PROFICIENCY TESTING SCHEMES

GENERAL PROTOCOL

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TTS PT PRESENTATION

Created in 2023, TTS PT is an organization that provides proficiency testing programs in different fields of textile and leather physical and chemical testing in accordance with ISO/IEC 17043 and ISO 13528 standards.

GENERAL INFORMATION ABOUT PROFICIENCY TESTING PROGRAMS

a) Introduction :

Proficiency Testing (PT) is defined as the evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons.

This statistical protocol presents the tools applied at TTS PT for the evaluation of the participant's datasets. Participating in interlaboratory comparisons or proficiency testing programs is the commonly used method for the quality assurance of test methods as defined in ISO/IEC 17025 standard. Also, laboratories should constantly participate in interlaboratory comparisons and PT programs and achieve successful results for the test methods in their accreditation scopes and the methods they want to add to their scopes. It is intended to evaluate and develop the performance of the participating laboratories and associate their accreditation process with these programs.

b) Standards

- ✓ ISO/IEC 17043 «Conformity assessment – General requirements for the competence of proficiency testing providers»
- ✓ ISO 13528 «Statistical methods for use in proficiency testing by interlaboratory comparison»
- ✓ ISO 5725 « Accuracy (trueness and precision) of measurement methods and results»

c) Proficiency testing program

TTS PT offers proficiency testing programs that are annual programs composed by several rounds including a wide range of matrices.

These annual programs allow, laboratories to get an evaluation of their performances in order to monitor themselves and highlight bias or drifts.

Proficiency testing schemes schedules are available on TTS website as well as the price of each round. Participants can follow the period of each proficiency testing round and the analyses to be conducted.

ORGANIZATION OF A PROFICIENCY TESTING

a) Proficiency testing scheme

A proficiency test is determined by the following steps:

- ✓ Laboratories' registration,
- ✓ Preparation of the samples,
- ✓ Homogeneity control of the samples,
- ✓ Dispatching of the samples,
- ✓ Report results and information,
- ✓ Stability control of the samples
- ✓ Statistical analysis of results with an estimation of assigned value,
- ✓ Evaluation of participant's performance,
- ✓ Publishing of the report for all participants.

b) Coordination and responsibility

Coordinator

For each proficiency testing scheme, a coordinator is in charge of the coordination of the tests. He mainly assists the chairperson and guarantees the compliance with the requirements of ISO/IEC 17043 standard.

PT expert

PT expert provides a specific technical competence to the proficiency testing's program.

The missions of the PT expert are:

- ✓ adding his/her technical expertise to the proficiency testing scheme,
- ✓ approving the results of the statistical analysis before publishing the report.

Technical manager

The missions of the technical manager are:

- ✓ The creation of a new proficiency testing scheme,
- ✓ The design of the general statistical model,
- ✓ Technical issues,
- ✓ New market development,
- ✓ Strategic focus.

TTS testing

TTS PT carries out homogeneity and stability control, in its own TTS testing laboratories. These tests are accredited according to ISO/IEC 17025 standard (when possible).

COMMUNICATION WITH PARTICIPANTS

a) Registration

All testing laboratories may be interested in TTS proficiency testing services. Our policy is based on the analysis of the performance of the laboratories to insure their conformity over time. The laboratories register at the beginning of the scheduled rounds announced by mailing or on our website.

Registration forms are available for each round, and these forms include information about the testing standards and costs of participation.

In order to join a scheme, participants should fill in the relevant registration form, indicating which testing standard they wish to participate with.

Most schemes do not have any restrictions to participation, but when these do occur, this will be made clear on the registration forms or through other documentations.

b) Participation fees

Costs for participation are reviewed annually and the current prices for each scheme are detailed on the scheme registration form as well as the proficiency testing annual schedule. Payment terms are detailed in TTS PT terms & conditions. Non-payment or late payment may result a non-distribution of the test material, or a late distribution if time still permits. The terms and conditions are available on TTS website.

c) Confidentiality

An automated coding system allows TTS PT to ensure the confidentiality of the information provided by the participants and anonymity of participants. A commitment of confidentiality is signed by all the TTS PT staff.

Confidentiality of participants

A "laboratory number" is assigned to each laboratory upon its registration in TTS PT registration system. This code is permanent and allows rapid identification. TTS PT does not publish any directory of its members, nor the list of participants in its proficiency testing program.

Confidentiality of participant's data

Identification of the results published in the interlaboratory comparisons report is ensured by a 6-digit code allocated to each of the participants: this code is entitled "Laboratory code". It is confidential and fix, it does not change.

d) Claims and appeals

If participants may have any concern, they ought to contact us by email:

- ✓ SCH@ttesting.org for claims and appeals,
- ✓ RHO@ttesting.org for any requests related to the proficiency testing.

