Direction de la Géotechnique
ir Ph. WELTER

L'état de la normalisation dans le domaine des forages de reconnaissance

Verkenningsboringen
Namen, 10 februari 2009

Les forages de reconnaissance
Namur, le 10 février 2009

Normalisation = Edition de standards

- nationale ----------→NBN
- européenne ----------→EN (CEN)
- Internationale ----------→ ISO

en Géotechnique (et pour les forages plus particulièrement) :
Anciennement pratiquement pas de textes NBN – quelques prescriptions via les CSC par les grands donneurs d'ordre (SWDE, SPW, MOW, INFRABEL,…..).

Normalisation = Edition de standards

européenne EN (CEN)←----- Accord de Vienne -----→internationale ISO

- Elaboration des textes par un comité technique (CEN ou ISO) avec présence d'observateurs (ISO ou CEN)
- Procédure de vote parallèle
- Publication de normes NBN EN ISO
- Au niveau belge, NBN a confié le travail au CSTC (Opérateur Sectoriel)
- Adresses utiles : www.cstc.be ou http://qc.met.wallonie.be

Les Eurocodes

Norme	Eurocodes	Titre	Prénorme
EN 1990	Eurocode 0	Bases du calcul	ENV 1991-1
EN 1991	Eurocode 1	Actions sur les constructions	ENV 1991-2 à 5
EN 1992	Eurocode 2	Calcul des structures en béton	ENV 1992
EN 1993	Eurocode 3	Calcul des structures en acier	ENV 1993
EN 1994	Eurocode 4	Calcul des structures mixtes acier-béton	ENV 1994
EN 1995	Eurocode 5	Calcul des structures en bois	ENV 1995
EN 1996	Eurocode 6	Calcul des ouvrages en maçonnerie	ENV 1996
EN 1997	Eurocode 7	Calcul géotechnique	ENV 1997
EN 1998	Eurocode 8	Calcul des ouvrages parasismiques	ENV 1998
EN 1999	Eurocode 9	Calcul des structures en aluminium	ENV 1999

+ Documents nationaux d'application DAN

Structure de l ’Eurocode 7 (EN-1997)

EUROCODE 7 - GEOTECHNICAL DESIGN

Part 1
General rules

projet final approuvé – DAN en cours d’élaboration

Part 2
Geotechnical design assisted by laboratory tests

Part 3
Geotechnical design assisted by field tests

Projets fusionnés – en cours de parution

Documents subordonnés (1)

élaborés par le CEN/TC341 - Geotechnical Investigation and Testing

Stages of development in CEN/TC 341 and ISO/TC 182/SC 1 *Geotechnical investigation and testing* Date: **2007-10-10** Page 1 of 3

ISO work item number	CEN work item number	WG of CEN/ TC 341	Short title	Resolutions CEN/TC 341	Accepted by CEN 10.99	Stage 20.60 CD	Stage 30.99 ENQ draft DIS	Stage 45.99 FV final draft FDIS	Publication ISO Availability CEN (DAV)	Remarks
14688-1	00341012		Identification of soil		2001-09				**2002-08**	ISO lead, EN ISO: 2002 *review 2007*
14688-2	00341001		Classification principles of soil		2001-09				**2004-07**	ISO lead, EN ISO: 2004
14688-3	00341055		Electronic data exchange – soil	29, 41, 70	2003-01	2003-12	2004-12	N/A	*2007-09*	ISO lead, TS sent again for publication as TS by 2005-12-22
14689-1	00341013		Identification of rock		2001-09				**2003-12**	ISO lead, EN ISO: 2005
14689-2	00341056		Electronic data exchange - rock	29, 41, 71	2003-01	2003-12	2004-12	N/A	2007/09	ISO lead, TS sent again for publication as TS by 2005-12-22
22475-1	00341038	1	Sampling – principles	19, 30, 39, 57, 63	2003-05				**2006-09**	EN ISO:2006
22475-2	00341036	1	Sampling – qualification criteria	19, 28, 41, 42, 57	2003-03				**2006-09**	TS:2006
22475-3	00341037	1	Sampling – conformity assessment	28,41,42,57	2003-03	2003-12	2004-07	N/A	*2007-12*	TS, final draft accepted, sent to CMC by 2005-07 Res. for incorporation of changes in the fdraft is pending
22476-1 [1)]	00341042	2	Electrical cone penetration tests	31, 41, 61, (76), (77), 86, 87	2003-03	2003-11	2005-01			Reactivation of the work item is pending
22476-9 [1)]	00341021	2	Field vane test	23	2002-03	2003-09	*2004-12*			WD 7 no progress yet
22476-12	00341054	2	Mechanical cone penetration test	31, 41, 69	2003-05 2005-11	2003-11 2006-04	2006-04	*2008-03*	*2008-11*	A fdraft from the WG is pending till 1/2008 to be sent for FV
22476-2	00341004	3	Dynamic probing	37	2001-09				**2005-01**	EN ISO: 2005
22476-3	00341005	3	Standard penetration test	37	2001-09				**2005-01**	EN ISO: 2005
22476-4	00341016	5	Menard pressuremeter test	22, 64,88	2002-03	2003-09	2005-04 2007-09	*2008-09*	*2009-05*	Sent for 2nd p Enquiry approved by Res. 88
22476-5	00341017	5	Flexible dilatometer test	22, 64	2002-03	2003-09	2005-06	*2007-10*	*2008-07*	Res for sending fdraft to FV is pending
22476-6	00341057	5	Self-boring pressuremeter test	22, 59, 73, 89	2002-03 2006-08	2003-09 *2007-03*	*2007-08*	*2008-12*	*2009-08*	Circulation of 1st CD is pending
22476-7	00341019	5	Borehole jack test	22, 64	2002-03	2003-09	2005-06	*2006-02 2007-10*	*2006-08 2008-07*	Res for sending fdraft to FV is pending
22476-8	00341058	5	Full displacement pressuremeter	22, 59, 74, 89	2002-03 2006-08	2004-08 *2007-03*	*2007-08*	*2008-12*	*2009-08*	Circulation of 1st CD is pending
22476-X	?	5	Phicometer shearing test	75						TS, WI number is pending
22476-10	00341022		Weight sounding test	24	2002-10				**2005-05**	TS: 2005
22476-11	00341023		Flat dilatometer test	24	2002-10				**2005-05**	TS: 2005

