

# **TEPS**

**(TExtile P Proficiency Testing Scheme)**

Protocol  
Issue 1.0  
September 2001

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## 1. Scope

The aims of the TEPS scheme are:

- a) to enable participating laboratories engaged in textile testing to monitor and improve the quality of their measurements;
- b) to provide additional confidence to the laboratory's clients;
- c) to enable participating laboratories to verify their test results and procedures to other interested bodies (e.g. accreditation bodies, retailer approval schemes) and to monitor laboratories performance against other similar organisations;
- d) to identify interlaboratory differences;
- e) to provide information on the understanding and effectiveness of particular test methods;
- f) to organise interlaboratory trials and statistical analysis of new test methods.

## 2. Organisation

The scheme is run by X-reference Limited. Contact details are shown below.

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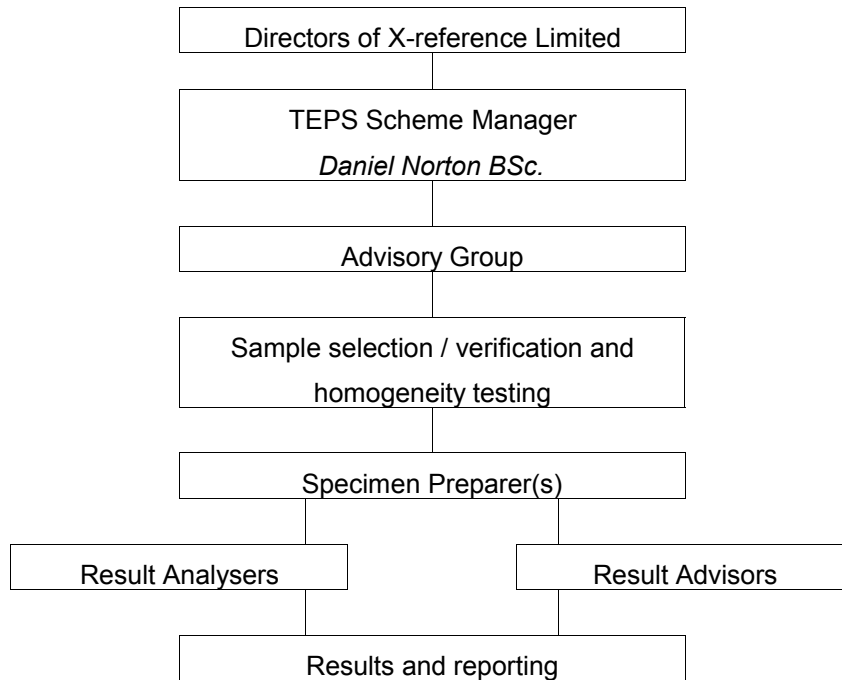
Web: [www.x-reference.co.uk](http://www.x-reference.co.uk)

The scheme is operated in accordance with ISO/IEC Guide 43-1: 1997.

“Proficiency testing by interlaboratory comparisons – Part 1: Development and

operation of proficiency testing schemes". *X-reference Limited will seek accredited status for TEPS to ISO/IEC guide 43-1: 1997 when this service is offered by UKAS.*

The organisational structure of the TEPS scheme is as follows:



An advisory group, consisting of representatives from interested parties, including scheme participants, accreditation bodies and retailer groups, meet at regular intervals as agreed necessary by its members (but at least twice a year).

The main functions of this group are to:

- a) review the effectiveness of the scheme and suggest any amendments to the planning and execution of the schedule;
- b) resolve any disputes between the scheme manager and the participants.

The membership of the advisory group is rotated on a 2-yearly basis. Any participant seeking to gain membership should apply to the scheme manager.

### 3. Types of Proficiency Testing

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Total-process schemes

In the majority of cases the interlaboratory testing scheme is used. This involves randomly selected sub-samples being distributed simultaneously to participants for concurrent testing. After testing, the results are returned and compared with an assigned value to give an indication of the performance of the individual laboratories and the group as a whole.

Partial-process schemes

In some cases other schemes may be used. Examples are partial-process schemes, which involve the evaluation of laboratories' abilities to perform parts of the overall testing, or measurement process.

In all cases clear instructions are given to participants.

