TECHNICAL SPECIFICATION

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Geotechnical investigation and testing — Qualification criteria and assessment —

Part 1: Qualified technician and qualified operator

Reconnaissance et essais géotechniques - Critères de qualification et évaluation —

Partie 1: Technicien et opérateur qualifié

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 182, *Geotechnics,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 341, *Geotechnical Investigation and Testing,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 24283 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 24283 series specifies the qualification criteria for geotechnical investigation and testing and has three parts:

— Part 1: Qualified technician and qualified operator

— Part 2: Responsible expert

— Part 3: Qualified enterprise

The fulfilment of the technical criteria by the enterprise or the individual can be proven by:

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

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

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

Geotechnical investigation and testing — Qualification criteria and assessment —

Part 1:
Qualified technician and qualified operator

1 Scope

This document specifies the qualification criteria for a person performing sampling, testing, measuring, monitoring and installation of equipment (e.g. piezometers, borehole heat exchangers, inclinometers and extensometers) in the framework of geotechnical investigation.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
qualified technician
qualified operator
person who has documented competence to perform specified parts of identification and description of soil and rock sampling, laboratory and field testing, measuring, monitoring and installation of equipment

3.2
vocational training
on-the-job or work place training

4 Qualification criteria

The qualified technician and qualified operator should have documented competence regarding the following:

a) basic knowledge of the purpose of geotechnical ground investigation, of geological, soil and rock properties and hydrogeological principles as relevant for the respective standard;

b) specified parts of identification and description of soil and rock, sampling, laboratory and field testing, measuring, monitoring and installation of any equipment in boreholes (e.g. piezometers, borehole heat exchangers, inclinometers and extensometers) according to the relevant standard (see Bibliography) in the framework of geotechnical investigation;

c) relevant work experience (e.g. see Table A.1 or Table A.2);

d) preparation of records according to the relevant standard (see Bibliography);

e) the relevant health, safety and environmental regulations;

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

g) the relevant part of quality management system.

Assessment and re-assessment of qualified technicians should be carried out in accordance with Annex A.

Annex A
(informative)

Assessment and re-assessment of qualified technicians and operators

A.1 General

This annex gives guidelines and recommendations for an assessment body in addition to ISO/IEC 17024.

A.2 Prerequisites for admission to assessment

The prerequisites for admission to the qualification assessment should be:

— minimum age at the time of the assessment: 18 years;

— sufficient knowledge of the assessment language;

— completed vocational training of a relevant subject and proof of suitable work experience (see Table A.1) in an enterprise that performs specified parts of identification and description of soil and rock, sampling, laboratory and field testing, measuring, monitoring and/or installation of equipment in boreholes; or

  proof of suitable work experience (see Table A.2) in an enterprise that performs specified parts of sampling, laboratory and field testing, measuring, monitoring and/or installation of equipment in boreholes according to the relevant standards;

— documented formal training in preparation of the assessment (see Annex B).

Table A.1 — Requirements concerning the work experience for a qualified technician and operator for field testing with a completed vocational training of a relevant subject

Subject	Relevant standard	Minimum years of relevant work experience
Identification and description of soil and rock	ISO 14688-1 and ISO 14689	1
Geothermal response test	ISO 17628	1
Installation of a geothermal heat exchanger	ISO 17628	1
Extensometer measurements	ISO 18674-2	1
Installation of extensometers	ISO 18674-2	1
Inclinometer measurements	ISO 18674-3	1
Installation of inclinometers	ISO 18674-3	1
Groundwater measurements in open systems	ISO 18674-4	1
Groundwater measurements in closed systems	ISO 18674-4	1
Installation of piezometers (open systems)	ISO 18674-4	1
Installation of piezometers (closed systems)	ISO 18674-4	2
Water permeability tests in a borehole using open systems	ISO 22282-2	1
NOTE This list can be expanded by national standards.		

