# Results of Proficiency Test
# Transformer Oil (used)
# November 2023

**CONTENTS**

**1      INTRODUCTION**

Since 2014 the Institute for Interlaboratory Studies (iis) organizes a proficiency scheme for the analysis of Transformer Oil (used) and a proficiency scheme for the analysis of Furanics in Transformer Oil (used), both based on the latest version of IEC60296 and ASTM D3487, every year. During the annual proficiency testing program of 2023 it was decided to continue the round robins for the analysis of Transformer Oil (used) and the analysis of Furanics in Transformer Oil (used).

In this interlaboratory study registered for participation:
- 94 laboratories in 43 countries for regular analyzes in Transformer Oil (used) iis23L12
- 62 laboratories in 33 countries on the Furanics analyzes iis23L12F

In total 98 laboratories in 44 countries registered for participation in one or both proficiency tests, see appendix 3 for the number of participants per country. In this report the results of the Transformer Oil (used) and Furanics in Transformer Oil (used) proficiency tests are presented and discussed. This report is also electronically available through the iis website www.iisnl.com.

**2      SET UP**

The Institute for Interlaboratory Studies (iis) in Spijkenisse, the Netherlands, was the organizer of this proficiency test (PT). Sample analyzes for fit-for-use and homogeneity testing were subcontracted to a laboratory that has performed the tests in accordance with for ISO/IEC17043 relevant requirements of ISO/IEC17025.
It was decided to send for the PT on Transformer Oil (used) one sample in a 1 L bottle labelled #23241 and for the PT on Furanics in Transformer Oil (used) one sample in a 100 mL bottle labelled #23242.
The participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for the statistical evaluation.

**2.1    ACCREDITATION**

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC17043:2010 (R007), since January 2000, by the Dutch Accreditation Council (Raad voor Accreditatie). This PT falls under the accredited scope. This ensures strict adherence to protocols for sample preparation and statistical evaluation and 100% confidentiality of participant's data. Feedback from the participants on the reported data is encouraged and customer's satisfaction is measured on regular basis by sending out questionnaires.

**2.2    PROTOCOL**

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5). This protocol is electronically available through the iis website www.iisnl.com, from the FAQ page.

## 2.3   CONFIDENTIALITY STATEMENT

All data presented in this report must be regarded as confidential and for use by the participating companies only. Disclosure of the information in this report is only allowed by means of the entire report. Use of the contents of this report for third parties is only allowed by written permission of the Institute for Interlaboratory Studies. Disclosure of the identity of one or more of the participating companies will be done only after receipt of a written agreement of the companies involved.

## 2.4   SAMPLES

For the preparation of the sample for the regular analyzes in Transformer Oil (used) a batch of approximately 200 liters of Transformer Oil (used) was obtained from a third party. After homogenization 105 amber glass bottles of 1 L were filled and labelled #23241.
The homogeneity of the subsamples was checked by determination of Density at 20 °C in accordance with ASTM D4052 on 8 stratified randomly selected subsamples.

|                   | Density at 20 °C in kg/m$^3$ |
|-------------------|------------------------------|
| sample #23241-1   | 865.15                       |
| sample #23241-2   | 865.13                       |
| sample #23241-3   | 865.15                       |
| sample #23241-4   | 865.15                       |
| sample #23241-5   | 865.15                       |
| sample #23241-6   | 865.15                       |
| sample #23241-7   | 865.15                       |
| sample #23241-8   | 865.15                       |

Table 1: homogeneity test results of subsamples #23241

From the above test results the repeatability was calculated and compared with 0.3 times the reproducibility of the reference test method in agreement with the procedure of ISO13528, Annex B2 in the next table.

|                                    | Density at 20 °C in kg/m$^3$ |
|------------------------------------|------------------------------|
| r (observed)                       | 0.02                         |
| reference test method              | ISO12185:96                  |
| 0.3 x R (reference test method)    | 0.15                         |

Table 2: evaluation of the repeatability of subsamples #23241

The calculated repeatability is in agreement with 0.3 times the reproducibility of the reference test method. Therefore, homogeneity of the subsamples was assumed.

For the preparation of the sample for the analyzes of Furanics in Transformer Oil (used) a batch of approximately 10 liters of Transformer Oil (used), positive on Furanics, was obtained from a third party. After homogenization 70 amber glass bottles of 100 mL were filled and labelled #23242.

The homogeneity of the subsamples was checked by determination of Density at 20 °C in accordance with ASTM D4052 on 8 stratified randomly selected subsamples.

|  | Density at 20 °C in kg/m$^3$ |
|---|---|
| sample #23242-1 | 872.47 |
| sample #23242-2 | 872.44 |
| sample #23242-3 | 872.47 |
| sample #23242-4 | 872.46 |
| sample #23242-5 | 872.47 |
| sample #23242-6 | 872.47 |
| sample #23242-7 | 872.47 |
| sample #23242-8 | 872.45 |

Table 3: homogeneity test results of subsamples #23242

From the above test results the repeatability was calculated and compared with 0.3 times the reproducibility of the reference test method in agreement with the procedure of ISO13528, Annex B2 in the next table.

|  | Density at 20 °C in kg/m$^3$ |
|---|---|
| r (observed) | 0.03 |
| reference test method | ISO12185:96 |
| 0.3 x R (reference test method) | 0.15 |

Table 4: evaluation of the repeatability of subsamples #23242

The calculated repeatability is in agreement with 0.3 times the reproducibility of the reference test method. Therefore, homogeneity of the subsamples was assumed.

