



1 General Information

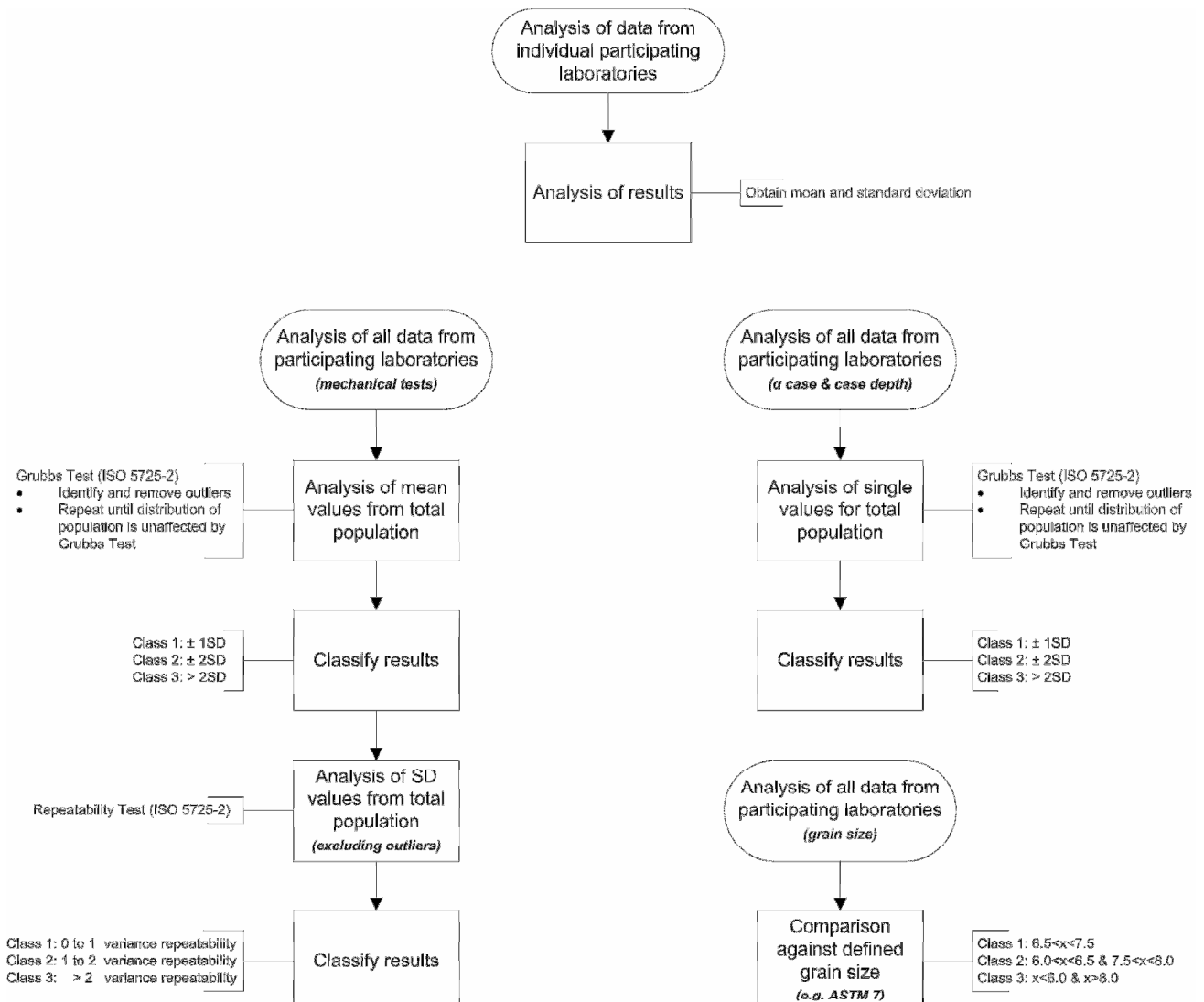
The specific data to be analysed is defined prior to the launch of the PTP Scheme and typically would include the material characteristics relevant to the test being performed (e.g. modulus, proof stress, UTS, elongation and reduction of area for a tensile test). Analysis of the chemical test data is to be carried out by **Dirats** and the results transmitted to **Exova PTP dpt** for inclusion within the final reports. Once the PTP Scheme has been closed the analysis process commences. The analysis process consists of two specific steps:

Analysis of data from individual participant laboratories

1.1 Analysis of all data

Test results received from participating laboratories will not be included within the analysis process. Where requested by "The Primes" a comparison of this data against the results obtained from the analysis may be performed.