Table A.1 *(continued)*

Subject	Relevant standard	Minimum years of relevant work experience
Water pressure tests	ISO 22282-3	1
Pumping tests	ISO 22282-4	1
Infiltrometer tests	ISO 22282-5	1
Water permeability tests in a borehole using closed systems	ISO 22282-6	2
Sampling in soil (sampling categories A to C)	ISO 22475	2
Sampling in soil (sampling categories C to E)	ISO 22475	1
Sampling in soil (sampling category E)	ISO 22475	1
Sampling in rock (sampling categories A to C)	ISO 22475	2
Sampling in rock (sampling categories C to E)	ISO 22475	1
Sampling in rock (sampling category E)	ISO 22475	1
Electric cone penetration tests	ISO 22476-1	1
Dynamic probing	ISO 22476-2	1
Standard penetration test	ISO 22476-3	1
Ménard pressuremeter test	ISO 22476-4	1
Flexible dilatometer test	ISO 22476-5	1
Self-boring pressuremeter test	ISO 22476-6	1
Borehole jack test	ISO 22476-7	1
Full displacement dilatometer	ISO 22476-8	1
Field vane test	ISO 22476-9	1
Weight sounding test	ISO 22476-10	1
Flat dilatometer test	ISO 22476-11	1
Mechanical cone penetration test	ISO 22476-12	1
Borehole dynamic probing	ISO 22476-14	1
Measuring while drilling	ISO 22476-15	1
NOTE This list can be expanded by national standards.		

Table A.2 — Requirements concerning the work experience for a laboratory qualified technician and operator with a completed vocational training of a relevant subject

Subject	Relevant standard	Minimum years of relevant work experience
Soil testing		
Understanding of the basis for lab testing	To be determined	1
Preparation of samples	To be determined	1
Recognition of sample disturbance	To be determined and ISO 22475	1
Identification and description of soil and rock	ISO 14688-1 and ISO 14689	1
Water content test	ISO 17892-1	1
NOTE 1 This table does not attempt to list all of the specialist soil and rock tests that are performed less regularly than the routine tests given in the table.		
NOTE 2 This list can however be expanded by national standards to reflect the types of tests undertaken in different countries.		

Table A.2 *(continued)*

Subject	Relevant standard	Minimum years of relevant work experience
Atterberg limit tests	ISO 17892-12	1
Particle size distribution tests (for both fine and coarse soils)	ISO 17892-4	1
Particle density	ISO 17892-3	1
Dry density – water content relationship test	To be determined	2
California bearing ratio (CBR) test	To be determined	1
Moisture condition value (MCV)	To be determined	1
Undrained triaxial strength	ISO 17892-8	2
Undrained triaxial strength with pore water pressure measurement	ISO 17892-9	3
Drained triaxial strength with porewater pressure measurement	ISO 17892-9	3
Ring shear test	To be determined	2
Small shear box test	ISO 17892-10	2
Large shear box test	ISO 17892-10	2
Triaxial permeability test	ISO 17892-11	3
Hydraulic cell permeability	ISO 17892-11	3
Rock testing		
Point load test	To be determined	1
Unconfined compressive strength (UCS)	To be determined	2
Brazil test	To be determined	1
Rock direct shear test	To be determined	1
Aggregate condition value (ACV)	To be determined	1
10 % fines test	To be determined	1
Aggregate impact value (AIV)	To be determined	1
Los Angeles abrasion test	To be determined	1
NOTE 1 This table does not attempt to list all of the specialist soil and rock tests that are performed less regularly than the routine tests given in the table. NOTE 2 This list can however be expanded by national standards to reflect the types of tests undertaken in different countries.		

Table A.3 — Requirements concerning the professional experience for a qualified technician and operator for field testing without a completed vocational training of a relevant subject

Subject	Relevant standard	Minimum years of relevant work experience
Identification and description of soil and rock	ISO 14688-1 and ISO 14689	3
Geothermal response test	ISO 17628	2
Installation of a geothermal heat exchanger	ISO 17628	3
Extensometer measurements	ISO 18674-2	2
Installation of extensometers	ISO 18674-2	3
Inclinometer measurements	ISO 18674-3	2
NOTE This list can be expanded by national standards.		