Documents subordonnés (2)

élaborés par le CEN/TC341 - Geotechnical Investigation and Testing

Stages of development in CEN/TC 341 and ISO/TC 182/SC 1 *Geotechnical investigation and testing* Date: **2007-10-10** Page 2 of 3

ISO work item number	CEN work item number	WG of CEN/ TC 341	Short title	Resolutions CEN/TC 341	Accepted by CEN	Stage 20.60 CD	Stage 30.99 ENQ draft DIS	Stage 45.99 FV final draft FDIS	Publication ISO Availability CEN (DAV)	Remarks
22282-1	00341060	1	General rules	56	2004-05 2007-07	*2008-01*	*2008-07*	*2009-11*	*2010-07*	Res. for sending draft to ENQ is pending
22282-2	00341061	1	Permeability tests using open systems	30, 41, 55	2003-05 2007-07	*2008-01*	*2008-07*	*2009-11*	*2010-07*	Res. for sending draft to ENQ is pending
22282-3	00341062	1	Water pressure test	30, 41, 55, 78 , 85	2003-05 2007-07	2007-09	2007-09	*2009-11*	*2010-07*	draft, sent for ENQ to ISO/CS
22282-4	00341063	1	Pumping tests	30, 41, 55, 79 , 85	2003-05 2007-07	2007-09	2007-09	*2009-11*	*2010-07*	draft, sent for ENQ to ISO/CS
22282-5	00341064	1	Infiltrometer tests	56, 80 , 85	2004-05 2007-07	2007-09	2007-09	*2009-11*	*2010-07*	draft, sent for ENQ to ISO/CS
22282-6	00341065	1	Permeability tests using closed systems	56, 81 , 85	2004-05 2007-07	2007-09	2007-09	*2009-11*	*2010-07*	draft, sent for ENQ to ISO/CS
22476-13 [1)]	00341008	4	Plate loading test	33, 62	2001-09	2003-11	*2005-02*			WD 1 no progress yet
.....	00341059	4	Pile load test – rapid axially loaded compression test	91						WD1 is pending for adoption (stage 10.99)
22477-1	00341053	4	Pile load test – static axially loaded compression test	32,38,65,66	2005-06	2005-12	2005-12	*2007-09*	*2008-04*	Comments on Enquiry sent to WG4 on 2006-10 Res. for 9months tolerance is pending
22477-2 [1)]	00341045	4	Pile load test – static axially loaded tension test	32, 38	2003-05					No progress
22477-3 [1)]	00341046	4	Pile load test – static transversally loaded tension test	32, 38	2003-05	2003-11				WD 1 no progress
22477-4 [1)]	00341047	4	Pile load test – dynamic axially loaded compression test	32, 38	2003-05	2003-11				WD 1 no progress
22477-5	00341007	4	Testing of anchorages	60	2001-09	2003-11	2005-04	*2006-02*	*2006-08*	Compiled comments sent to AFNOR on 2005-11-30
22477-6 [1)]	00341009	4	Testing of nailing	62	2001-09	2003-11	*2005-02*			WD 3 no progress
22477-7 [1)]	00341010	4	Testing of reinforced fill	62	2001-09	*2003-11*	*2005-02*			No progress
17892-1	00341024		Water content	25, 43	2002-10				**2004-11**	TS – *review 2007*
17892-2	00341025		Density of fine grained soils	25, 44	2002-10				**2004-11**	TS - *review 2007*
17892-3	00341026		Density of solid particles	25, 45	2002-10				**2004-11**	TS - *review 2007*
17892-4	00341027		Particle size distribution	25, 46	2002-10				**2004-11**	TS - *review 2007*
17892-5	00341028		Oedometer test	25, 47	2002-10				**2004-11**	TS - *review 2007*
17892-6	00341029		Fall cone test	25, 48	2002-10				**2004-11**	TS - *review 2007*
17892-7	00341030		Unconfined compression test	25, 49	2002-10				**2004-11**	TS - *review 2007*
17892-8	00341031		Unconsolidated triaxial test	25, 50	2002-10				**2004-11**	TS - *review 2007*
17892-9	00341032		Consolidated triaxial test	25, 51	2002-10				**2004-11**	TS - *review 2007*

Documents subordonnés (3)