Depending on the registration of the participant the appropriate set of PT samples was sent on November 1, 2023. An SDS was added to the sample package.

## 2.5   STABILITY OF THE SAMPLES

The stability of Transformer Oil (used) packed in amber glass bottles was checked. The material was found sufficiently stable for the period of the proficiency test.

## 2.6   ANALYZES

The participants were requested to determine on sample #23241: Total Acid Number (Potentiometric and Colorimetric), Breakdown Voltage, Density at 20 °C, Di-electric Dissipation Factor (DDF) at 90 °C and Specific Resistance at 90 °C, Flash Point (C.O.C. and

PMcc), Interfacial Surface Tension, Kinematic Viscosity at 40 °C and Water. Also, some analytical details were asked for the Total Acidity Number (Potentiometric) determination. On sample #23242 it was requested to determine: Total Furanic Compounds, 2-Acetyl Furan, 2-Furfural, 2-Furfurylalcohol, 5-Hydroxy Methyl-2-Furfural and 5-Methyl-2-Furfural.

It was explicitly requested to treat the samples as if they were routine samples and to report the test results using the indicated units on the report form and not to round the test results, but report as much significant figures as possible. It was also requested not to report 'less than' test results, which are above the detection limit, because such test results cannot be used for meaningful statistical evaluations.

To get comparable test results a detailed report form and a letter of instructions are prepared. On the report form the reporting units are given as well as the reference test methods (when applicable) that will be used during the evaluation. The detailed report form and the letter of instructions are both made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The participating laboratories are also requested to confirm the sample receipt on this data entry portal. The letter of instructions can also be downloaded from the iis website www.iisnl.com.

## 3 RESULTS

During five weeks after sample dispatch, the test results of the individual laboratories were gathered via the data entry portal www.kpmd.co.uk/sgs-iis/. The reported test results are tabulated per determination in appendices 1 and 2 of this report. The laboratories are presented by their code numbers.

Directly after the deadline, a reminder was sent to those laboratories that had not reported test results at that moment. Shortly after the deadline, the available test results were screened for suspect data. A test result was called suspect in case the Huber Elimination Rule (a robust outlier test) found it to be an outlier. The laboratories that produced these suspect data were asked to check the reported test results (no reanalyzes). Additional or corrected test results are used for data analysis and the original test results are placed under 'Remarks' in the result tables in appendices 1 and 2. Test results that came in after the deadline were not taken into account in this screening for suspect data and thus these participants were not requested for checks.

### 3.1 STATISTICS

The protocol followed in the organization of this proficiency test was the one as described for proficiency testing in the report 'iis Interlaboratory Studies: Protocol for the Organisation, Statistics and Evaluation' of June 2018 (iis-protocol, version 3.5).
For the statistical evaluation the *unrounded* (when available) figures were used instead of the rounded test results. Test results reported as '<…' or '>…' were not used in the statistical evaluation.

First, the normality of the distribution of the various data sets per determination was checked by means of the Lilliefors-test, a variant of the Kolmogorov-Smirnov test and by the

calculation of skewness and kurtosis. Evaluation of the three normality indicators in combination with the visual evaluation of the graphic Kernel density plot, lead to judgement of the normality being either 'unknown', 'OK', 'suspect' or 'not OK'. After removal of outliers, this check was repeated. If a data set does not have a normal distribution, the (results of the) statistical evaluation should be used with due care.

The assigned value is determined by consensus based on the test results of the group of participants after rejection of the statistical outliers and/or suspect data.

According to ISO13528 all (original received or corrected) results per determination were submitted to outlier tests. In the iis procedure for proficiency tests, outliers are detected prior to calculation of the mean, standard deviation and reproducibility. For small data sets, Dixon (up to 20 test results) or Grubbs (up to 40 test results) outlier tests can be used. For larger data sets (above 20 test results) Rosner's outlier test can be used. Outliers are marked by D(0.01) for the Dixon's test, by G(0.01) or DG(0.01) for the Grubbs' test and by R(0.01) for the Rosner's test. Stragglers are marked by D(0.05) for the Dixon's test, by G(0.05) or DG(0.05) for the Grubbs' test and by R(0.05) for the Rosner's test. Both outliers and stragglers were not included in the calculations of averages and standard deviations.

For each assigned value the uncertainty was determined in accordance with ISO13528. Subsequently the calculated uncertainty was evaluated against the respective requirement based on the target reproducibility in accordance with ISO13528. In this PT the criterion of ISO13528, paragraph 9.2.1, was met for all evaluated tests. Therefore, the uncertainty of all assigned values may be negligible and need not be included in the PT report.

Finally, the reproducibilities were calculated from the standard deviations by multiplying them with a factor of 2.8.

## 3.2 GRAPHICS

In order to visualize the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for one determination (see appendix 1). On the Y-axis the reported test results are plotted. The corresponding laboratory numbers are on the X-axis. The straight horizontal line presents the consensus value (a trimmed mean). The four striped lines, parallel to the consensus value line, are the +3s, +2s, -2s and -3s target reproducibility limits of the selected reference test method. Outliers and other data, which were excluded from the calculations, are represented as a cross. Accepted data are represented as a triangle.

