

HOKLAS SC-18
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HOKLAS Supplementary Criteria No. 18

Construction Materials Test Category – Accreditation of Soil and Rock Testing

1 INTRODUCTION

- 1.1 This criteria document serves to clarify and supplement the requirements of ISO/IEC 17025 for the accreditation of soil and rock testing under the test category of ‘Construction Materials’. This criteria document shall be read in conjunction with ISO/IEC 17025, HKAS Policy Document No. 1 and relevant HKAS and HOKLAS supplementary criteria documents. The soil tests generally cover Phase I and Phase II soil tests of Geospec 3 (Model Specification for Soil Testing) and other soil tests such as GCO probe, soil nail pull-out tests, geotextile tests and time domain reflectometry (TDR). The rock tests generally include classification tests, strength and deformation tests, rock anchor lift-off tests and other rock tests.
- 1.2 Laboratories shall comply with all specific requirements of the test methods in addition to the requirements specified in this document.

2 PERSONNEL

- 2.1 An **approved signatory** who is responsible for an accredited test shall have the necessary competence (e.g. education, qualification, training, technical knowledge, skills and experience) to ensure the test is performed in accordance with the test method and HKAS requirements. In this regard, each nominee for an approved signatory shall satisfy one of the following qualification and experience requirements (Option 1, 2, 3, 4 or 5):-

Option 1: Be a Corporate Member of The Hong Kong Institution of Engineers (Civil or Geotechnical Discipline), or an equivalent professional qualification, and has at least one year of experience in supervising relevant soil and rock tests.

Option 2: Possess a Bachelor of Engineering (Civil or Geotechnical) degree, or an equivalent or higher academic qualification conferred by a recognised university, and have a minimum of five years of post-qualification civil or geotechnical engineering experience, with at least one year of experience in supervising relevant soil and rock tests.

Option 3: Possess a Higher Diploma in Civil Engineering, or an equivalent academic qualification conferred by a recognised higher education institution, and has at least seven years of post-qualification experience in construction material testing, including two years in supervising relevant soil and rock tests.

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Option 4: Has completed a learning programme² recognised under Hong Kong Qualifications Framework and at least seven years of experience in construction material testing, including two years in supervising relevant soil and rock tests.

Option 5: Possess Level 2 or above in five subjects including Physics and Mathematics in the Hong Kong Diploma of Secondary Education (HKDSE), or equivalent, and have a minimum of ten years of post-qualification experience in construction material testing, with at least two years in the relevant types of soil and rock tests, one year of which shall be in a supervisory role.

- 2.2 **Each test operator** shall have the necessary competence to perform the accredited tests. Each test operator for Phase II soil tests of the Geospec 3 shall meet one of the following qualification and/or experience requirements (Route a or b):
- a. has attained level 2 or above for five subjects including Mathematics and Physics in HKDSE, or equivalent, and at least one year of experience in Phase II soil tests of the Geospec 3, or
 - b. has at least two years of experience in Phase II soil tests of the Geospec 3.
- 2.3 Each laboratory shall evaluate the technical competence of its test operators, especially for Phase II soil tests, and keeps a list of **qualified operators** who are authorised to perform the concerned tests and sign the worksheets. Record of assessing the competence of the qualified operator(s) shall be kept in the laboratory and ready for examination during each HKAS assessment visit or upon request by HKAS.

3 EQUIPMENT AND METROLOGICAL TRACEABILITY

- 3.1 General requirements on equipment calibration are given in the HOKLAS SC-02. Specific requirements on equipment calibration/ verification for soil and rock tests are given in the Appendix of this document. These requirements shall be complied with unless overridden by more stringent requirements stipulated in the relevant test methods.
- 3.2 Where a laboratory has the necessary reference standard or reference material, suitably controlled environment and competent staff, it may perform in-house calibration/verification for its working equipment. Documented internal calibration/verification procedures shall be ready for examination during each HKAS assessment visit. HKAS Executive may require the laboratory to provide the calibration/verification procedures in the briefing notes to the assessment team.