élaborés par le CEN/TC341 - Geotechnical Investigation and Testing

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17892-10	00341033		Direct shear test	25, 52	2002-10				**2004-11**	TS - *review 2007*
17892-11	00341034		Permeability test	25, 53	2002-10				**2004-11**	TS - *review 2007*
17892-12	00341035		Atterberg limits	25, 54	2002-10				**2004-11**	TS - *review 2007*

Explanations:

WD: Working Draft
CD: Committee Draft (CEN stage 20.60)
DIS: Draft International Standard (Dispatch ENQ draft to CEN/MC – ISO/CS stage 30.99)
FDIS: Final Draft International Standard (Dispatch FV draft to CEN/MC – ISO/CS stage 45.99)
TS: Technical Specification
N/A: not applicable
ENQ: Enquiry
FV: Formal vote
DAV: Date of Availability (date when the definitive text in the official language versions of an approved CEN publication is distributed by the Central Secretariat)

yellow shadow: stage of progress
dates in italic: target dates
underlined dates: target dates including a tolerance of 9 months
standard number in bold black: finalised project (standard)
standard number in blue: draft
standard number in green: final draft
standard number in red: work items with no progress
[1)] has been deleted by CEN, because the time schedule between approval of New WI and enquiry has been exceeded

Explanation on Timeframe and CEN stage codes:

Stage Code	***Description***	***Maximum timeframe***
10.99	Decision on WI proposal (on first pre-working draft)	Sending of TC resolution to CMC - Accepted by ISO/CS – CMC
20.60	Circulation of 1st working draft	10.99 + 6 months max.
30.99	Dispatch draft (Enquiry, PQ/UQ), UAP or TC Approval draft to CMC - ISO/CS	20.60 + 6 months max.
45.99	Dispatch Formal Vote, parallel Formal Vote to CMC - ISO/CS	30.99 + 16 months max.

Normalisation européenne en Géotechnique = secteur volontaire

= n'est d'application que si un texte réglementaire (fédéral, régional, particulier) l'impose.

Terminologie : « shall » = imposition

« should » = recommandé. Dérogation possible dûment motivée.

« can or may » = autorisation

Textes normatifs ISO en Géologie

- Symboles graphiques géologiques : série NBN ISO 710-1à 7

- Identification, description, classification des sols, échanges électroniques de données : série NBN EN ISO 14688- 1 à 3

- Identification des roches, échanges électroniques de données : série NBN EN ISO 14689-1 et 2

Eurocode 7 – 2

Geotechnical design assisted by field an laboratory tests

ISO/TC **182**/SC **1**

Secretariat: **DIN**

Voting begins on:
2005-09-29

Voting terminates on:
2005-11-29

Geotechnical investigation and testing — Sampling methods and groundwater measurements —

Part 1:
Technical principles for execution

Reconnaissance et essais géotechniques — Méthodes de prélèvement et mesurages piézométriques —

Partie 1: Principes techniques des travaux

Contents

Figures

1 Scope

This part of ISO 22475 deals with the technical principles of sampling of soil, rock and groundwater, and with groundwater measurements, in the context of geotechnical investigation and testing, as described in EN 1997-1 and EN 1997-2.

The aims of such ground investigations are:

a) to recover soil and rock samples of a quality sufficient to assess the general suitability of a site for geotechnical engineering purposes and to determine the required soil and rock characteristics in the laboratory;

b) to obtain information on the sequence, thickness and orientation of strata and joint system and faults;

c) to establish the type, composition and condition of strata;

d) to obtain information on groundwater conditions and recover water samples for assessment of the interaction of groundwater, soil, rock and construction material.

The quality of a sample is influenced by the geological and hydrogeological conditions, the choice and execution of the drilling and/or the sampling method, handling, transport and storage of the samples.

This part of ISO 22475 does not cover soil sampling for the purposes of agricultural and environmental soil investigation.

NOTE 1 Soil sampling for these purposes is to be found in ISO 10381.

Water sampling for the purposes of quality control, quality characterisation, and identification of sources of pollution of water, including bottom deposits and sludges is not covered.

NOTE 2 Water sampling for these purposes is to be found in ISO 5667.

- category A sampling methods: samples of quality class 1 to 5 can be obtained;
- category B sampling methods: samples of quality class 3 to 5 can be obtained;
- category C sampling methods: only samples of quality class 5.

6.2.2 Samples of quality class 1 or 2 can only be obtained by using category A sampling methods. The intention is to obtain samples in which no or only slight disturbance of the soil structure has occurred during the sampling procedure or in handling of the samples. The water content and the void ratio of the soil correspond to that in-situ. No change in constituents or in chemical composition of the soil has occurred. Certain unforeseen circumstances such as varying of geological strata may lead to lower sample quality classes being obtained.

6.2.3 By using category B sampling methods, this will preclude achieving sampling quality class better than 3. The intention is to obtain samples containing all the constituents of the in-situ soil in their original proportions and the soil has retained its natural water content. The general arrangement of the different soil layers or components can be identified. The structure of the soil has been disturbed. Certain unforeseen circumstances such as varying of geological strata may lead to lower sample quality classes being obtained.

6.2.4 By using category C sampling methods, this will preclude achieving sampling quality class better than 5. The soil's structure in the sample has been totally changed. The general arrangement of the different soil layers or components has been changed so that the in-situ layers cannot be identified accurately. The water content of the sample may not represent the natural water content of the soil layer sampled.

