

PROFICIENCY TESTING PLAN

in accordance with ISO/IEC 17043:2023

No. PTS 26/03-T-3

Testing of Hardened Concrete – Concrete Cubes with Nominal
Dimensions 150 × 150 × 150 mm



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1. Type of the proficiency testing scheme

- Simultaneous PT scheme - sub-samples from a source of material being distributed simultaneously to participants for concurrent tests. (item A.2.2, Annex A of ISO/IEC 17043:2023)
- Sequential PT scheme - PT item being circulated successively from one participant to the next, or occasionally circulated back to the PT provider for rechecking. (item A.2.3, Annex A of ISO/IEC 17043:2023)

2. Personnel involved in the design and operation of the PT scheme

PT Scheme Manager



eng. Valentin Belovski

Materials Engineer



eng. Ivanka Dobreva, PhD

Statistical Processing Expert



eng. Atanas Atanasov

Data Collection and Coding Expert



Tatyana Kasabova

3. Information about the Activities, Undertaken by External Providers



LABORATORY COMPLEX OF "EN JI EN" LTD

No. 3 Planinski Izgled Street,
6300 Haskovo, Bulgaria

- sampling;
- preparation and storage of test specimens;
- random grouping of the test specimens into sets of three, with each set assigned a single laboratory code and treated as one sample;
- packaging of the samples before dispatch to the participants;
- testing for the assessment of sample homogeneity;
- testing for the assessment of sample stability.

The PT provider bears full responsibility for all activities assigned to the external provider, while ensuring control and evaluation of their performance in accordance with the requirements of ISO/IEC 17043:2023.

4. Criteria for participation in the present proficiency testing scheme

Laboratories performing testing of hardened concrete, as well as laboratories wishing to evaluate their performance with respect to the characteristics included in the scheme, may participate in the present proficiency testing scheme.

Participation is open and does not depend on the laboratory's accreditation status.

5. Number and type of expected participants in the proficiency testing scheme

The expected number of participants in the present proficiency testing scheme is from 5 to 45 laboratories, mainly performing testing of hardened concrete. The scheme shall be conducted provided that at least 5 participations are registered for at least one characteristic. A characteristic for which fewer than 5 participations have been registered shall not be included in the scheme, and the respective participants shall be notified by email.

6. Methods, characteristics, and range of expected values

Proficiency Testing Item	Method	Characteristic	Range of Expected Values
Hardened concrete – concrete cubes with nominal dimensions 150×150×150 mm	* EN 12390-3	Compressive strength (mean value of three individual determinations)	(15–50) MPa
	* EN 12390-7 (volume by measurement of actual dimensions, mass in water-saturated condition)	Density (mean value of three individual determinations)	(1900–2800) kg/m ³

* Testing shall be performed in accordance with the latest valid version of the applicable normative document.

Note: Each sample consists of three cubes with dimensions 150×150×150 mm. The test specimens are aged over 28 days at the time of testing and are provided to all participants under identical conditions. The age of the test specimens is not expected to influence the comparative evaluation of the results within the scheme.

7. Potential major sources of errors

- incorrect application of the requirements of the relevant standardized test methods;
- use of uncalibrated, technically defective or unsuitable equipment;
- incorrect positioning and centring of test specimens during compressive strength testing;
- deviations in the loading regime during compressive strength testing;
- errors in measuring the actual dimensions of the test specimens;
- errors in determining the mass of the test specimens in the water-saturated condition;
- changes in the condition of the test specimens due to inappropriate environmental conditions or improper storage and handling;
- errors in recording, transcribing, processing and reporting results;
- errors in calculation and rounding of results.

8. Requirements regarding the production, quality control, storage and distribution of PT items

- The proficiency testing items consist of hardened concrete test specimens prepared specifically for the purposes of the present proficiency testing scheme.
- The test specimens shall be prepared under controlled conditions in order to ensure the required quality and an appropriate degree of homogeneity of the scheme items.
- Prior to distribution to the participants, quality control shall be performed, including verification of dimensions, visual inspection for damage or loss of integrity, and assessment of homogeneity.
- The proficiency testing items shall be stored under conditions preventing changes in their condition, mechanical damage, contamination or other influences that could affect the test results.
- The test specimens shall be distributed to the participants under packaging and transport conditions ensuring preservation of their characteristics until the tests are performed.
- Detailed requirements regarding the manner of performing the tests, the conditions for validity of the results, and the procedure for reporting are specified in the **Instruction for Participants /F 7.3.5-1/**.