² Acceptable learning programme shall include the following Unit of Competency (UoC): 105767L5, 105867L5, 105868L5, 105960L5, 105755L5, 105835L4 (for Phase I soil tests) and 105834L5 (for Phase II soil tests).

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4 SELECTION AND VERIFICATION OF METHODS

- 4.1 When determining the relative compaction of fill material in accordance with Section 11.4 of Geospec 3 for acceptance by the Buildings Department, the maximum dry density and optimum moisture contents testing shall be carried out when first used and thereafter at the same time as every set of field density tests (sand replacement or nuclear density) are carried out on site. (Reference to Clause 2, Appendix A of APP-15)

5 HANDLING OF TEST ITEMS AND TECHNICAL RECORDS

- 5.1 Items to be tested shall be identified throughout the test and records of identification of each test item shall be kept. Such identification shall also include the sampling location of a specific test item where applicable.

6 ENSURING THE VALIDITY OF RESULTS

- 6.1 An applicant or accredited laboratory shall conform with the proficiency testing requirements as stipulated in HOKLAS SC-33.
- 6.2 As far as the minimum proficiency testing requirements are concerned, soil testing and rock testing are considered as two test areas.

APPENDIX

SPECIFIC CALIBRATION/VERIFICATION REQUIREMENTS

This appendix lists the current recommended specific calibration requirements for equipment of soil and rock tests.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
General Soil & Rock Tests		
BALANCE		
(Reference) (for calibration of hanger weights, volume change measuring devices)	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
	6 months	Repeatability check using reference masses of higher grades.
	1 month	One-point check using reference masses to balance capacity.
BALANCE		
(Working)	2 years or immediately following servicing	Calibrate using reference masses in accordance with the CSIRO method or other equivalent method and uncertainty estimation in accordance with ISO GUM method.
	6 months	Repeatability check using reference masses in accordance with a standard method. Adjust the balance and carry out a full calibration if the required testing accuracy is exceeded.
	One month	One-point check using a known mass close to balance capacity.
	Daily before use	One-point check using a known mass at or close to a frequently encountered value or the balance capacity for a specified range.
	Each weighing	Zero check after tare.
CALIPER		
(Vernier or digital readout)		
(a) Accuracy equal to and better than 0.01 mm	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(b) Accuracy between 1 mm and	1 year	Calibrate using reference gauge

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
0.01 mm		blocks or a caliper checker. A sufficient number of readings shall be taken covering the expected working range.
(c) Accuracy not better than 1 mm	Initial only	Calipers from reputable manufacturers may be used.
(d) Calipers of any accuracies	Before use	Zero check.
DIAL GAUGE		
(a) Accuracy equal to and better than 0.01 mm	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(b) Accuracy not better than 0.01 mm	1 year	Calibrate using reference gauge blocks or a micrometer type calibrator for compliance with BS 907 or AS 2103.
LINEAR DISPLACEMENT MEASURING DEVICE (LVDT, digimatic gauge or any other transducer types)		
(a) Accuracy equal to and better than 0.01 mm	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
	Before use	One-point check using a gauge block.
(b) Accuracy not better than 0.01 mm	1 year	Calibrate the measuring device together with the same readout unit as is used for test using reference gauge blocks or a micrometer type calibrator. The readout unit can be an electrical display unit, digital display unit or data logging system.
	Before use	One-point check using a gauge block.
MASS		
(Working-hanger weights)	1 year	Calibrate using reference balance.
MICROMETER		
(a) Accuracy equal to and better than 0.01 mm	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
(b) Accuracy not better than 0.01 mm	1 year	Calibrate using reference gauge blocks. A sufficient number of readings shall be taken covering the expected working range.
(c) Micrometer of any accuracies	Before Use	Zero Check.
OVEN	3 years or immediately following servicing or each change in temperature setting	Check temperature variation in working space using different reference thermocouples at the same time and also check evaporation rate for compliance with the requirements of AS 2853 and AS 1289 or other relevant standard methods.
	6 months	Check temperature at centre of usable oven space inside an empty oven using a reference thermocouple. Ten readings shall be taken at 3-minute intervals with the oven set at the working temperature range.
PRESSURE GAUGE CALIBRATOR (Reference standard)		
(a) Dead weight tester	5 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(b) Manometer	5 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-0 2.
PRESSURE GAUGE (Reference) (Electrical transducer type)	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
PRESSURE GAUGE (Working gauge)		
(a) Bourdon tube or hydraulic type	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02
(b) Transducers types	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(c) Transducers types (For triaxial testing only)	Before use	Check against calibrated values of the pressure gauge Bourdon tube