Table 1 — Quality classes of soil samples for laboratory testing and sampling categories to be used

Sampling categories	Quality classes of soil samples for laboratory testing according to prEN 1997-2				
	1	2	3	4	5
A	A	A	A	A	A
B			B	B	B
C					C

Table 2 — Sampling by drilling in soils

Column	1	2	3	4	5	6	7	8	9	10	11	Column
Line	Drilling method				Equipment		Application and limitations [d]		Sampling categories [e]	Achievable quality class [e]	Remarks	Line
	Soil cutting technique [b]	Use of flushing medium	Extraction of sample by	Designation	Tool	Borehole diameter range mm	Unsuitable for [a, d]	Preferred method for [a, d]				
1	Rotary drilling	No	Drilling tool	Rotary dry core drilling [c]	Single-tube corebarrel	100 to 200	coarse gravel, cobbles, boulders	clay, silt, fine sand, silt	B (A)	4 (2-3)	Good interior, outside dried out	1
					Hollow stem auger	100 to 300		clay, silt, sand, organic soils	B (A)	3 (1-2)	–	
2		Yes	Drilling tool	Rotary core drilling	Single tube corebarrel	100 to 200	non-cohesive soils	clay, clayey and cemented composite soils, boulders	B (A)	4 (2-3)	–	2
					Double-tube corebarrel				B (A)	3 (1-2)		
					Triple-tube corebarrel				A	1		
3		Yes	Drilling tool	Rotary core drilling	Double/triple-tube corebarrel with extended inner tube	100 to 200	gravel, cobbles, boulders	clay, silt	A	2 (1)	–	3
4		No	Drilling tool	Auger drilling	Drill rods with shell or flight auger; hollow stem auger	100 to 2000	boulders larger than $D_e/3$	all soils above water table, all cohesive soils below water table	B	4 (3)	Maximum length of auger: ≤ 0,5 m	4
5		Yes	Reverse flow of flushing medium	Reverse circulation drilling	Drill rods with hollow chisel	150 to 300	–	all soils	C (B)	5 (4)	–	5
6		No	Drilling tool	Auger drilling with light equipment	Shell auger or spiral flight auger	40 to 80	coarse gravel with a particle size larger than $D_e/3$ and dense soils and not for cohesion-less soils beneath groundwater surface	clay to medium gravel above water table; cohesive soils below water table	C [f]	5	Only to be used for small depths	6
7	Hammer driving	No	Drilling tool	Percussive core drilling	Percussion clay cutter with cutting edge inside; also with sleeve (or hollow stem auger) [b]	80 to 200	soils with a particle size larger than $D_e/3$ laminated soil, e.g. varve	clay, silt and soils with a particle size up to $D_e/3$	cohesive soil: A	2 (1)	Plotting of driving chart on the basis of number of impacts	7
									non-cohesive soil: B (A)	3 (2)		
8		No	Drilling tool	Percussive drilling	Percussive clay cutter with cutting edge outside [b]	150 to 300	soils with a particle size larger than $D_e/3$	gravel and soils with a particle size up to $D_e/3$	B	4		8
9		No	Drilling tool	Small diameter hammer driving	Hammer driving linkage with tube sampler	30 to 80	soils with a particle size larger than $D_e/2$	soils with a particle size up to $D_e/5$	C [f]	5	Only to be used for small depths	9
10	Rotary hammer driving	Yes	Drilling tool	Rotary percussive drilling	Single- or double-tube corebarrel	100 to 200	composite and pure sands with a particle size larger than 2,0 mm, gravel, firm and stiff clays	clay, silt, fine sand	cohesive soil: A	2 (1)	–	10
									non-cohesive soil: B	4 (3)		
11	Percussion	No	Drilling tool	Cable percussion drilling	Cable with percussion shell auger	150 to 500	gravel above water table, silt, sand and gravel below water table	clay and silt above water table, clay below water table	C (B)	4 (3)	–	11
12		No	Drilling tool	Light cable percussion drilling	Cable with valve auger	100 to 1000	recovery above water table	gravel and sand in water	C (B)	5 (4)	Can also be used in cohesive soils if water is added	12
13	Pneumatic/ continuous thrust	No	Drilling tool	Small diameter pneumatic/ continuous thrust drilling	Pneumatic/ continuous thrust linkage, with tube sampler	30 to 80	dense and coarse-grained soils	clay, silt, fine sand	C [f]	5	Only to be used for small depths	13
14	Grabbing	No	Drilling tool	Grab drilling	Cable with grab	400 to 1500	firm, cohesive soils, boulders of size larger than $D_e/2$	gravel, boulders of size less than $D_e/2$, cobbles	above water surface: B	4	–	14
									below water surface: C	5		

[a] Guideline values.

[b] Using the hammer driving technique the drilling tool will be driven by a special driving tool. Using the percussion technique the drilling tool will be driven by its repetitive lifting and falling.

[c] Rotary core drilling is commonly used if the observation of the groundwater surface is the most important aim of the ground investigation

[d] D_e is the internal diameter of the sampling tool.

[e] The sampling categories and intended quality classes given in brackets can only be achieved in particularly favourable ground conditions, which shall be explained in such cases.

[f] Sampling category B is sometimes possible in light cohesive soils.