Table A.3 *(continued)*

Subject	Relevant standard	Minimum years of relevant work experience
Installation of inclinometers	ISO 18674-3	3
Groundwater measurements in open systems	ISO 18674-4	1
Groundwater measurements in closed systems	ISO 18674-4	2
Installation of piezometers (open systems)	ISO 18674-4	3
Installation of piezometers (closed systems)	ISO 18674-4	3
Water permeability tests in a borehole using open systems	ISO 22282-2	3
Water pressure tests	ISO 22282-3	3
Pumping tests	ISO 22282-4	3
Infiltrometer tests	ISO 22282-5	1
Water permeability tests in a borehole using closed systems	ISO 22282-6	2
Sampling in soil (sampling categories A t E)	ISO 22475	3
Sampling in soil (sampling categories C to E)	ISO 22475	2
Sampling in soil (sampling category E)	ISO 22475	1
Sampling in rock (sampling categories A to C)	ISO 22475	3
Sampling in rock (sampling category C)	ISO 22475	2
Electric cone penetration tests	ISO 22476-1	1
Dynamic probing	ISO 22476-2	1
Standard penetration test	ISO 22476-3	1
Ménard pressuremeter test	ISO 22476-4	3
Flexible dilatometer test	ISO 22476-5	3
Self-boring pressuremeter test	ISO 22476-6	3
Borehole jack test	ISO 22476-7	2
Full displacement dilatometer	ISO 22476-8	2
Field vane test	ISO 22476-9	1
Weight sounding test	ISO 22476-10	1
Flat dilatometer test	ISO 22476-11	1
Mechanical cone penetration test	ISO 22476-12	1
Borehole dynamic probing	ISO 22476-14	1
Measuring while drilling	ISO 22476-15	1
NOTE This list can be expanded by national standards.		

Table A.4 — Requirements concerning the work experience for a laboratory qualified technician and operator without a completed vocational training of a relevant subject

Subject	Relevant standard	Minimum years of relevant work experience
Soil testing		
Understanding of the basis for lab testing	To be determined	3
Preparation of samples	To be determined	3
Recognition of sample disturbance	To be determined and ISO 22475	3
Identification and description of soil and rock	ISO 14688-1 and ISO 14689	3
Water content test	ISO 17892-1	2
Atterberg limit tests	ISO 17892-12	3
Particle size distribution tests (for both fine and coarse soils)	ISO 17892-4	2
Particle density	ISO 17892-3	2
Dry density – water content relationship test	To be determined	3
California bearing ratio (CBR) test	To be determined	2
Moisture condition value (MCV)	To be determined	2
Undrained triaxial strength	ISO 17892-8	3
Undrained triaxial strength with porewater pressure measurement	ISO 17892-9	4
Drained triaxial strength with porewater pressure measurement	ISO 17892-9	4
Ring shear test	To be determined	3
Small shear box test	ISO 17892-10	3
Large shear box test	ISO 17892-10	3
Triaxial permeability test	ISO 17892-11	4
Hydraulic cell permeability	ISO 17892-11	4
Rock testing		
Point load test	To be determined	1
Unconfined compressive strength (UCS)	To be determined	2
Brazil test	To be determined	1
Rock direct shear test	To be determined	1
Aggregate condition value (ACV)	To be determined	1
10 % fines test	To be determined	1
Aggregate impact value (AIV)	To be determined	1
Los Angeles abrasion test	To be determined	1

NOTE 1 This table does not attempt to list all of the specialist soil and rock tests that are performed less regularly than the routine tests given in the table.

NOTE 2 This list can however be expanded by national standards to reflect the types of tests undertaken in different countries.

The prerequisites for admission to the re-assessment is a certificate as qualified technician and operator whose validity has not expired by more than 12 months.