9. Confidentiality

Participants shall not exchange among themselves any information related to the proficiency testing items, the testing conditions, the results obtained, or the processing of those results until the final report has been issued by the PT provider.

An authorized representative of the participant shall complete a **Confidentiality Declaration /F 4.2-2/**.

Where collusive actions between participants are identified, including exchange of results, manipulation or falsification of data, the results of the respective participants shall not be included in the evaluation, and the grounds for this shall be documented.

The members of the PT provider's team have signed confidentiality declarations and shall not disclose information related to the present proficiency testing scheme, except where such disclosure is required by the accreditation body or by applicable regulatory requirements.

10. Time schedule of the PT scheme and information for participants



⚠ In case of any changes related to the time schedule for the conduct of the present proficiency testing scheme or other significant changes, all participants shall be notified by email.

Detailed information will be provided in the "**Instruction for Participants**" /F 7.3.5-1/, which will be sent to participants by email.

11. Methods or procedures to be used for the storage, handling, preparation, dispatch and disposal of proficiency testing items

- Upon receipt of the proficiency testing items, the participant shall verify the completeness and condition of the delivered test specimens, without performing any actions that could affect the test results.
- **After receipt at the participant laboratory, the test specimens shall be stored in a water environment at a temperature of (20 ± 2) °C until the time of testing. For the purpose of density determination, the mass of the test specimens shall be determined in the water-saturated condition. The test specimens shall be kept under water for at least 72 h prior to testing in order to be considered water-saturated to constant mass.**
- Handling of the test specimens shall be carried out carefully so as to avoid impacts, chipping, damage to edges or other effects that could influence the test results.
- Preparation and testing shall be performed in accordance with EN 12390-3 and EN 12390-7, using appropriate and calibrated equipment. The test specimens shall be tested without additional treatment unless such treatment is specified in the applicable method.
- Dispatch of the proficiency testing items to the participants shall be carried out using appropriate packaging and under conditions ensuring preservation of their characteristics during transport.
- After completion of testing, residual materials and destroyed test specimens shall be treated in accordance with the internal procedures of the participating laboratory and the applicable waste management requirements.

12. Methods to be used for the assessment of homogeneity and stability of proficiency testing items

- The assessment of homogeneity and stability of the proficiency testing items shall be carried out in accordance with ISO/IEC 17043:2023, ISO 13528:2022 (where applicable), and procedure **P 7.3.2 “Assessment of homogeneity and stability of proficiency testing items”**. The acceptance criteria shall be defined in advance so that any potential inhomogeneity or instability does not compromise the evaluation of participant performance.
- The assessment of homogeneity shall be performed on final prepared, packaged and labelled samples selected at random. Testing shall be carried out using the applicable methods for determination of the characteristics included in the scheme — compressive strength in accordance with EN 12390-3 and density in accordance with EN 12390-7 — under the conditions defined in the present plan.
- The assessment of stability shall be performed for the period relevant to the scheme, including transportation, storage and testing at the participants’ premises, by testing samples at predefined time intervals in accordance with procedure P 7.3.2.
- The testing required for the assessment of homogeneity and stability shall be performed by a designated external provider of laboratory services. The external provider shall supply the test results, while the statistical analysis, evaluation of acceptability and conclusions shall be performed by the PT provider. The PT provider retains full responsibility for the final evaluation, documentation and decisions taken.
- The approaches, criteria, results and conclusions from the assessment of homogeneity and stability shall be documented and included in the final report.

13. Reporting of results

The results shall be reported using the **“Results Sheet” (F 7.2.1-7)**, which shall be sent by email within the deadline specified in Clause 10.