NOTE Straight flush drilling is not covered because the sample quality class that can be achieved are mostly worse than 5.

6.3.5 Sampling by hollow stem auger drilling

6.3.5.1 In sampling by hollow stem auger drilling the hollow stem auger which consists of a spiral flight wound round a hollow central tube and fitted with an appropriate cutting head is drilled into the ground in a similar manner to the flight auger (see 7.2.2.4). Additional sections of hollow stem auger are added till the required depth is reached.

6.3.5.2 Once the required depth is reached a sampling system or corebarrel may be lowered through the centre tube of the hollow stem auger to take samples from the bottom of the hole without removing the hollow stem auger string. Sampling by grab drilling

6.3.6 Sampling by grab drilling

6.3.6.1 In sampling by grab drilling, the sampling tool is a cable with grab

6.3.6.2 The borehole diameter should be between 400 mm and 1500 mm.

6.3.6.3 This sampling technique is the preferred method for gravel, cobbles and boulders of size less than $D_e/2$. It is unsuitable for firm, cohesive soils, boulders of size larger than $D_e/2$.

6.3.7 Soil sampling by small diameter drilling

6.3.7.1 Small diameter drilling refers to all drilling with a hole diameter between 30 mm and 80 mm. In principle the same drilling methods and equipment described in Table 2 can be used.

6.3.7.2 Sampling by small diameter drilling is only suitable in sands and fine grained soils. When employing small diameter drilling methods, it should be noted that the samples recovered are sufficient in size and mass, related to the scheduled laboratory testing.

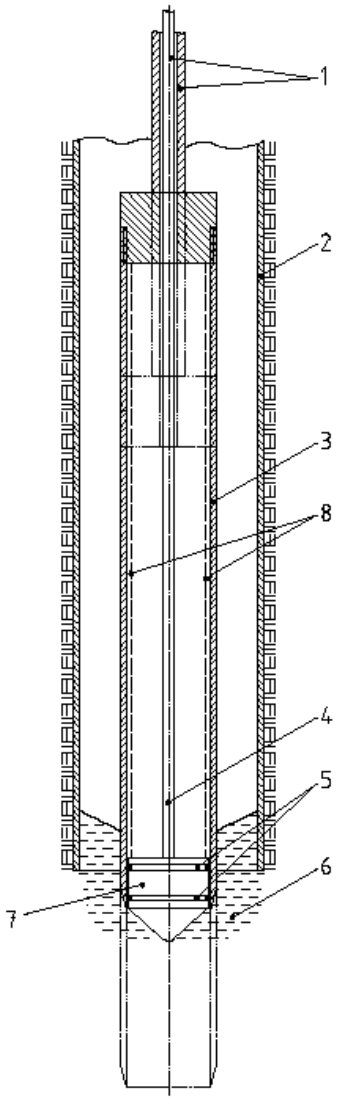
6.3.7.3 Generally the quality of a core sample obtained by small diameter drilling is lower than if larger diameter drilling for the same drilling method is used.

Table 3 — Soil sampling using samplers

Column	1	2	3	4	5	6	7	8
Line	Type of sampler [b]	Preferred sample dimensions		Technique used	Applications and limitations		Sampling category for soils as in column 6 [a]	Achievable quality class [a]
		Diameter mm	Length mm		Unsuitable for	Recommended for use in		
1	thin-walled (OS-T/W)	70 to 120	250 to 1 000	static or dynamic driving	gravel, loose sand below water surface, firm cohesive soils, soils including coarse particles	cohesive or organic soils of soft or stiff consistency	A	1
						(medium) dense sand below water surface	B (A)	3 (2)
						cohesive or organic soils of stiff consistency	A	2 (1)
2	thick-walled (OS-TK/W)	>100	250 to 1 000	dynamic driving	gravel, sand below water surface, pasty and firm cohesive or organic soils, soils including coarse particles	cohesive or organic soils of soft to stiff consistency, and including coarse particles	B (A)	3 (2)
3	thin-walled (PS-T/W)	50 to 100	600 to 800	static driving	gravel, very loose and dense sands, semi-firm and firm cohesive or organic soils, soils including coarse particles	cohesive or organic soils of pasty or stiff consistency, and sensitive soils	A	1
						sand above ground water	B	3
4	thick-walled (PS-TK/W)	50 to 100	600 to 1 000	static driving	gravel, sand below water surface, pasty and firm cohesive or organic soils, soils including coarse particles	cohesive or organic soils of soft to stiff consistency, and sensitive soils	B (A)	2 (1)
5	cylinder (LS)	250	350	static rotating	sand	clay, silt	A	1
6	cylinder (S-SPT)	35	450	dynamic driving	coarse gravel, blocks	sand, silt, clays	B	4
7	window	44 to 98	1 500 or 3 000	static or dynamic driving	sand, gravel	silt, clay	C	5

[a] The sampling categories and achievable quality classes given in parentheses can only be achieved in particularly favourable soil conditions, which shall be explained in such cases.