The analysis processes for the various tests are shown in the following diagram:





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2 Analysis of data from individual participant laboratories

2.1 Analysis of results

For each characteristic of the test performed the mean and standard deviation shall be calculated.

3 Analysis of data from all participant laboratories

3.1 Analysis of results (mechanical tests, α -case and case depth)

The purpose of this analysis is to validate the acceptance and rejection criteria of the program. The techniques to be used are as follows:

3.1.1 Centring criterion ISO 5725-2 (Simple GRUBBS test)

Using the mean values obtained for the following statistical analysis is performed:

$$GP = \frac{\bar{X}_{\max} - \bar{X}}{S(\bar{x})}$$

GP = test statistics for the largest mean

$$G1 = \frac{\bar{X}_{\min} - \bar{X}}{S(\bar{x})}$$

G1 = test statistics for the smallest mean

Perform comparison of GP, G1 with the critical values (V_c) if $GP, G1 \geq V_c$ at 5 %, the mean tested is considered as outlier.

All outliers as defined above are discarded and the GRUBBS Test is repeated. This process is then repeated further until no outliers exist.

3.1.2 Repeatability test ISO 5725-2

Using the standard deviation values from all results remaining in the population following completion of the GRUBBS Test, the following statistical analysis is performed:

$$s_{ij}^2 = \frac{\sum_{i=1}^p (n_{ij} - 1) s_{ij}^2}{\sum_{i=1}^p (n_{ij} - 1)}$$

3.2 Classification of data

The data obtained from the analysis is evaluated and classified against the following criteria:

3.2.1 Classification of data obtained from GRUBBS Test:

- Class 1: ± 1 Standard Deviation of the population without taking into account the values eliminated by the Grubbs test
- Class 2: ± 2 Standard Deviations of the population without taking into account the values eliminated by the Grubbs test
- Class 3: > 2 Standard Deviations of the population without taking into account the values eliminated by the Grubbs test



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3.2.2 Classification of data obtained from Repeatability test:

Class 1: 0 to 1 variance repeatability

Class 2: 1 to 2 variance repeatability

Class 3: > 2 variance repeatability

3.2.3 Definition of “Outside Criteria” values

Results are considered as “Outside Criteria” if the value is either eliminated during the Grubbs test or is identified as a Class 3 result.

3.3 Analysis of results (grain size)

The analysis of grain size is purely based upon the distribution of test data in relation to the target grain size as defined from the analysis of the homogeneity test results.

3.4 Classification of data (grain size)

The classification values are defined once the homogeneity tests have been completed as they do not follow the same approach described earlier. For example, a target grain size is defined following the analysis of the homogeneity tests as ASTM 7 and the classification levels used are:

Class 1: 6.5 to 7.5

Class 2: $6.0 < x > 6.5$ & $7.5 < x > 8.0$

Class 3: < 6.0 & > 8.0

4 Graphical presentation of results

The specific requirements for graphical presentation of the analysis results will be defined by “The Primes” but they shall allow for visual comparison of the data obtained from the participating laboratories. Examples of such graphs are shown below for one characteristic of a tensile test (mean values of R_m), chemical analysis of a single material, grain size and case depth.

