....	6
7.5 Factors influencing MWD results .....	7
7.5.1 Tool influence .....	7
7.5.2 Drilling rig influence.....	7
7.5.3 Operator influence.....	8
8 Test procedures.....	8
8.1 General .....	8
8.2 Position and level of drill rig .....	8
8.3 Preparation of the measurement .....	8
8.4 Drilling procedure.....	9
8.5 Frequency of logging parameters .....	9
8.6 Registration of penetration length.....	9
8.7 Test completion .....	9
8.8 Equipment checks and calibrations .....	10
9 Test results .....	10
9.1 General .....	10
9.2 Calculated parameters .....	10
9.2.1 General .....	10
9.2.2 Penetration rate .....	10
9.2.3 Down-thrust pressure .....	11
9.2.4 Net down-thrust pressure.....	11
9.2.5 Flushing medium pressure.....	11
9.2.6 Drill head rotational torque.....	11
10 Reporting.....	12
10.1 General .....	12
10.2 Reporting of test results .....	12
10.2.1 General information .....	12
10.2.2 Location of the test .....	12
10.2.3 Test equipment .....	13
10.2.4 Test procedure.....	13

10.2.5 Measured parameters..... 13

Annex A (informative) Application of drilling parameters..... 14

A.1 The interpretation of drilling parameters ..... 14

A.1.1 General..... 14

A.1.2 Penetration rate..... 14

A.1.3 Net down-thrust ..... 14

A.1.4 Flushing medium pressure..... 14

A.1.5 Torque..... 14

A.1.6 Conclusion ..... 14

A.2 Calculated parameters ..... 16

A.2.1 General..... 16

A.2.2 Penetration resistance ..... 16

A.2.1 Soil-rock resistance..... 16

A.2.2 Somerton Index..... 16

A.2.3 Energy..... 17

Annex B (normative) Graphical presentation of drilling parameters..... 19

B.1 Presentation of test results ..... Error! Bookmark not defined.

Bibliography ..... 21

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally performed through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22476-15 was prepared by Technical Committee ISO/TC 182, *Geotechnique*, Subcommittee SC 1, *Recherches et essais géotechniques*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 22476 consists of the following parts, under the general title *Geotechnical investigation and testing — Field testing*:

- *Part 1: Electrical cone penetration tests*
- *Part 2: Dynamic probing*
- *Part 3: Standard penetration test*
- *Part 4: Menard pressuremeter test*
- *Part 5: Flexible dilatometer test*
- *Part 6: Self-boring pressuremeter test*
- *Part 7: Borehole jack test*
- *Part 8: Full displacement pressuremeter*
- *Part 9: Field vane test*
- *Part 10: Weight sounding test*
- *Part 11: Flat dilatometer test*
- *Part 12: Mechanical cone penetration test*
- *Part 13: Plate loading test*

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## Introduction

ISO 22476-15 specifies the technical principles for measuring equipment requirements, the execution and reporting on the parameters of investigation drilling process for geotechnical purposes.

The measuring while drilling (MWD) method deals with the recording of the machine parameters during the drilling process. This can be done manually or with the use of computerized systems which monitor a series of sensors installed on rotary and/or percussive drilling equipment. These sensors continuously and automatically collect data on all aspects of drilling, in real time, without interfering with the drilling progress. The data are displayed in real-time and are also recorded for further analysis. Examples for interpretation of the results are presented in an annex.

The method shall be used for its own purpose. The borehole can be used for other application such as installation of monitoring equipment, geophysical logging or realisation of expansion tests. The interpretation of the MWD results can be done in relation with the information provided by sampling.

It should be noted that measured and calculated drilling parameters are relative and dependant of the test conditions, procedures and equipment.

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# Geotechnical investigation and testing — Field testing — Part 15: Measuring while drilling

## 1 Scope

This international standard deals with equipment, execution and reporting of the measuring while drilling method (MWD) as a method of geotechnical investigation and testing.

It is applicable to top driven destructive drilling methods performed by a fully hydraulically powered drill rig and driving device.

The recording of the drilling parameters during soil grouting, drilling of nails, anchors or piles are beyond the scope of this standard.

## 2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1219-1, *Fluid power systems and components - Graphic symbols and circuit diagrams - Part 1: Graphic symbols for conventional use and data-processing applications*

EN 1997-1, *Eurocode 7: Geotechnical design – Part 1: General rules.*

EN 1997-2, *Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing*

EN 16228-1, *Drilling and foundation equipment - Safety - Part 1: Common requirements*

EN 16228-2, *Drilling and foundation equipment - Safety - Part 2: Mobile drill rigs for civil and geotechnical engineering, quarrying and mining*

ENV 13005:1999, *Guide to the expression of uncertainty in measurement.*

EN ISO 10012, *Measurement management systems – Requirements for measurement processes and measuring equipment.*

EN ISO 14688-1, *Geotechnical investigation and testing – identification and classification of soil – Part 1: identification and description.*

EN ISO 14689-1, *Geotechnical investigation and testing – identification and classification of rock – Part 1: identification and description.*

EN ISO 22475-1, *Geotechnical investigation and testing – Sampling methods and ground water measurements – Part 1: Technical principles for execution.*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 22475-1 and the following apply.

#### 3.1

##### reflected vibration

acceleration due to elastic rebound of rods compressed by hammer impact

### 4 Symbols and abbreviations

Table 1 — Symbols, units and abbreviations

Symbol	Name	Unit
a	measured penetration length	m
$\alpha$	efficiency coefficient of down-thrust work	-
$\beta$	efficiency coefficient of torque work	-
$\gamma$	efficiency coefficient of hammering work	-
$C_R$	measured drill head torque	kN.m
$C_{R\ max}$	maximum measured drill head torque	kN.m
$d_o$	external diameter of drill bit	m
E	calculated drilling energy	J
$E_S$	calculated specific energy	J
$E_R$	measured reflected vibrations	J
f	hammer frequency	Hz
$F_{\ max}$	maximum down thrust force	kN
$H_{\ max}$	maximum hold back force	kN
$I_A$	calculated alteration index	-
n	quantity of rods	-
p	measured hydraulic pressure in feed motor or cylinder	MPa
$p_{CR}$	measured hydraulic pressure in torque motor	MPa
$p_{CRO}$	unloaded engine rotation pressure	MPa
$p_{CR\ max}$	maximum measured hydraulic pressure in torque motor	MPa
$p_H$	measured hold back pressure	MPa