[b]
- OS-T/W open-tube samplers, thin-walled
- OS-TK/W open-tube samplers, thick-walled
- PS-T/W piston samplers, thin-walled
- PS-TK/W piston samplers, thick-walled
- LS large sampler
- S-SPT SPT (standard penetration test) sampler



Key

1	drill rod locking device above ground	5	sealing ring
2	casing	6	disturbed soil
3	sample tube	7	piston
4	vent	8	liner (optional)

Figure 5 — Schematic thin-walled stationary piston sampler (PS) for sampling from borehole bottom

Table 4 — Examples on sampling methods with respect to the sampling category in different soils

Soil type	Suitability depends on e.g.	Sampling method		
		Category A	Category B	Category C
Clay	Stiffness or strength sensitivity plasticity	PS-PU OS-T/W-PU [b] OS-T/W-PE [a] OS-TK/W-PE [a, b] CS-DT, CS-TT LS, S-TP, S-BB	OS-T/W-PE OS-TK/W-PE CS-ST HSAS AS [a]	AS
Silt	Stiffness or strength sensitivity groundwater surface	PS OS-T/W-PU[b] OS-TK/W-PE [a- b] LS, S-TP	CS-DT, CS-TT OS-TK/W-PE HSAS	AS CS-ST
Sand	sizes of the particles density groundwater surface	S-TP OS-T/W-PU [b]	OS-TK/W-PE [b] CS-DT, CS-TT HSAS	AS CS-ST
Gravel	size of the particles density groundwater surface	S-TP	OS-TK/W-PE [a,b] HSAS	AS CS-ST
Organic soil	state of decay	PS OS-T/W-PU [b] S-TP	CS-ST HSAS AS [a]	AS

[a] Can be used only in favourable conditions.

[b] See also 6.4.2.3 for the detailed geometry.

Key

OS-T/W-PU	Open-tube samplers, thin-walled/pushed	CS-ST	Rotary core drilling, single tube
OS-T/W-PE	Open-tube samplers, thin-walled/percussion	CS-DT, CS-TT	Rotary core drilling, double or triple tube
OS-TK/W-PE	Open-tube samplers, thick-walled/percussion	AS	Augering
PS	Piston samplers	HSAS	Hollow stem augering
PS-PU	Piston samplers, pushed	S-TP	Sampling from trial pit
LS	Large samplers	S-BB	Sampling from borehole bottom

7.2 Categories for rock sampling methods

7.2.1 There are three categories of rock sampling methods depending on the best obtainable quality of rock samples under given ground conditions:

— category A sampling methods;

— category B sampling methods;

— category C sampling methods.

7.2.2 By using category A sampling methods it is intended to obtain samples in which no or only slight disturbance of the rock structure has occurred during the sampling procedure of the samples. The strength and deformation properties, water content, density, porosity and the permeability of the rock sample correspond to the in-situ values. No change in constituents or in chemical composition of the rock mass has occurred. Certain unforeseen circumstances such as varying of geological conditions may lead to lower sample quality being obtained.

7.2.3 By using category B sampling methods it is intended to obtain samples that contain all the constituents of the in-situ rock mass in their original proportions and the rock pieces have retained their strength and deformation properties, water content, density and porosity. By using category B sampling the general arrangement of discontinuities in the rock mass may be identified. The structure of the rock mass has been disturbed and thereby the strength and deformation properties, water content, density, porosity and permeability for the rock mass itself. Certain unforeseen circumstances such as varying of geological conditions may lead to lower sample quality being obtained.

7.2.4 By using category C sampling methods the structure of the rock mass and its discontinuities has been totally changed. The rock material may have been crushed. Some changes in constituents or in chemical composition of the rock material may occur. The rock type and its matrix, texture and fabric may be identified.

Table 5 — Soil sampling using samplers

Column	1	2	3	4	5	6	7	8	9	10
Line	Drilling method			Equipment		Drilling method less suitable for [a]	Samples		Achievable sampling category [b]	Remarks
	Flushing medium	Extraction of sample by	Designation	Sampling tool	Guideline for borehole diameter range [a] mm		Cores [a]	Cuttings		
1	No	Drilling tool attached to drill rods	Rotary dry core drilling	Single-tube corebarrel	70 [c] to 200	Rock of medium to high hardness	Soft, erodable, water-sensitive rock; short core runs	None	B (A)	To prevent overheating of the bit, core runs should not exceed 0,5 m.
2	Yes	Drilling tool attached to drill rods	Rotary core drilling	Single-tube corebarrel	70 [c] to 200	Rock of medium to high hardness	Jointed, soft rock	Sieve residue and suspended matter	B (A)	Flushing medium can cause disturbance of core material
3	Yes	Drilling tool attached to drill rods	Rotary core drilling	Double-tube corebarrel	70 [c] to 200	Erodable, water-sensitive rock	All types of rock	Sieve residue and suspended matter	A (B)	—
4	Yes	Drilling tool attached to drill rods	Rotary core drilling	Triple-tube corebarrel	70 to 200	—	All types of rock	Sieve residue and suspended matter	A	—
5	Yes	Drilling tool attached to drill rods, with wireline extractable inner barrel	Wireline core drilling	Wireline corebarrel, or triple-tube corebarrel	70 to 180	—	All types of rock	Sieve residue and suspended matter	A	—
6	Yes	Drilling tool attached to drill rods	Open hole drilling	Solid bit, roller bit, DTTH	50 to 350	—	None	Sieve residue and suspended matter	C	—

[a] Guideline values considering the possible use of a casing.

[b] The sampling categories given in parentheses can only be achieved in particularly favourable or unfavourable ground conditions, which shall be explained in such cases.