**4. Framework of the Scheme**

This protocol, covering all aspects of the scheme, is provided to all new participants. The protocol includes contact details for the scheme manager. New participants are asked to provide a schedule of tests they wish to have included on their scope. This can be amended at any time. Participants are required to take part in rounds involving tests contained in their scope.

All participants are notified of the annual charge at the beginning of each annual series. Participants are invoiced at the start of each year. Participants must notify the scheme manager of their intention to resign from the scheme. If payment is not received within 30 days of the invoice date 2 reminders will be sent to the participant. If payment is not received in 60 days of the invoice date the participant will be removed from the scheme.

Test materials are distributed every three months to participants, who are required to return the results (and samples if requested) within the specified deadline. The results are then subject to statistical analysis and participants are notified of their performance. Participant confidentiality is assured by the issuing of Laboratory Identification Numbers. These are randomly assigned and are different for each round.

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Each round of the scheme is assigned a Round Identification Number consisting of the year and round number. (e.g. 2002-2 will be the second round in 2002)

## 5. Test Materials

Sample types used are those normally encountered in routine analysis. A record is kept of all suppliers of bulk materials. The date of purchase is also recorded. Each bulk material is given a unique identification number and clearly labelled as such.

All bulk materials are stored in such a way as to ensure the continued stability of the material (e.g. avoiding excessive temperature/ humidity fluctuations, protection from light)

## 6. Homogeneity Testing

All bulk materials are tested for sufficient homogeneity before being used in a round of the scheme.

The homogeneity testing is normally sub-contracted to Technicare Services Limited. They are an independent, UKAS-accredited testing laboratory (Accreditation No. 1635). If necessary, other UKAS-accredited laboratories with specialist expertise may be used.

Details and results of homogeneity assessments are included in the reports sent to participants on completion of each trial.

## 7. Sub-sampling Procedures

After the material has been assessed as fit for purpose, the bulk material is sub-sampled by suitably trained sample preparers. The sub-samples are packaged in such a way as to protect the stability and characteristics of the test items.

All sub-samples are given a unique identification number which includes the unique identification number of the bulk material. (e.g. if 100 sub-samples of bulk material 123 are taken, they are labelled as 123-1, 123-2, 123-3, ... 123-100.)

Surplus sub-samples are prepared and stored whenever possible. These are made available for sale to participants for their own internal proficiency testing when requested.

## 8. Distribution of Test Items

The test items are sent to participants by the scheme co-ordinator. Included with the test items are clear instructions to the participants telling them exactly what is expected of them. The instructions include the following information:

- a) round identification number;
- b) description of test item(s);
- c) test(s) to be carried out;

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- d)** method(s) to be used\*;
- e) values to record;
- f) number of replicates required;
- g) units;
- h) significant figures (if applicable);
- i) result deadlines;
- j) any special requirements.

\*The methods are normally nationally or internationally accepted standard methods.

Standardised results sheets/mounting cards are provided for participants to use. These must be used in order that confidentiality is assured when an external advisor / assessor is used to assist in the analysis of the results / specimens. Any results/specimens not submitted on the sheets or cards provided may be excluded from the trial.

Participants are advised to treat proficiency test items as if they were performing routine tests. Only one set of results will be accepted per participant. If they wish to assess several technicians internally they should purchase additional samples for their own use.

In certain trials, questions relevant to the test procedure, that are considered important to the accuracy of the end result, or in determining any ambiguity within the test procedure, may be asked in the form of a questionnaire. This should be read by participants before carrying out the test in order that all questions can be answered accurately. The questions will be structured in such a way that information confidential to the participating laboratory is not requested.

## 9. Late Returns

The policy on results not returned by the required deadline is as follows:

If a participant is unable to return the results by the deadline, they are required to contact the co-ordinator with an explanation before the deadline. If no contact is made, or if no valid reason is given, they are excluded from the round.

If a reasonable explanation is given to the co-ordinator, the co-ordinator will decide on a new deadline for the laboratory to send their results. This new deadline must not be more than 14 days from the original deadline. After this time all results not sent in are excluded from the round.

If a participant is late in sending in results on two consecutive rounds, the relevant accreditation bodies and retailers are informed.