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
		type at three points, one at middle of the range, one at lower (not less than 200 kPa) and one at uppermost range. Carry out a full calibration if the drift of the gauge exceeds the test requirement.
RULE	2 years	Check against reference length standard with a higher accuracy. Check at a minimum of 5 points over the entire length.
SIEVE		
(a) Reference woven wire cloth sieves, for performance checking of test sieves	Initial only	Sieves with recognized manufacturer's certificates which certify conformance with BS410:1986 or ISO 3310-1 shall be used. Reference sieves shall be downgraded to test sieves after 30 passes.
(b) Perforated plate test sieves – apertures larger than or equal to 4mm	300 passes but not exceeding 6 months	Check aperture and bridge width using calibrated calipers, optical projection, or other appropriate devices in accordance with BS410 : 1986 or ISO 3310-1.
(c) Woven wire cloth test sieves – apertures less than 4mm	300 passes but not exceeding 6 months	Check aperture using optical projection or other appropriate equipment in accordance with BS410:1986 or ISO 3310-1. Alternatively, check performance of apertures using certified reference samples or performance check samples with reference sieves in accordance with BS 812:Part 100: 1990 or BS 1377:Part 1:1990. Sieves with manufacturer's certificates which certify conformance with BS410:1986 or ISO 3310-1 may be used directly without initial checking.
THERMOCOUPLE (for checking ovens)	3 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
	6 months	One-point check, at ice point or some other appropriate temperature.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
THERMOMETER - (Mercury-in-glass)		
(a) Accuracy equal to and better than 0.5°C	5 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
	6 months	One-point check, at ice point or some other appropriate temperature.
(b) Accuracy not better than 0.5°C	5 years	Calibrate over the expected working range using a reference thermometer and suitable calibration bath.
	6 months	One-point check, at ice point or some other appropriate temperature.
THERMOMETER (Electronic, digital and platinum resistance)		
	3 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
	6 months	One-point check, at ice point or some other appropriate temperature.
TIME MEASURING DEVICE		
(a) Accuracy equal to or better than 0.5 second	1 year	Calibrate against reference time standard in accordance with relevant calibration standard.
(b) Accuracy not better than 0.5 second	3 months	Check against time given by radio time (RTHK) signal for at least half an hour.
VACUUM GAUGE		
(a) Mechanical or hydraulic	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(b) Transducer	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
VOLUMETRIC GLASSWARE (burettes, pipettes, volumetric flasks including measuring cylinders)	Initial only	Check by weighing the amount of distilled water that the vessel contains or delivers at a measured temperature, applying any temperature corrections necessary using the Tables in BS1797: 1987. The mass of water shall be determined to within 0.01%. The checking shall be repeated a sufficient number of times to obtain the average volume. Where a vessel is to be used at a particular graduation mark only, checking may be limited to that mark but the vessel must be labelled to indicate clearly the limited checking.

SOIL TEST

SPECIAL SOIL TEST EQUIPMENT :