[c] In some crystalline rocks, a minimum borehole diameter of 30 mm may be sufficient for the identification and description of rock.

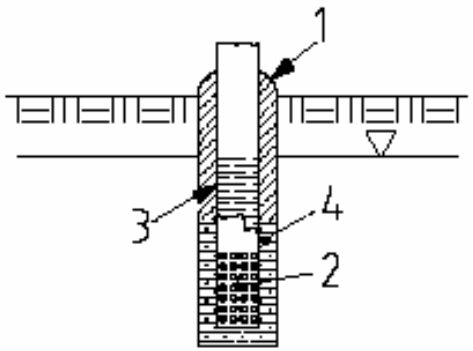
DTTH Down-the-hole-hammer.

NOTE The sample diameter is smaller for the same borehole diameter when a triple-tube corebarrel is used, instead of a single-tube corebarrel.

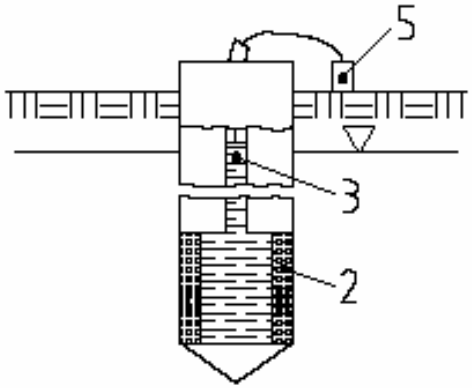
9.2.1.1 Open systems can be divided in two groups as follows (see Figure 6):

a) open standpipe;

b) open pipe with inner hose.



a) Open standpipe

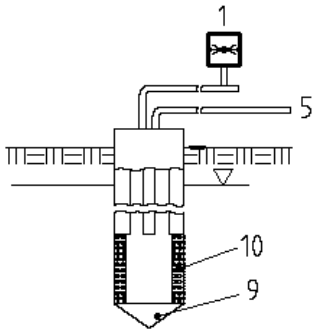


b) Open pipe with inner hose

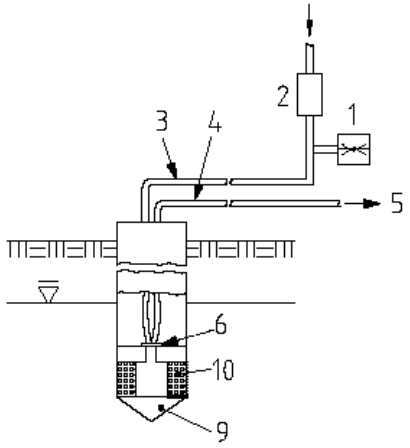
Key

1 seal
2 filter
3 tube
4 filter pack
5 indicating instrument

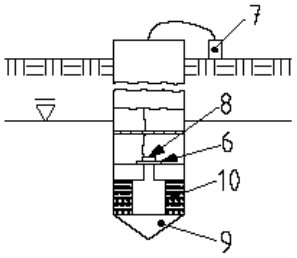
Figure 6 — Examples of open systems



a) Hydraulic system



b) Pneumatic system



c) Electrical system

Key

1 pressure transducer
2 flow regulator
3 pressure supply tube
4 return tube to atmosphere
5 valve for flushing
6 membrane
7 measuring instrument
8 electrical transducer
9 filter tip
10 filter

Figure 7 — Examples of closed systems

9.2.2 Checking installation

9.2.2.1 General

Function controls shall be performed during installation if possible and immediately after installation to ensure the proper function of the groundwater measuring system. All groundwater measuring stations shall be marked indelibly. A record shall be prepared for each groundwater measuring station (see 12.1.7).

9.4 Decommissioning

The piezometers shall be de-installed when required and the borehole shall be back-filled according to 6.5.

11 Handling, transport and storage of samples

11.1 General

11.1.1 Handling according to this standard starts when the sample comes out of the sampling tool.

11.1.2 The relevant conditions of soil and rock samples that were present after the sample had come out of the sampling tool, shall be preserved.

11.1.3 National laws or regulations shall be considered when transporting samples known or suspected to contain hazardous material.

11.1.4 A separate traceability record shall accompany each shipment so that the possession of the sample is traceable from collection to shipment to laboratory disposition.

11.1.5 When transferring the possession of samples the persons(s) relinquishing and receiving the samples shall sign, date, record the time and check completely the traceability record.

11.1.6 Every soil and rock sample shall be protected any time from direct sun light, heat, frost and rain.

11.2 Preservation materials and sample containers

The type of preservation materials and sample containers depend on the sampling categories A, B, and C and on the climate and transporting mode and distance:

a) Sealing wax e. g. microcrystalLine wax , or combinations there of:

b) metal discs, ca 2 mm thick and having a diameter slightly less than the inside diameter of the tube liner or ring and to be used in union with wax or caps and tape or tube;

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12 Report

12.1 Field report

12.1.1 General

At the project site, for each borehole, etc., a field report of sampling and groundwater measurements shall be completed. This field report shall consists of the following, if applicable:

a) summary log (see 12.1.2);

b) drilling record (see 12.1.3);

c) sampling record (see 12.1.4);

d) record of identification and description of soil and rock (see 12.1.5);

e) backfilling record (see 12.1.6);

f) record of the installation of piezometers (see 12.1.7);

g) record of groundwater measurements (see 12.1.8).