A.3 Assessment procedure

The assessment should consist of the following parts:

— a written examination;

— practical examination and demonstration;

— an oral examination.

The assessment may cover the subjects according to Table A.1, Table A.2, Table A.3 and Table A.4.

NOTE Table A.1, Table A.2, Table A.3 and Table A.4 represent the current status of available standards on sampling, laboratory and field testing, measuring, monitoring and installation of hereon related equipment. They can be extended when new standards are published or by national standards.

The duration of the examinations should be adapted to the complexity of the above techniques.

The examinee may choose the subjects individually according to his or her qualification.

When the assessment is judged satisfactory, the conformity assessment body issues a certificate to the qualified technician or operator. The certificate is valid for seven years.

When assessment is judged not satisfactory, the applicant may repeat the assessment.

A.4 Re-assessment procedure

The competence of the qualified technician or operator in accordance with the qualification criteria should be verified by a re-assessment after seven years.

The re-assessment is a combination of a written and a practical test.

When the re-assessment is judged satisfactory, the conformity assessment body issues a certificate to the qualified technician or operator. The certificate is valid for seven years.

When re-assessment is judged not satisfactory, the applicant may repeat the re-assessment, but only twice at most.

Annex B
(informative)

Training course and preparation for the assessment

B.1 General

This concept for a training course gives an overview and a guideline about the assessment subjects and the recommended time needed to prepare the qualified technicians or operators for the examination.

The training course for the preparation of the examination is divided into different parts:

a) principles of geotechnical investigation and testing;

b) sampling of soil, rock and groundwater according to the ISO 22475 series including preliminary identification of soil and rock according to ISO 14688-1 and ISO 14689;

c) field testing according to the ISO 22476 series:

   1) cone penetration testing according to ISO 22476-1 and ISO 22476-12;

   2) standard-penetration testing according to ISO 22476-2;

   3) dynamic probing according to ISO 22476-3;

   4) pressuremeter testing according to ISO 22476-4;

   5) field vane testing according to ISO 22476-9;

d) geohydraulic testing according to the ISO 22282 series:

   1) water permeability tests in a borehole without packer according to ISO 22282-2;

   2) water pressure test in rock according to ISO 22282-3;

   3) pumping test according to ISO 22282-4;

   4) infiltrometer test according to ISO 22282-5;

e) installation of monitoring equipment in boreholes according to the ISO 18674 series;

   1) installation of extensometer equipment according to ISO 18674-2;

   2) installation of inclinometer equipment according to ISO 18674-3;

   3) installation of piezometer according to ISO 18674-4;

f) geotechnical monitoring according to the ISO 18674 series;

   1) extensometer measurements according to ISO 18674-2;

   2) inclinometer measurements according to ISO 18674-3;

g) installation of geothermal heat exchangers according to ISO 17628;

h) geothermal response test in geothermal heat exchangers according to ISO 17628;

i) laboratory testing according to ISO 17892.

B.2 Principles of geotechnical investigation and testing

	Subject	Time
1	**Introduction**	**1 h**
1.1	Qualification criteria in geotechnical investigation and testing	
1.2	The qualified technician or operator	
2	**Principles in geology**	**6 h**
2.1	Introduction in the formation of soils and rocks	2 h
2.2	Types, properties and distribution of soils and rock	4 h
3	**Principles in hydrogeology**	**5 h**
3.1	Occurrence of ground water	1 h
3.2	Groundwater flow	2 h
3.3	Environmental and ground water protection	2 h
4	**Principles of geotechnical investigation and equipment**	**8 h**
4.1	Mechanical properties of soil and rock	2 h
4.2	Methods and scope of geotechnical investigation according to Eurocode 7 – geotechnical field tests and measurements	3 h
4.3	Ground water measurements and geohydraulic test methods	3 h
	Total	**20 h**