(a) Bottle shaker (for sedimentation analysis)	1 year or immediately following servicing	Check the speed of rotation with the shaker fully laden in accordance with Geospec 3.
(b) Cone penetrometer (for LL test)	6 months	Check mass of sliding assembly of LL cone. Check angle of the cone and visually its surface condition. Check condition of the tip of the cone using a metal gauge plate in accordance with Geospec 3.
(c) Cone gauge plate (for checking the tip of LL cones)	5 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(d) Cylindrical metal container with siphon tube (for bulk density tests)	2 years	Check in accordance with Geospec 3.
(e) Dial gauge of cone penetrometer	1 year	Calibrate at a minimum of 10 points over the range using reference gauge blocks or micrometer type calibrator.
(f) Gauge rod (for PL tests)	5 years	Check diameter of gauge rod in two orthogonal directions at two points along its length in accordance with Geospec 3.
(g) Hydrometer (for sedimentation analysis)	Initial only	Check in accordance with Geospec 3.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
(h) Metal plugs (for CBR tests)	1 year	Check in accordance with Geospec 3.
(i) Moulds (for compaction tests)	1 year	Check internal dimension and thicknesses of the mould. The diameter shall be measured at each end in two orthogonal directions. The height shall be measured at four locations evenly spaced around the mould's circumference. Calculate internal volume of the mould using the mean diameter and mean height in accordance with Geospec 3.
(j) Pipettes (for sedimentation analysis)	Initial only	Check in accordance with in accordance with Geospec 3. Check also depth of immersion.
(k) Pouring cylinders & calibrating containers (for sand replacement tests)	1 year	Check dimensions of the cylinder and calibrating containers in accordance with Geospec 3
(l) Pykometer with stoppers – 50 mL (for particle density tests)	Initial only	Check in accordance with Geospec 3.
(m) Pykometer with screw-top lid – 1 L (for particle density tests)	Initial only	Check in accordance with Geospec 3.
(n) Rammers (for compaction tests)	6 months	Detailed inspection of rammer to check for damage, distortion and wear. Check that the lifting knob is secure and the rammer falls freely, and that the vent holes in the guide tube are free of obstruction. Also, check the dimensions and mass of rammer, as well as the height of drop inside the guide tube.
(o) Replacement sand (for sand replacement test)	Daily before use	Determine bulk density of the sand in accordance with Geospec 3.
(p) Sieve shakers (for wet sieving analysis)	1 year, or immediately following servicing	Check the timing mechanism at the time setting by timing the shaking period using a timer. Two readings shall be taken. If the actual times of shaking falls outside the set time ± 1 minute, then the timer setting control shall be adjusted and re-checked, until the shaking period is satisfactory in accordance with Geospec 3

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
(q) Vibrating hammers (for compaction tests)	6 months, or immediately following servicing	Check the dry density of the reference sand achieved using the vibrating hammer. Check also the dimensions of the tampers in accordance with Geospec 3
(r) Water bath (constant temperature, for sedimentation analysis)	1 year	Check temperature using thermometer(s) immersed within the working space of the bath. The checking is performed to determine both the fluctuation and variation of temperature in the bath. The number of checking points depends on the size of water bath. A minimum of one checking point per 30 litres of water is considered to be necessary. The points shall be approximately equally spaced along the length of the bath. When the temperature reading from each thermometer and continue to record the reading at 5-minute intervals for 30 minutes in accordance with Geospec 3
	Daily before use	Check temperature at one of the calibrated temperature setting
(s) Water bath (for particle density tests)	6 months	Check the fluctuation and variation of temperature in the bath using a thermometer of sufficient accuracy to detect within $\pm 0.2^{\circ}\text{C}$ in a range of 20°C to 30°C . When the temperature becomes steady, take an initial temperature reading from each thermometer and continue to record the reading at 5-minute intervals for 30 minutes in accordance with Geospec 3.
	Daily before use	Check temperature at one point at the calibrated temperature setting.
ALL EQUIPMENT SUBJECT TO WEAR (calipers, cone penetrometers, formers, gauge blocks, gauge plates, gauge rods, masses, moulds, rammers, scale rules, straightedges, thin-walled split mould, test sieves, etc.)	Before use	Visual inspection to check for damage, distortion and wear. Where necessary, carry out a full calibration check and/or repair/replace the item as appropriate.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
DISTILLED WATER	6 months	Check for compliance with the requirements on non-volatile residue and pH of BS 1377: Part 1: 1990 + Amd. 8258. Alternatively, distilled water from a reputable source which has adequate quality control and can demonstrate compliance with the requirements of BS 1377: Part 1: 1990 + Amd. 8258 may be used directly without checking.
FORCE STANDARD DEVICE (Reference force standard)	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02 in accordance with BS EN 10002-3 or other equivalent standards.
GCO PROBE		
(a) Hammer weight	6 months	By use of appropriate reference device
(b) Anvil and guide rod-weight and geometry	6 months	By use of appropriate reference device
(c) Fall height	6 months	By use of appropriate reference device
(d) Pointer-diameter and cylindrical portion length	6 months	By use of appropriate reference device
(e) Extension rod straightness and cone angle and sharpness	1 month or before use, whichever is more stringent	By use of appropriate reference device
LEVER SYSTEM (for the consolidation and direct shear apparatus)	2 years	Calibrate the system using calibrated hanger weights at one end against reference force standard device at the other end.
NUCLEAR DENSITY GAUGE	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02 in accordance with ASTM D2922 using not less than two standard density blocks.
	Switch on before use	Carry out standard count and compare with the mean of last four readings. If difference is greater than 1%, then recheck. If failed once more, recalibration is required.