Furthermore, Kernel Density Graphs were made. This is a method for producing a smooth density approximation to a set of data that avoids some problems associated with histograms. Also, a normal Gauss curve (dotted line) was projected over the Kernel Density Graph (smooth line) for reference. The Gauss curve is calculated from the consensus value and the corresponding standard deviation.

### 3.3   Z-SCORES

To evaluate the performance of the participating laboratories the z-scores were calculated. As it was decided to evaluate the performance of the participants in this proficiency test (PT) against the literature requirements (derived from e.g. ISO or ASTM test methods), the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the variation in this interlaboratory study.

The target standard deviation was calculated from the literature reproducibility by division with 2.8. In case no literature reproducibility was available, other target values were used, like Horwitz or an estimated reproducibility based on former iis proficiency tests.

When a laboratory did use a test method with a reproducibility that is significantly different from the reproducibility of the reference test method used in this report, it is strongly advised to recalculate the z-score, while using the reproducibility of the actual test method used, this in order to evaluate whether the reported test result is fit-for-use.

The z-scores were calculated according to:

$z_{(target)}$ = (test result - average of PT) / target standard deviation

The $z_{(target)}$ scores are listed in the test result tables in appendix 1.

Absolute values for z<2 are very common and absolute values for z>3 are very rare. Therefore, the usual interpretation of z-scores is as follows:

$$|z| < 1 \quad \text{good}$$
$$1 < |z| < 2 \quad \text{satisfactory}$$
$$2 < |z| < 3 \quad \text{questionable}$$
$$3 < |z| \quad \text{unsatisfactory}$$

## 4   EVALUATION

In this proficiency test some problems were encountered with the dispatch of the samples. For the PT on Transformer Oil (used) four participants reported test results after the final reporting date and two other participants did not report any test results.
For the PT on Furanics in Transformer Oil (used) three participants reported test results after the final reporting date and five other participants did not report any test results.
Not all participants were able to report all tests requested.
In total 96 participants reported 752 numerical test results. Observed were 40 outlying test results, which is 5.3%. In proficiency tests outlier percentages of 3% - 7.5% are quite normal.

Not all data sets proved to have a normal Gaussian distribution. These are referred to as "not OK" or "suspect". The statistical evaluation of these data sets should be used with due care, see also paragraph 3.1.

**4.1 EVALUATION PER SAMPLE AND PER TEST**

In this section the reported test results are discussed per sample and per test. The test methods which were used by the various laboratories were taken into account for explaining the observed differences when possible and applicable. These test methods are also in the tables together with the original data in appendix 1. The abbreviations, used in these tables, are explained in appendix 4.

In the iis PT reports ASTM test methods are referred to with a number (e.g. D1298) and an added designation for the year that the test method was adopted or revised (e.g. D1298:12b). When a method has been reapproved an "R" will be added and the year of approval (e.g. D1298:12bR17e1).

**sample #23241**

Total Acid Number (Potentiometric): The group of participants had difficulty to meet the target requirements. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is not in agreement with the requirements of ASTM D664-A:18e2 for none of the end point types Buffer End Point and Inflection Point at both volumes (60 mL and 125 mL) of titration solvent.
When the test results were evaluated separately for ASTM D664 and EN/IEC62021-1 only, both the calculated reproducibilities after rejection of the statistical outlier are again not in agreement with the respective requirements of ASTM D664-A:18e2 for both end point types and titration volumes and IEC6202-1.

Total Acid Number (Colorimetric): The group of participants may have had difficulty to meet the target requirements depending on the test method used. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D974:22 but not in agreement with the requirements of EN62021-2:07.
When the test results were evaluated separately for ASTM D974 the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D974:22. However, for the test results for EN/IEC62021-2 the calculated reproducibility is not in agreement with the requirements of EN62021-2:07.

Breakdown Voltage: The group of participants met the target requirements. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of IEC60156:18.

Density at 20 °C: The group of participants may have had difficulty to meet the target requirements depending on the test method used. Thirteen statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ISO12185:96 and ASTM D4052:22 but is in agreement with the requirements of ISO3675:98 and D1298:12bR17e1.

When the test results were evaluated separately for ISO12185/D4052 the calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ISO12185/D4052. However, the test results for ISO3675/D1298, the calculated reproducibility after rejection of the statistical outliers is not in agreement with requirements of ISO3675/D1298.

DD-Factor at 90 °C: The group of participants met the target requirements. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of EN60247:04.

Specific Resistance at 90 °C: The group of participants met the target requirements. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of EN60247:04.

Flash Point C.O.C.: The group of participants met the target requirements. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of ASTM D92:18 and ISO2592:17.

Flash Point PMcc: The group of participants met the target requirements. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ISO2719-A:16, ASTM D93-A:20 and ASTM D93-B:20.

Interfacial Surface Tension: The group of participants may have had difficulty to meet the target requirements depending on the test method used. No statistical outliers were observed. The calculated reproducibility is not in agreement with the requirements of ASTM D971:20 but is in agreement with the requirements of IEC62961:18.

Kinematic Viscosity at 40 °C: Until 2017 a precision statement for used oils was not present in ASTM D445. In the 2019 version of ASTM D445 a precision statement is given for used (in-service) formulated oils. However, it appears that this reproducibility is very strict. Therefore, iis has estimated a reproducibility on used oils for Kinematic Viscosity at 40 °C based on previous PTs (see iis memo 1401, lit. 13). This reproducibility has been used for the calculation of the z-scores.
The group of participants may have had difficulty to meet the target requirements depending on the test method used. Five statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of iis memo 1401, ASTM D445:23 and ISO3104-A:20 but is in agreement with the requirements of ASTM D7042:21a.