In case of any claim or appeal, appropriate corrective actions are implemented and communicated to the concerned participants.

e) Contact

Adress : Total Testing Services Proficiency testing

PB53 Industrial Zone Technopole Menzel Harb 5036 TUNISIA

TEL : +216 70 146 260

Fax : +216 70 146 269

E-Mail : RHO@ttesting.org / SCH@ttesting.org

Web-Site: www.ttesting.org

PROFICIENCY TEST DESIGN

a) Choice of raw material and production:

The products used in the proficiency tests are selected to be as close as possible to real matrices analyzed by laboratories on routine bases. Raw materials can be commercial products or not, used as they are or modified, spiked or processed.

The characteristics can be naturally present, added or spiked to reach the levels required by the participants. For homogeneity and stability reasons, the samples can be synthetic matrices. The production procedure ensures the sufficient homogeneity between-samples and stability for the duration and the purpose of the test.

b) Homogeneity and Stability control

Homogeneity and stability testing will be conducted according to the ISO 13528 standard. An assessment of the homogeneity is done before sending the PT sample to participants. Meanwhile, the stability evaluation is performed during and/or after each program.

Homogeneity and stability checking's conclusion are indicated in the proficiency test report.

The sample is considered as sufficiently homogeneous when the following requirement is fulfilled :

$$s_S > \sqrt{c}$$

With : $\sigma_{allow}^2 = \left(0{,}3 \times \sigma_{pt}\right)^2$ And $c = F_1 \times \sigma_{allow}^2 + F_2 \times s_w^2$

σ_{pt} : proficiency test standard deviation

σ^2_{allow} : allowable sampling variance

s_s : between-sample standard deviation

s_w : within-sample standard deviation

F_1 & F_2 : are from standard statistical tables detailed in ISO 13528.

The sample is considered as stable when the difference between the general average of the measurements obtained during the homogeneity test before sample dispatch and the general average of the results obtained during the stability verification is less than or equal to 0,3 times the reference value of standard deviation σ_{pt}.

c) Packaging and shipping

Test materials are sent in appropriate packaging and under conditions intended to maintain the integrity of the test materials during transit. All shipments are made by express carrier.

d) Analyses and methods

Once the shipping is done, participants receive an email with their tracking number, the instructions which explain how to manage the samples and the submission data-sheet. The analyses to be performed are also available. Participants choose analyses and methods with which they want to check their proficiency. The samples must be analyzed according to the usual procedures applied by participants.

e) Participant result's transmission

The participant must send their results in TTS PT submission data-sheet within a deadline frame. Beyond the deadline, the results cannot be taken into account in the statistical treatment. However, some exceptions could be made.

DATA ANALYSIS AND PERFORMANCE ASSESSMENT

TTS PT organizes a wide range of schemes, which may include qualitative and quantitative testing.

The aim of TTS PT services is to enable the participant to control the trueness analysis results. This control is carried out through the comparison with an assigned value.

The statistical treatment is performed according to ISO 13528 standard "Statistical methods for use in proficiency testing by interlaboratory comparisons".

The way to estimate the assigned value and the tolerance is defined and validated by a qualified technical group for each proficiency testing scheme.

Before conducting the statistical treatment, the data set is checked for possible obviously gross errors « blunders » such as typing errors, incorrect unit and/or decimal point error. Test results reported as "<…" or ">…" will not be used in statistical evaluation.

Various statistical methods are also used to check results distribution and to identify outliers. The identification of outliers is also defined and validated by a qualified technical group for each proficiency testing scheme.

a) Check on normal distribution of the test results

The kernel density plot is used to visualize the general shape of the distribution of the data set. The shape of the curve is taken as an indication of the distribution from which the data were drawn. Outlying values appear as separate peaks that are well separated from the main body of the data.

The normality is judged as being either "OK", "Suspect" or "NOT OK" according to the distribution of the data set.

b) Normal probability plot

The Normal probability plot is used to visualize data distribution. It is used to adjust the data distribution and visually identify and/or remove outliers.

c) Boxplot

The boxplot is used to visualize the distribution of data across their quartiles. It is used to identify and/or remove outliers if they extend from the box.

d) Grubbs tests

The Grubbs tests (Single & Paired) are also used to identify and/or remove outliers.

e) Assigned value

The assigned value or "conventionally true value" (x_{pt}) corresponds to the value assigned to an analytical parameter for the proficiency test. This value is estimated at the end of the proficiency testing round, from the results of all the participating laboratories. The method used to determine the assigned value may vary depending upon the particular scheme and test parameter, and is detailed in the relevant PT report, along with details of the traceability in each case.