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
	Each soil type	Carry out comparability of test results between nuclear density and sand replacement methods in accordance with Geospec 3.
REAGENT SOLUTIONS (solutions of hydrogen peroxide, sodium hexametaphosphate and other solutions for chemical tests)	---	Reagents used for analytical work shall be at least of recognized analytical reagent quality. Reagent solutions which are not stable shall be freshly prepared before use. Stocks of reagent solutions may be prepared if the solution is stable on standing. Such stocks shall be labelled with an expiry date.
SOIL NAIL PULL OUT TESTING		
(a) Reference force standard	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(b) Force measuring devcie (e.g. force transducer)	Each time before a test or a series of tests on the same site	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
(c) Displacement measuring devices (e.g. LVDT, digimatic gauge, dial gauge or any transducer gauge)	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02.
	Before use	One-point check using a reference gauge block
TRIAXIAL TEST PRESSURE SYSTEM (Complete check)		
(a) Cell pressure	3 months, after introducing new items of equipment or an integral part of a system had been removed, overhauled or repaired	Check according to Geospec 3
(b) Back pressure	Same as (a) above	Check according to Geospec 3
(c) Pore pressure	Same as (a) above	Check according to Geospec 3
(Routine check)		
(a) Back pressure	Before each test	Check according to Geospec 3
(b) Pore pressure	Before each test	Check according to Geospec 3
OTHER ACCESSARIES		
(a) O-rings	Before use	Check according to Geospec 3

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
(b) Plastic tubing	2 years	Check according to Geospec 3
(c) Porous plate	1 year	Permeability check
	Before each test	Check according to Geospec 3
(d) Rubber membrane	Before use	Check according to Geospec 3
(e) Valves	Before use	Check according to Geospec 3

VOLUME CHANGE MEASURING DEVICE

(piston displacement type) coupled with LVDT, digital gauge or any other electrical transducer gauge	1 year	Calibrate the measuring device together with the readout by weighing the amount of distilled water that the volume change gauge contains at various displaced volumes at a measured temperature in accordance with Geospec 3
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ROCK TEST

DIRECT SHEAR TESTER

Load verification or load cell	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02
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POINT LOAD TESTER

(a) Load verification	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02
(b) Coaxiality of load pointers	6 months	By use of appropriate reference measuring device
(c) Geometry of the cone	Initial -and before use	By use of appropriate reference measuring device
(d) Hardness of the cone	Initial only	By use of appropriate reference measuring device

ROCK ANCHOR LIFT OFF TESTING

(a) Reference force standard	2 years	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02
(b) Force measuring devcie	Each time before a test or a series	By a 'competent calibration body'

Type of equipment	Recommended maximum period between successive calibrations/verification	Recommended calibration/verification procedure or guidance documents and equipment requirements
(e.g. force transducer)	of tests on the same site	as defined in clause 2.1 of HOKLAS SC-02
(c) Displacement measuring devices (e.g. LVDT, digimatic gauge, dial gauge or any transducer gauge)	1 year Before use	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02 One-point check using a reference gauge block

ROCK BOLT TESTING

Torque wrench	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02
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ROCK TEST

UNCONFINED OR UNIAXIAL COMPRESSION STRENGTH TESTER

(a) Load verification	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02
(b) Uniaxial and circumferencial strain measuring devices	1 year	By a 'competent calibration body' as defined in clause 2.1 of HOKLAS SC-02