Water: The group of participants met the target requirements. Six statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of EN60814:98 and ASTM D1533:20.

**sample #23242**

For the Furanics the observed reproducibilities were compared against the (strict) estimated reproducibilities calculated with the Horwitz equation. It is remarkable that the precision requirements of IEC61198:93 are stricter than with the Horwitz equation.

Total Furanic Compounds: The group of participants met the target requirements. Five statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the estimated reproducibility calculated with the Horwitz equation but is not in agreement with the strict requirements of IEC61198:93.

2-Furfural: The group of participants met the target requirements. Seven statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the estimated reproducibility calculated with the Horwitz equation but is not in agreement with the strict requirements of IEC61198:93.

The participants agreed on a concentration near or below the limit of detection for all other Furanic compounds mentioned in paragraph 2.6. Therefore, no z-scores are calculated for these compounds. The reported test results are given in appendix 2.

### 4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the reference test method and the reproducibility as found for the group of participating laboratories. The number of significant test results, the average, the calculated reproducibility (2.8 * standard deviation) and the target reproducibility derived from reference methods are presented in the next tables.

| Parameter | unit | n | average | 2.8 * sd | R(lit) |
|---|---|---|---|---|---|
| Total Acid Number (Pot. metric) | mg KOH/kg | 54 | 0.027 | 0.024 | 0.016 |
| Total Acid Number (Colorimetric) | mg KOH/kg | 41 | 0.020 | 0.024 | 0.04 |
| Breakdown Voltage | kV/2.5 mm | 85 | 39.3 | 31.7 | 33.0 |
| Density at 20 °C | kg/m$^3$ | 53 | 865.2 | 0.8 | 0.5 |
| D-Dissipation Factor 90 °C | | 74 | 0.028 | 0.027 | 0.038 |
| Specific Resistance at 90 °C | GΩm | 54 | 15.1 | 16.2 | 15.8 |
| Flash Point C.O.C. | °C | 26 | 156.6 | 13.4 | 18 |
| Flash Point PMcc | °C | 45 | 147.4 | 8.9 | 10.5 |
| Interfacial Surface Tension | mN/m | 68 | 26.2 | 6.4 | 2.6 |
| Kinematic Viscosity at 40 °C | mm$^2$/s | 49 | 9.545 | 0.221 | 0.172 |
| Water | mg/kg | 77 | 24.08 | 5.88 | 7.36 |

Table 5: reproducibilities of tests on sample #23241

| Component | unit | n | average | 2.8 * sd | R(target) |
|---|---|---|---|---|---|
| Total Furanic Compounds | mg/kg | 36 | 1.73 | 0.61 | 0.71 |
| 2-Furfural | mg/kg | 50 | 1.67 | 0.65 | 0.69 |

Table 6: reproducibilities of tests on sample #23242

Without further statistical calculations it can be concluded that for many tests there is a good compliance of the group of participants with the reference test methods. The problematic tests have been discussed in paragraph 4.1.

### 4.3   COMPARISON OF THE PROFICIENCY TEST OF NOVEMBER 2023 WITH PREVIOUS PTS

| | November 2023 | November 2022 | November 2021 | November 2020 | November 2019 |
|---|---|---|---|---|---|
| Number of reporting laboratories | 96 | 86 | 77 | 70 | 70 |
| Number of test results | 752 | 674 | 822 | 581 | 678 |
| Number of statistical outliers | 40 | 27 | 35 | 24 | 24 |
| Percentage of statistical outliers | 5.3% | 4.0% | 4.3% | 4.1% | 3.5% |

Table 7: comparison with previous proficiency tests

In proficiency tests outlier percentages of 3% - 7.5% are quite normal.

The performance of the determinations of the proficiency tests was compared to the requirements of the reference test methods. The conclusions are given in the following table.

| Parameter | November 2023 | November 2022 | November 2021 | November 2020 | November 2019 |
|---|---|---|---|---|---|
| Total Acid Number (Pot. metric) | - | +/- | - | - | - |
| Total Acid Number (Colorimetric) | + | ++ | ++ | ++ | + |
| Breakdown Voltage | +/- | + | +/- | - | - |
| Density at 20 °C | - | - | + | + | - |
| D-Dissipation Factor 90 °C | + | + | + | ++ | + |
| Specific Resistance at 90 °C | +/- | + | - | ++ | + |
| Flash Point C.O.C. | + | + | + | +/- | + |
| Flash Point PMcc | + | + | + | +/- | + |
| Interfacial Surface Tension | -- | -- | -- | -- | -- |
| Kinematic Viscosity at 40 °C | - | +/- | - | + | - |
| Water | + | + | - | +/- | -- |
| Total Furanic Compounds | + | + | ++ | +/- | ++ |
| 2-Acetyl Furan | n.e. | n.e. | + | n.e. | n.e. |
| 2-Furfural | +/- | +/- | + | +/- | ++ |
| 2-Furfurylalcohol | n.e. | n.e. | - | n.e. | - |
| 5-Hydroxymethyl-2-Furfural | n.e. | n.e. | +/- | n.e. | n.e. |
| 5-Methyl-2-Furfural | n.e. | n.e. | +/- | n.e. | + |