## 10. Statistical Analysis of Results

The analysis of the results depends on the test being carried out. For textile testing, the tests can be grouped into two broad categories:

- a) numerical results (e.g. tensile strength, mass per unit area);
- b) subjectively assessed results (e.g. colour fastness, pilling).

***In case a)***, robust statistics are used. Robust statistics are statistics that are not highly influenced by the presence of extreme results.

### ***Summary statistics:***

- a) Number of results – the number of results for this test/sample.
- b) Median – the middle value, i.e. half the results are higher than it and half are lower.
- c) Normalised IQR – the interquartile range (IQR) multiplied by a factor of 0.7413. The IQR is the difference between the lower quartile (below which a quarter of the results lie) and the upper quartile (above which a quarter of the results lie). Multiplying the IQR by a factor of 0.7413 makes it comparable to the classical standard deviation.

- d)** Robust CV – coefficient of variation equal to the normalised IQR divided by the median, expressed as a percentage.
- e)** Minimum – the smallest value in the group.
- f)** Maximum – the largest value in the group.
- g)** Range – the maximum minus the minimum.

***Performance statistics:***

Z-scores are normalised values which gives a “score” to each result, relative to the other results in the group. In the case of a ‘single result’ trial the robust z-score is simply the difference between the laboratory’s result and the median, divided by the normalised IQR.

In the case of a pair of results, two types of z-score are calculated, the between-laboratories z-score and the within-laboratories z-score, assessing the between-laboratories variation and the within-laboratory variation and based on the sum and difference of the pair of results respectively.

Suppose the pair of results are from two samples called A and B. The median and normalised IQR of all the sample A results are denoted by median(A) and normIQR(A), respectively. (Similarly for sample B.)

The standardised sum (denoted by S) and standardised difference (D) for the pair of results are:

$$S = \frac{(A+B)}{\sqrt{2}}$$

$$D = \frac{(B-A)}{\sqrt{2}} \quad \text{if median(A) < median(B)}$$

$$D = \frac{(A-B)}{\sqrt{2}} \quad \text{otherwise}$$

Each laboratory’s standardised sum and difference are calculated, followed by the median and normalised IQR of all the S’s and D’s – i.e. median(S), normIQR (D), etc.

The between laboratories z-score (denoted by  $Z_B$ ) is then calculated as the robust z-score for S and the within-laboratory z-score ( $Z_W$ ) is the robust z-score for D, i.e.

$$Z_B = \frac{S - \text{median}(S)}{\text{normIQR}(S)}$$

$$Z_W = \frac{D - \text{median}(D)}{\text{normIQR}(D)}$$

Ordered z-score bar charts are used to illustrate the data.

Value of z-score	Classification
$ Z  > 3$	Outlier
$2 <  Z  < 3$	Questionable
$ Z  < 2$	Satisfactory

***In case b)***, the mode (most popular) result is classed as the “assigned value” and all results within half a grade of the mode are classed as acceptable. Any result that differs from the mode by more than half a grade is classed as an outlier.

In some cases, depending on the distribution of results, more than one result may be classed as “the assigned value”.

## **11. Reporting**

Each round will result in the issuing of a report to each participant. This report contains the following information:

- a) round identification number;
- b) laboratory identification number;
- c) date of issue of report;
- d) tests included in the round;
- e) description of test items;
- f) results of homogeneity assessment;

- g) all results and statistical analysis, including a brief explanation of statistics;
- h) general comments sheet;
- i) individual comments sheet.

## 12. Feedback

Participants are able to refer to the scheme co-ordinator if they consider that assessment of their performance is in error.

Feedback from laboratories is encouraged in order that they can actively contribute to the development of the scheme.

All complaints are made the subject of a report, which includes the following information:

- a) complaint report number;
- b) date complaint was made;
- c) who made the complaint;
- d) method of transmission;
- e) details of complaint;
- f) findings of investigation into complaint;
- g) actions taken.

A copy of the report is made available to the complainant.

**13. Confidentiality**

Normally the identity of participants is confidential to TEPS and individual participating laboratories, except where participation in a recognised proficiency testing scheme is a requirement of an assessment organisation e.g. UKAS, retailer scheme or similar. In this case, organisations will be provided with the completed reports. However, the identity of participants will not be included. Details of any exceptions will be provided in separate documentation and agreement reached between the organisation, TEPS and the participating laboratories before information is made available.