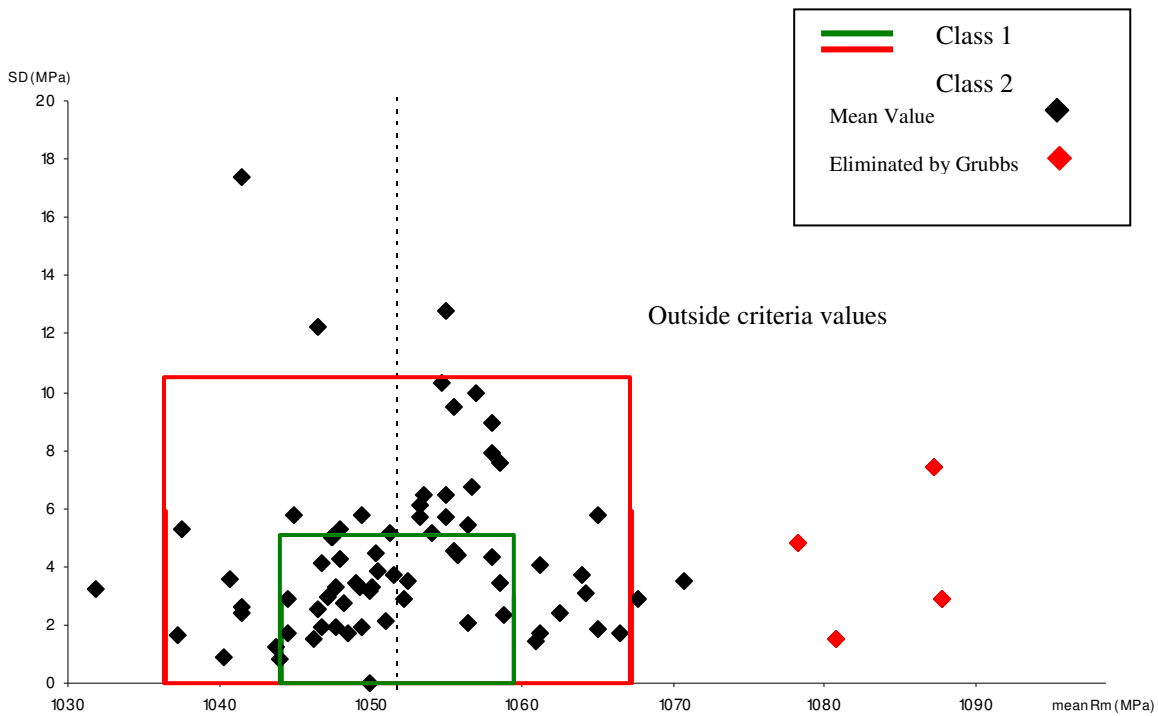


Figure 1 Presentation of R_m values, showing spread of data and limits for classification



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Figure 2 Presentation of grain size results, showing spread of data and limits for classification

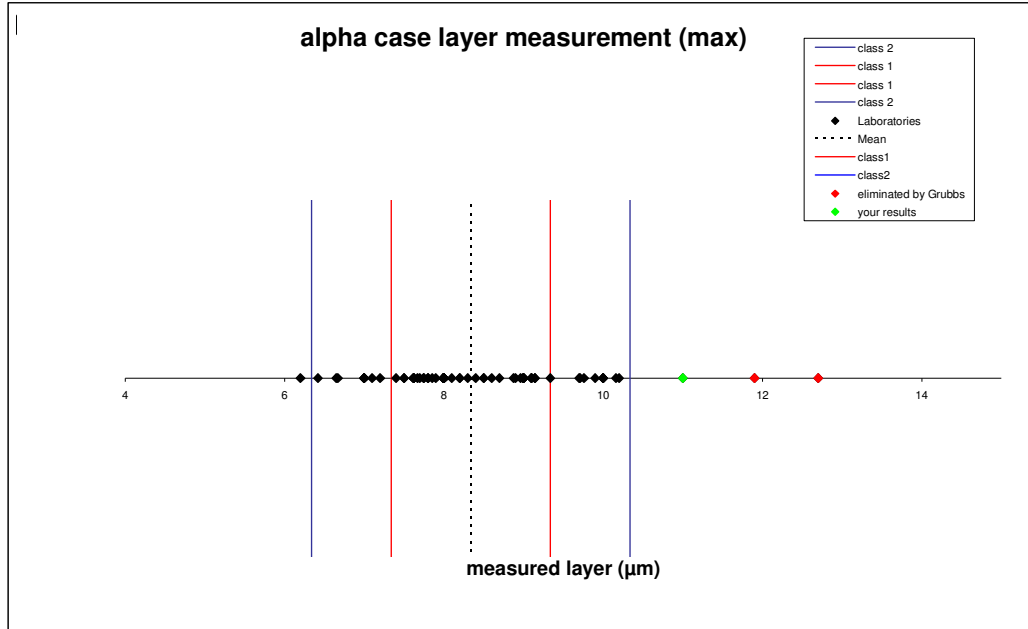


Figure 3 Presentation of case depth results, showing spread of data and limits for classification