Table 8: comparison of determinations to the reference test methods

The following performance categories were used:

       ++    : group performed much better than the reference test method

       +     : group performed better than the reference test method

       +/-   : group performance equals the reference test method

       -     : group performed worse than the reference test method

       --    : group performed much worse than the reference test method

       n.e.  : not evaluated

## APPENDIX 1
## Determination of Total Acid Number (Potentiometric) on sample #23241; results in mg KOH/g

| lab | method | value | mark | z(targ) | end point | volume solvent | remarks |
|---|---|---|---|---|---|---|---|
| 179 | | ----- | | ----- | Buffer End Point pH 11 | 60 mL | |
| 237 | D664-A | <0.1 | | ----- | Inflection Point | 125 mL | |
| 325 | D664-A | 0.03 | | 0.55 | Buffer End Point pH 10 | 125 mL | |
| 331 | D664-A | <0.05 | | ----- | --- | --- | |
| 398 | D664-A | 0.019 | | -1.35 | Inflection Point | 125 mL | |
| 445 | | ----- | | ----- | --- | --- | |
| 455 | EN62021-1 | 0.028 | | 0.21 | --- | --- | |
| 511 | | ----- | | ----- | Inflection Point | --- | |
| 614 | | ----- | | ----- | --- | --- | |
| 657 | D664-A | 0.0119 | | -2.57 | Buffer End Point pH 10 | 60 mL | |
| 780 | D664-A | 0.05 | | 4.01 | Buffer End Point pH 10 | 60 mL | |
| 840 | D664-A | <0.1 | | ----- | Buffer End Point pH 10 | 60 mL | |
| 862 | D664-A | <0.10 | | ----- | Inflection Point | 60 mL | |
| 901 | | ----- | | ----- | --- | --- | |
| 912 | | ----- | | ----- | --- | --- | |
| 963 | | ----- | | ----- | --- | --- | |
| 974 | D664-A | 0.02 | | -1.17 | Inflection Point | 125 mL | |
| 975 | D664-A | 0.021 | | -1.00 | Inflection Point | 125 mL | |
| 1135 | | ----- | | ----- | --- | --- | |
| 1146 | D664-A | 0.024 | | -0.48 | Buffer End Point pH 10 | 125 mL | |
| 1156 | EN62021-1 | 0.029 | | 0.38 | Buffer End Point pH 11.5 | --- | |
| 1178 | IEC62021-1 | 0.025 | | -0.31 | --- | --- | |
| 1264 | D664-A | 0.033 | | 1.07 | Inflection Point | 60 mL | |
| 1304 | | ----- | | ----- | --- | --- | |
| 1306 | | ----- | | ----- | --- | --- | |
| 1352 | | ----- | | ----- | --- | --- | |
| 1374 | D664-A | 0.024 | | -0.48 | Inflection Point | 60 mL | |
| 1430 | | ----- | | ----- | --- | --- | |
| 1435 | D664-A | 0.020 | | -1.17 | Buffer End Point pH 11.5 | 100 mL | |
| 1439 | | ----- | | ----- | --- | --- | |
| 1440 | EN62021-1 | 0.035 | | 1.42 | Buffer End Point pH 11 | 60 mL | |
| 1442 | | ----- | | ----- | --- | --- | |
| 1458 | | ----- | | ----- | --- | --- | |
| 1461 | | ----- | | ----- | --- | --- | |
| 1478 | IEC62021-1 | 0.0257 | | -0.19 | Buffer End Point pH 11 | 60 mL | |
| 1505 | | ----- | | ----- | --- | --- | |
| 1513 | IEC62021-1 | 0.022 | | -0.83 | Buffer End Point pH 11.5 | --- | |
| 1529 | IEC62021-1 | 0.0185 | | -1.43 | Buffer End Point pH 10 | --- | |
| 1545 | | ----- | | ----- | --- | --- | |
| 1554 | | ----- | | ----- | --- | --- | |
| 1560 | IEC62021-1 | 0.022 | | -0.83 | Buffer End Point pH 11 | 60 mL | |
| 1624 | IEC62021-1 | 0.035 | | 1.42 | Buffer End Point pH 11 | 60 mL | |
| 1660 | IEC62021-1 | 0.031 | | 0.72 | Buffer End Point pH 11 | 60 mL | |
| 1687 | D664-A | 0.024 | | -0.48 | Buffer End Point pH 10 | 60 mL | |
| 1702 | IEC62021-1 | 0.029 | | 0.38 | --- | --- | |
| 1719 | D664-A | 0.019 | | -1.35 | Buffer End Point pH 10 | 25 mL | |
| 1743 | IEC62021-1 | 0.016 | | -1.87 | Buffer End Point pH 11 | 60 mL | |
| 1801 | EN62021-1 | 0.035 | | 1.42 | Buffer End Point pH 11 | 125 mL | |
| 1816 | EN62021-1 | 0.028 | | 0.21 | --- | 60 mL | |
| 1885 | | ----- | | ----- | --- | --- | |
| 1888 | IEC62021-1 | 0.02 | | -1.17 | Buffer End Point pH 11 | 60 mL | |
| 1890 | ISO6619 | 0.031 | | 0.72 | Inflection Point | 60 mL | |
| 1891 | | ----- | | ----- | Inflection Point | 60 mL | |
| 1923 | EN62021-1 | 0.0261 | | -0.12 | Buffer End Point pH 11 | 60 mL | |
| 1924 | EN62021-1 | 0.028 | | 0.21 | Inflection Point | 60 mL | |
| 1925 | EN62021-1 | 0.0265 | | -0.05 | Buffer End Point pH 11 | 60 mL | |
| 1955 | D664-A | 0.01762 | | -1.59 | Buffer End Point pH 10 | 60 mL | |
| 1958 | | ----- | | ----- | --- | --- | |
| 3031 | IEC62021-1 | 0.04 | | 2.28 | Inflection Point | 80 mL | |
| 6002 | EN62021-1 | 0.034 | | 1.24 | Buffer End Point pH 11 | 60 mL | |
| 6015 | | ----- | | ----- | --- | --- | |
| 6031 | | ----- | | ----- | --- | --- | |
| 6036 | EN62021-1 | 0.0255 | | -0.23 | --- | --- | |
| 6053 | IEC62021-1 | 0.046 | | 3.31 | Buffer End Point pH 10 | 60 mL | |
| 6085 | D8045 | 0.03 | | 0.55 | Inflection Point | 60 mL | |
| 6088 | IEC62021-1 | 0.0281 | | 0.22 | Buffer End Point pH 10 | 60 mL | |
| 6099 | IEC62021-1 | 0.026 | | -0.14 | Buffer End Point pH 11 | 60 mL | |
| 6124 | IEC62021-1 | 0.0222 | | -0.80 | Buffer End Point pH 11 | 60 mL | |
| 6141 | D664-A | 0.12 | R(0.01) | 16.09 | Inflection Point | 60 mL | |
| 6167 | | ----- | | ----- | --- | --- | |
| 6239 | D664-A | 0.009 | | -3.07 | Inflection Point | 125 mL | |
| 6264 | IEC62021-1 | 0.029 | | 0.38 | Inflection Point | 50 mL | |
| 6275 | IEC62021-1 | 0.0200 | | -1.17 | Buffer End Point pH 11 | 60 mL | |
| 6278 | | ----- | | ----- | --- | --- | |
| 6280 | IEC62021-1 | 0.0486 | | 3.76 | --- | 60 mL | |