B.3 Sampling and installation of measuring, monitoring equipment

	Subject	Time
1	**Introduction**	**0,5 h**
2	**Equipment for sampling and the installation of measuring, monitoring equipment**	**12 h**
2.1	Drill rigs	4 h
2.2	Flushing media and additives	2 h
2.3	Drilling parameters	2 h

2.4	Installation and filling material	3 h
3	**General requirements before sampling and installation**	**7 h**
3.1	Selection of techniques and methods	1 h
3.2	Requirements for ground investigation sites and points	1 h
3.3	Preliminary information needed before starting sampling and groundwater measurements	1 h
3.4	Safety requirements	2 h
3.5	Environmental protection measures	1 h
3.6	Safety and special requirements	1 h
4	**Soil sampling equipment and methods**	**10,5 h**
4.1	Categories of soil sampling methods	1 h
4.2	Sampling by drilling (continuous sampling)	3 h
4.3	Sampling using samplers	2 h
4.4	Block sampling	0,5 h
4.5	Practical demonstration of common methods	4 h
5	**Rock sampling equipment and methods**	**9 h**
5.1	Categories of soil sampling methods	1 h
5.2	Sampling by drilling (continuous sampling)	3 h
5.3	Block sampling	0 h
5.4	Integral sampling	0 h
5.5	Practical demonstration of common methods	4 h
6	**Groundwater sampling equipment and methods for geotechnical purposes** (including practical demonstration of common methods)	**3 h**
7	**Installation of measuring, monitoring equipment in boreholes**	**11 h**
7.1	Piezometers, inclinometers, extensometers and similar	3 h
7.2	Installation of the measuring, monitoring equipment in a borehole	3 h
7.3	Protective measures	1 h

7.4	Maintenance	3 h
7.5	Decommissioning	1 h
8	**Groundwater measurements**	**6 h**
8.1	Calibration	1 h
8.2	Performance of the measurements	3 h
8.3	Practical demonstration and exercises	2 h
9	**Handling, transport and storage of samples**	**3 h**
9.1	Preservation materials and sample containers	1 h
9.2	Transport of samples	1 h
9.3	Storage of samples	1 h
10	**Description and identification of soil according to ISO 14688-1** (including practical exercises)	**11 h**
11	**Description and identification of rock according to ISO 14689** (including practical exercises)	**11 h**
12	**Report**	**15 h**
12.1	Summary log	2 h
12.2	Drilling record	2 h
12.3	Sampling record	2 h
12.4	Record of description and identification of soil and rock	5 h
12.5	Backfilling record	1 h
12.6	Record of the installation of measuring, monitoring equipment in a borehole	1 h
12.7	Record of groundwater measurements	1 h
	Total	**98 h**

B.4 Field testing

Subject	Time

1	**Cone penetration test according to ISO 22476-1 (CPT)**	**20 h**
	Equipment, test procedures, test results, reporting, maintenance, checks and calibration	
2	**Dynamic probing according to ISO 22476-2 (DP)**	**8 h**
	Equipment, test procedures, test results, reporting, maintenance, checks and calibration	
	Optional: Method to measure the actual energy	(8 h)
3	**Standard penetration test according to ISO 22476-3 (SPT) and borehole dynamic probing according to ISO 22476-14 (BDP)**	**8 h**
	Equipment, test procedures, test results, reporting, maintenance, checks and calibration	
	Optional: Method to measure the actual energy	(8 h)
4	**Ménard pressuremeter test according to ISO 22476-4 (PMT)**	**20 h**
	Equipment, test procedures, test results, reporting, maintenance, checks and calibration	
5	**Field vane test according to ISO 22476-9 (FVT)**	**8 h**
	Equipment, test procedures, test results, reporting, maintenance, checks and calibration	
6	**Other tests (optional)**	
	Total	**64 h**

B.5 Geohydraulic testing

	Subject	**Time**
1	**Water permeability tests in a borehole without packer according to ISO 22282-2**	**10 h**
	Equipment, test procedures, test results, reporting, maintenance, checks and calibration	
2	**Water pressure test in rock according to ISO 22282-3**	**20 h**