14. Detailed description of the statistical analysis used and the criteria for evaluation of participant performance

The statistical analysis shall be performed in accordance with ISO/IEC 17043:2023, ISO 13528:2022 and Procedure **P 7.2.3 “Determination of assigned values”**.

The statistical evaluation shall be carried out separately for each characteristic included in the scheme. For the purposes of evaluation, one result shall be used for each participant and for each characteristic, representing the mean value of the valid individual results reported in accordance with the requirements of the scheme.

For each characteristic, the assigned value, the standard deviation for proficiency assessment and the standard uncertainty of the assigned value shall be determined using a consensus-based robust statistical approach based on participant results, in accordance with ISO 13528:2022.

Before the statistical analysis is performed, the submitted results shall be checked for:

- technical validity of the submitted results;
- compliance of the format, units, rounding and manner of reporting of the results;

- the presence of recording, transcription, recalculation or other obvious errors or inconsistencies.

Results that are unsuitable for statistical evaluation due to calculation errors, transposed digits, incorrect units or other gross errors shall be treated in accordance with the PT provider's predefined documented criteria and procedures, and the decisions taken shall be documented.

In order to limit the influence of outlying results on the summary statistics, an appropriate statistical approach shall be applied in accordance with ISO/IEC 17043:2023 and ISO 15528:2022. Decisions regarding the flagging, inclusion or exclusion of results shall be documented and justified.

The evaluation of participant performance shall be carried out by means of:

- z score - when the uncertainty of the assigned value is negligibly small in relation to the standard deviation for proficiency assessment;
- z' score - when the uncertainty of the assigned value is not negligibly small;
- ζ score - when the participant has reported uncertainty of the result in the required format.

The evaluation results shall be interpreted as follows:

- $|z| \leq 2.0$ - satisfactory performance;
- $2.0 < |z| < 3.0$ - questionable performance (warning signal);
- $|z| \geq 3.0$ - unsatisfactory performance (action signal).

Where z' scores or ζ scores are used, the results shall be interpreted in an analogous manner, unless another justified evaluation criterion is defined in the final report.

Detailed information regarding the statistical methods used, the assumptions made, the evaluation criteria, the treatment of invalid and outlying results, and the sources used shall be presented in the final report of the proficiency testing scheme.

15. Origin, metrological traceability and measurement uncertainty of the assigned value

The assigned value, the standard deviation for proficiency assessment and the standard uncertainty of the assigned value shall be determined by statistical analysis of participant results in accordance with ISO 15528:2022 and Procedure **P 7.2.3 "Determination of assigned values"**. A consensus-based robust statistical approach shall be used for the determination of the assigned value.

The origin of the assigned value is consensual and is based on the valid results provided by the participants for the respective characteristic.

The metrological traceability of participant results shall be ensured by the participants themselves through the use of appropriate calibrated or verified measuring equipment and the application of the relevant standardized test methods. Where applicable, participants shall ensure documented traceability to national or international measurement standards.

The standard uncertainty of the assigned value shall be evaluated in accordance with ISO 15528:2022, taking into account the statistical approach used and the variation of participant results.

The methods used, assumptions made, criteria applied, results obtained and conclusions regarding the determination of the assigned value, its metrological traceability and its uncertainty shall be documented and included in the final report of the proficiency testing scheme in accordance with ISO/IEC 17043:2023.

16. Treatment of results for the same characteristic obtained by different test methods, where permitted by the proficiency testing scheme

Not applicable to the present proficiency testing scheme. For each characteristic, one specified method as indicated in Clause 6 shall be applied.

17. Disclosure of participant information and of the final report

Information obtained from participants in connection with the present proficiency testing scheme shall be used solely for the purposes of conducting the scheme, statistical analysis, evaluation of performance and preparation of the final report.

Each participant shall receive information only regarding its own results and evaluation, in compliance with the confidentiality requirements with respect to other participants. Information that would allow identification of other participants or their results shall not be disclosed, except in aggregated and anonymized form included in the final report.

The **final report /F 7.4.3-1/** shall be provided to all participants in the proficiency testing scheme and, upon request, to the accreditation body of the PT provider or to another competent authority where required by applicable regulations.