| lab | method | value | mark | z(targ) | end point | volume solvent | remarks |
|------|------------|--------|------|--------|-------------------------|-----------|---------|
| 6334 | | ----- | | ----- | --- | --- | |
| 6367 | | ----- | | ----- | --- | --- | |
| 6372 | IEC62021-1 | 0.016 | | -1.87 | Buffer End Point pH 11.5 | 20 mL | |
| 6382 | IEC62021-1 | 0.0267 | | -0.02 | Inflection Point | 125 mL | |
| 6393 | | ----- | | ----- | --- | --- | |
| 6402 | | ----- | | ----- | --- | --- | |
| 6414 | IEC62021-1 | 0.020 | | -1.17 | Buffer End Point pH 11.5 | 50 mL | |
| 6422 | | ----- | | ----- | --- | --- | |
| 6434 | IEC62021-1 | 0.044 | | 2.97 | Buffer End Point pH 11 | --- | |
| 6446 | D664-A | <0.03 | | ----- | --- | --- | |
| 6465 | IEC62021-1 | 0.04 | | 2.28 | Buffer End Point pH 11 | 60 mL | |
| 6484 | | ----- | | ----- | --- | --- | |
| 6495 | EN62021-1 | 0.022 | | -0.83 | Buffer End Point pH 11 | 40 mL | |
| 6501 | IEC62021-1 | 0.029 | | 0.38 | Inflection Point | 60 mL | |
| 6527 | IEC62021-1 | 0.017 | | -1.69 | Inflection Point | 60 mL | |
| 6541 | D664-A | 0.03 | | 0.55 | Buffer End Point pH 10 | 125 mL | |
| 6542 | D664-A | 0.02 | | -1.17 | Buffer End Point pH 10 | 125 mL | |
| 6549 | | ----- | | ----- | --- | --- | |
| 6556 | | ----- | | ----- | --- | --- | |