For quantitative schemes, the assigned value is the mean value coming from the application of the robust algorithm A of ISO 13528 standard. This assigned value is provided with its standard uncertainty which allows to quantify the confidence that can be granted to this assigned value.

If another estimator is used, it is then indicated in the corresponding PT report.

For nominal qualitative schemes, mode is used to determine the assigned value meanwhile for ordinal qualitative schemes, both mode or median are used to determine the assigned value.

f) Standard deviation for proficiency assessment (SDPA):

The method used to determine the SDPA may vary depending upon the particular scheme and test parameter. For quantitative schemes, the SDPA is the standard deviation coming from the application of the robust algorithm A of ISO 13528 standard.

If another estimator is used, it is then indicated in the corresponding PT report.

g) Performance criteria

i) Qualitative schemes

For qualitative tests, participant results will be compared with the assigned value, based on the consensus value of participant's results. The evaluation of performance is carried out in the form of comments/recommendations or graphical representation available in the report.

For nominal qualitative data, a result which is the same as the assigned value is considered satisfactory.

For ordinal qualitative data, a result which is equal to the assigned value or assigned value ± tolerance value is also considered satisfactory.

The tolerance value is defined by the technical manager and PT expert before or through the PT program.

For textile and leather quotation testing, using a scale from 1 to 5, a tolerance value ± 0.5 is accepted.

For textile and leather quotation testing, using a scale from 1 to 8, a tolerance value ± 1 is accepted.

For textile and leather ordinal results presented as grades or classifications, these results are classified as numbers on a linear scale (For example : 1 = Poor, 2 = Unsatisfactory, 3 = Satisfactory, 4 = Good, 5 = Very good). For this type of results, a tolerance value ± 1 is accepted.

ii) Quantitative schemes

For quantitative tests, participant results will be compared with the assigned value, based on the consensus value of participant's results. Participants are assessed on the difference between their result and the assigned value, with this difference being represented by a performance score called a Z_{score} or Z'_{score}

$\boldsymbol{Z_{score}}$

To evaluate the performance of the participating laboratories, the Z_{score} is calculated using the following formula :

$$Z_{score} = \frac{(x_i - x_{pt})}{\sigma_{pt}} \quad \textbf{or} \quad Z_{score} = \frac{(x_i - x_{pt})}{\sigma'_{pt}}$$

Z'_{score}

To evaluate the performance of the participating laboratories, the Z'_{score} is calculated using the following formula :

$$Z'_{score} = \frac{(x_i - x_{pt})}{\sqrt{\sigma_{pt}^2 + u^2(x_{pt})}} \quad \textbf{or} \quad Z'_{score} = \frac{(x_i - x_{pt})}{\sqrt{\sigma_{pt}'^2 + u^2(x_{pt})}}$$

x_i : participant laboratory mean value

x_{pt} : consensus value

σ_{pt} : proficiency test standard deviation

σ'_{pt} : is used for non-homogenous tested entity

$u(x_{pt})$: Uncertainty

The interpretation of Z_{score} and Z'_{score} according to ISO 13528 is as follows :

$|Z_{score}| \leq 2$: performance is satisfactory

$2 < |Z_{score}| < 3$: performance is questionable

$|Z_{score}| \geq 3$: performance is unsatisfactory

Uncertainty evaluation

In a proficiency testing scheme, the uncertainty claimed by the laboratories might be asked for a specific proficiency test. It is calculated using the following formula :

$$u(x_{pt}) = 1{,}25 \times \frac{\sigma_{pt}}{\sqrt{p}}$$

$$U(x_{pt}) = 2 \times u(x_{pt})$$

If the uncertainty of the laboratory is more than the PT uncertainty, the laboratory is invited to check the value or the estimation of its uncertainty. Meanwhile, an uncertainty below the PT uncertainty remains correct.

h) Small PT

In the case of a small proficiency test (i.e., where the number of participants is between 2 and 7), TTS PT will apply the same performance evaluation as described above.

The assigned value and SDPA and/or uncertainty will be independent of the reported participant results. They can be obtained from CRM certificate or measurements performed by expert laboratories or an earlier ILC on the same or a similar material.

However, TTS PT expert can use an alternative statistical method. TTS PT can choose one of these alternatives:

- Algorithme A for assigned value and standard deviation
- Mean and standard deviation
- Median and MADe or nIQR