The final report, the results and the related information shall not be made publicly available and shall not be disclosed to other interested parties, except where required by applicable legislation or upon official request from a competent authority.

18. Actions to be taken in the case of lost, delayed or damaged PT items.

- The proficiency testing items shall be delivered to the respective participant within 24 to 48 hours after dispatch within Bulgaria and within 5 to 20 days for international deliveries. All participants shall be notified by email at the time of dispatch of the samples. Participants outside Bulgaria shall also receive a consignment note number by email for shipment tracking.
- In case of delays in the receipt of the proficiency testing items, the PT provider may extend the deadline for performing the tests and for reporting the results, where appropriate. Where participation cannot be completed due to such delay, the PT provider shall refund the participation fee and shall not include the participant in the scheme.
- Upon receipt of the proficiency testing items, the participant shall complete a **“Protocol for PT item receipt” /F 7.3.4-1/** and send it by email to the PT provider in order to confirm the condition and suitability of the samples for testing. If the samples are damaged or unsuitable for testing, the participant shall provide objective evidence, such as photographic material, together with the completed protocol.
- In the event of loss or damage of the proficiency testing items, the PT provider shall arrange dispatch of a replacement sample from the available reserve samples.

19. Feedback and communication with the participants

Throughout the entire duration of the proficiency testing scheme, the PT scheme coordinator shall maintain communication with participant representatives via telephone, written correspondence and email.

No later than one day after dispatch of the proficiency testing items, each participant shall receive the following documents by email:

- **Instruction for Participants /F 7.3.5-1/;**
- **Protocol for PT Item Receipt /F 7.3.4-1/;**
- **Results Sheet /F 7.2.1-7/;**
- **Confidentiality Declaration /F 4.2-2/.**

Where necessary, the PT provider may organize technical meetings with the participants in relation to the present scheme. Such meetings may be conducted remotely or in another mutually agreed format and may cover organizational and technical aspects related to the conduct of the scheme, including scope, schedule, storage and handling of proficiency testing items, reporting requirements and significant changes. Individual participant results shall not be discussed or disclosed during these meetings prior to the issuance of the final report.

Participant feedback after completion of the scheme shall be collected through the **“Feedback Form” /F 8.6-2/**, which shall be sent by email. The deadline for completion shall be specified in the **Instruction for Participants /F 7.3.5-1/**.

20. Registration for participation in the proficiency testing scheme

- Registration for participation shall be made by submitting an **“Application for Participation” /F 7.2.1-3/**. The application may also be submitted electronically through the website of **“PTS Bulgaria” Ltd.**
- By submitting the application, the participant confirms that it is aware of and accepts the conditions of the proficiency testing scheme, including that the assessment of the homogeneity and stability of the proficiency testing items, as well as the determination of the assigned value, the standard deviation for proficiency assessment and the standard uncertainty of the assigned value, are carried out by the PT provider in accordance with predefined documented rules and in compliance with ISO/IEC 17043:2023 and ISO 13528:2022.
- Each laboratory may participate more than once in the proficiency testing scheme depending on the purpose of participation. In such cases, more than one laboratory code shall be assigned to the laboratory, and samples with different codes shall be provided accordingly.
- The PT provider may require submission of more than one result where this is specified in the conditions of the scheme or is necessary for the purposes of evaluation.
- The PT provider shall not be responsible for the internal allocation of laboratory codes and the corresponding samples among the personnel of the participating laboratory in cases of multiple participation.
- The **final report /F 7.4.3-1/** shall be sent to the participants by email.
- The certificate of participation shall be generated automatically by the PT provider’s software and sent to the email address indicated in the **“Application for Participation” /F 7.2.1-3/**. Information on the issued certificates shall be published in the **“Register”** section of the official website of **“PTS Bulgaria” Ltd.**



21. Financial conditions

- The financial conditions are specified in the “**Invitation for Proficiency Testing**” (F 7.2.1-2).
- To receive the “**Invitation for Proficiency Testing**” (F 7.2.1-2) with the applicable prices, please contact us.



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