|  |  | | D664 only | EN/IEC62021-1 only |
|---|---|---|---|---|
| normality | OK | | not OK | OK |
| n | 54 | | 16 | 36 |
| outliers | 1 | | 1 | 0 |
| mean (n) | 0.0268 | | 0.0233 | 0.0282 |
| st.dev. (n) | 0.00867 | | 0.00945 | 0.00820 |
| R(calc.) | 0.0243 | | 0.0265 | 0.0230 |
| st.dev.(D664-A:18e2, BEP 60 mL) | 0.00579 | | 0.00505 | --- |
| R(D664-A:18e2, BEP 60 mL) | 0.0162 | | 0.0141 | --- |
| Compare: | | | | |
| R(EN62021-1:03) | 0.0094 | | --- | 0.0099 |
| R(D664-A:18e2, BEP 125 mL) | 0.0070 | | 0.0061 | --- |
| R(D664-A:18e2, IP 60 mL) | 0.0207 | | 0.0184 | --- |
| R(D664-A:18e2, IP 125 mL) | 0.0050 | | 0.0043 | --- |
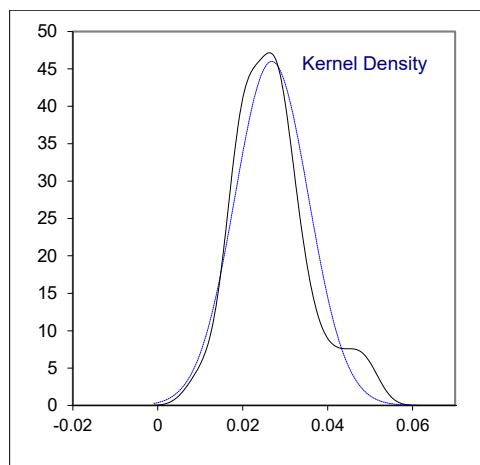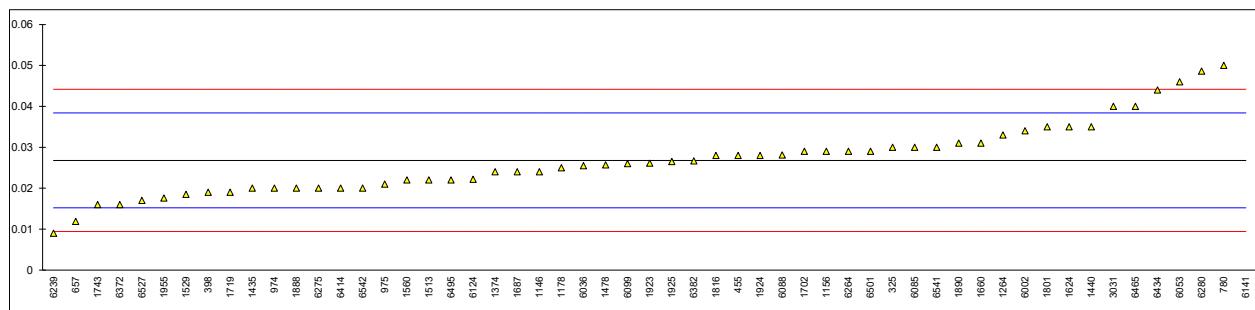
Determination of Total Acid Number (Colorimetric) on sample #23241; results in mg KOH/g

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 179 | D974 | 0 | | -1.39 | |
| 237 | D974 | 0.027 | | 0.50 | |
| 325 | D974 | 0.02 | | 0.01 | |
| 331 | | ----- | | ----- | |
| 398 | D974 | 0.018 | | -0.13 | |
| 445 | | ----- | | ----- | |
| 455 | | ----- | | ----- | |
| 511 | D974 | 0.02 | | 0.01 | |
| 614 | D974 | 0.02 | | 0.01 | |
| 657 | D974 | 0.018 | | -0.13 | |
| 780 | D974 | 0.06 | R(0.01) | 2.81 | |
| 840 | D974 | 0.012 | | -0.55 | |
| 862 | D974 | 0.04 | | 1.41 | |
| 901 | D974 | 0.02 | | 0.01 | |
| 912 | D974 | 0.0155 | | -0.30 | |
| 963 | D974 | 0.027 | | 0.50 | |
| 974 | D974 | 0.017 | | -0.20 | |
| 975 | D974 | 0.020 | | 0.01 | |
| 1135 | D974 | 0.02 | | 0.01 | |
| 1146 | | ----- | | ----- | |
| 1156 | | ----- | | ----- | |
| 1178 | | ----- | | ----- | |
| 1264 | D974 | 0.035 | | 1.06 | |
| 1304 | In house | 0.007 | | -0.90 | |
| 1306 | D974 | 0.0208 | | 0.07 | |
| 1352 | IEC62021-2 | 0.01891 | | -0.06 | |
| 1374 | | ----- | | ----- | |
| 1430 | EN62021-2 | 0.0205 | | 0.05 | |
| 1435 | | ----- | | ----- | |
| 1439 | | ----- | | ----- | |
| 1440 | ISO6618 | 0.016 | | -0.27 | |
| 1442 | IEC62021-2 | 0.014 | | -0.41 | |
| 1458 | D974 | 0.021 | | 0.08 | |
| 1461 | | 0.007 | | -0.90 | |
| 1478 | | ----- | | ----- | |
| 1505 | D974 | 0.016 | | -0.27 | |
| 1513 | IEC62021-2 | 0.013 | | -0.48 | |
| 1529 | | ----- | | ----- | |
| 1545 | D974 | 0.013 | | -0.48 | |
| 1554 | | ----- | | ----- | |
| 1560 | | ----- | | ----- | |
| 1624 | | ----- | | ----- | |
| 1660 | | ----- | | ----- | |
| 1687 | | ----- | | ----- | |
| 1702 | | ----- | | ----- | |
| 1719 | | ----- | | ----- | |
| 1743 | | ----- | | ----- | |
| 1801 | | ----- | | ----- | |
| 1816 | | ----- | | ----- | |
| 1885 | D974 | 0.019 | | -0.06 | |
| 1888 | | ----- | | ----- | |
| 1890 | | ----- | | ----- | |
| 1891 | IEC62021-2 | 0.01 | | -0.69 | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | IEC62021-2 | 0.01236 | | -0.52 | |
| 1958 | D974 | <0.02 | | ----- | |
| 3031 | IEC62021-2 | 0.044 | | 1.69 | |
| 6002 | | ----- | | ----- | |
| 6015 | | ----- | | ----- | |
| 6031 | D974 | 0.0356 | | 1.10 | |
| 6036 | | ----- | | ----- | |
| 6053 | | ----- | | ----- | |
| 6085 | | ----- | | ----- | |
| 6088 | | ----- | | ----- | |
| 6099 | | ----- | | ----- | |
| 6124 | | ----- | | ----- | |
| 6141 | D974 | 0.15 | R(0.01) | 9.11 | |
| 6167 | | ----- | | ----- | |
| 6239 | | ----- | | ----- | |
| 6264 | | ----- | | ----- | |
| 6275 | D974 | 0.0181 | | -0.12 | |
| 6278 | D974 | 0.024 | | 0.29 | |
| 6280 | IEC62021-2 | 0.0223 | | 0.17 | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | IEC62021-2 | 0.024 | | 0.29 | |
| 6367 | IEC62021-2 | 0.03 | | 0.71 | |
| 6372 | | ----- | | ----- | |
| 6382 | | ----- | | ----- | |
| 6393 | EN62021-2 | 0.013 | | -0.48 | |
| 6402 | | ----- | | ----- | |
| 6414 | | ----- | | ----- | |
| 6422 | IEC62021-2 | 0.0289 | | 0.64 | |
| 6434 | | ----- | | ----- | |
| 6446 | D974 | <0.03 | | ----- | |
| 6465 | | ----- | | ----- | |
| 6484 | EN62021-2 | 0.015 | | -0.34 | |
| 6495 | | ----- | | ----- | |
| 6501 | | ----- | | ----- | |
| 6527 | | ----- | | ----- | |
| 6541 | | ----- | | ----- | |
| 6542 | | ----- | | ----- | |
| 6549 | DIN51558 | 0.02 | | 0.01 | |
| 6556 | | ----- | | ----- | |