All field investigations shall be recorded and reported such that third persons are able to check and understand the results.

12.2 Report of the results

The report of the results shall include the following essential information, if applicable:

a) The field report (in original and/or computerised form);

b) a final record of the identification and description of soil and rock, according to ISO 14688-1 and ISO 14689-1;

c) a graphical presentation of the record of the drilling parameters;

d) a graphical presentation of the final record of the identification and description of soil and rock;

e) a graphical presentation of the backfilling;

f) a graphical presentation of the piezometer;

g) a graphical or numerical presentation of the results of the groundwater measurements;

h) name and signature of the responsible expert.

Geotechnical investigation and testing — Sampling by drilling and excavation methods and groundwater measurements — Part 2: Qualification criteria for enterprises and personnel (N/A)

EN ISO 22475-1 specifies the technical principles for the execution of sampling and groundwater measurements.

The quality of these services can be proven by:

1) a declaration of conformity by a contractor (first party control);

2) a declaration of conformity by a client (second party control);

3) a declaration of conformity by a conformity assessment body (third party control).

Every enterprise or individual may decide, if and how they will prove the fulfilment of the technically related criteria: by first, second or third party control because no part of EN ISO 22475 requires such a declaration.

CEN ISO/TS 22475-2 specifies the qualification criteria for enterprises and personnel that perform sampling and groundwater measurements according to EN ISO 22475-1.

The conformity assessment by third party control may be made according to the technical principles for execution of sampling and groundwater measurements according to EN ISO 22475-1 as indicated in CEN ISO/TS 22475-2 and the conformity assessment procedure given in CEN ISO/TS 22475-3.

1 Scope

This document specifies the qualification criteria for an enterprise and personnel performing sampling by drilling and excavation methods and groundwater measurement services so that both have the appropriate experience, knowledge and qualifications as well as the correct equipment for sampling by drilling and excavation methods and groundwater measurements for the task to be carried out according to EN ISO 22475-1.

Contents

4.2 Personnel requirements

4.2.1 General

4.2.1.1 The enterprise shall have a minimum of one responsible expert and qualified drillers in adequate numbers appointed for each project of specified parts of sampling by drilling and excavations methods or groundwater measurement.

4.2.1.2 The enterprise shall provide vocational training of its personnel on a regular basis and maintain records of this training.

4.2.1.3 The qualification of external personnel and sub-contractors shall meet the same criteria and shall be verified by the enterprise.

4.2.2 Qualified driller

4.2.2.1 The competence of a qualified driller shall be documented (e.g. according to CEN ISO/TS 22475-3 or other assessment procedures). Proof of suitable work experience of at least three years or more depending on the sampling methods in an enterprise that performs specified parts of sampling by drilling and excavation methods and groundwater measurement services according to EN ISO 22475-1 is required.

4.2.2.2 The qualified driller shall have documented competence regarding the following:

a) basic knowledge of the purpose of geotechnical ground investigation, of geological, soil and rock mechanical and hydrogeological fundamental principles;

b) specified parts of sampling by drilling and excavation methods and groundwater measurements including borehole back filling, handling, transport and storage of samples according to EN ISO 22475-1;

c) completion of records according to EN ISO 22475-1;

d) a preliminary identification and description of soil and/or rock in each sample according to EN ISO 14688-1 and EN ISO 14689-1 during the sampling process;

e) the relevant health, safety and environmental regulations;

f) the functioning, safe operation and maintenance of the equipment (including field checks);

g) the quality assurance system.

Introduction

EN ISO 22475-1 specifies the technical principles for the execution of sampling and groundwater measurements.

The quality of these services can be proven by:

1) a declaration of conformity by a contractor (first party control);

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3) a declaration of conformity by a conformity assessment body (third party control).

Every enterprise or individual may decide, if and how they will prove the fulfilment of the technically related criteria: by first, second or third party control because no part of EN ISO 22475 requires such a declaration.

CEN ISO/TS 22475-2 specifies the qualification criteria for enterprises and personnel that perform sampling and groundwater measurements according to EN ISO 22475-1.

The conformity assessment by third party control may be made according to the technical principles for execution of sampling and groundwater measurements according to EN ISO 22475-1 as indicated in CEN ISO/TS 22475-2 and the conformity assessment procedure given in CEN ISO/TS 22475-3.

1 Scope

This document applies for the conformity assessment of enterprises and personnel performing specified parts of sampling by drilling and excavation methods and groundwater measurements according to EN ISO 22475-1 complying with the technical qualification criteria according to CEN ISO/TS 22475-2 by third party.

Contents

ISO 22282 consists of the following parts, under the general title *Geotechnical investigation and testing — Geohydraulic testing*:

— *Part 1: General rules*

— *Part 2: Water permeability tests in a borehole using an open system*

— *Part 3: Water pressure test in rocks*

— *Part 4: Pumping tests*

— *Part 5: Infiltrometer tests*

— *Part 6: Water permeability tests in a borehole using a closed system*

New work items pour le CEN-TC341-WG1

Proposal for a new work item
"Geotechnical testing and investigation - Drilling parameters - Technical principles for measuring, recording and reporting as geotechnical data"

Proposal for a new work item
"Installation of geotechnical monitoring measurements"

Proposal for a new work item
"Geothermal testing methods for geothermal heat exchanger –Technical principles for execution"

Je vous remercie de votre attention