| | | | D974/ISO6618/DIN51558 only | EN/IEC62021-2 only |
|---|---|---|---|---|
| normality | suspect | | not OK | not OK |
| n | 41 | | 26 | 13 |
| outliers | 2 | | 2 | 0 |
| mean (n) | 0.0198 | | 0.0205 | 0.0205 |
| st.dev. (n) | 0.00866 | | 0.00791 | 0.00954 |
| R(calc.) | 0.0243 | | 0.0221 | 0.0267 |
| st.dev.(D974:22) | 0.01429 | | 0.01429 | --- |
| R(D974:22) | 0.04 | | 0.04 | --- |
| Compare: | | | | |
| R(EN62021-2:07) | 0.0040 | | --- | 0.0041 |





Kernel Density
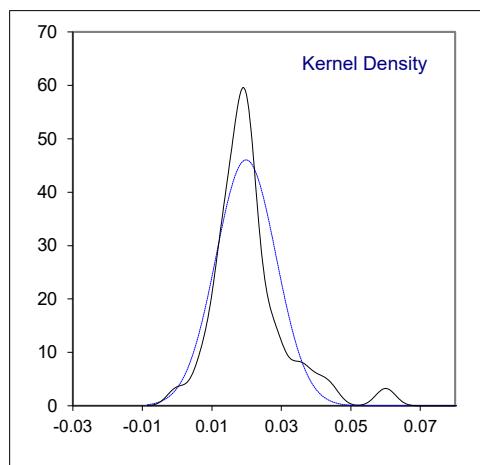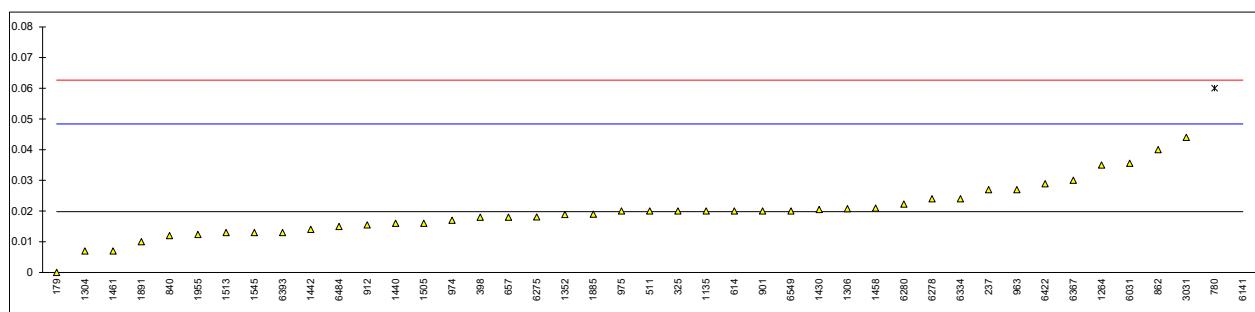
## Determination of Breakdown Voltage on sample #23241, results in kV/2.5 mm

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 179 | D877 | 36.9 | | -0.20 | |
| 237 | IEC60156 | 35.8 | | -0.30 | |
| 325 | | ----- | | ----- | |
| 331 | | ----- | | ----- | |
| 398 | IEC60156 | 26.2 | | -1.11 | |
| 445 | | ----- | | ----- | |
| 455 | EN60156 | 23.8 | | -1.31 | |
| 511 | | ----- | | ----- | |
| 614 | IEC60156 | 31 | | -0.70 | |
| 657 | IEC60156 | 45.9 | | 0.56 | |
| 780 | GOST6581 | 31.6 | | -0.65 | |
| 840 | IEC60156 | 45.4 | | 0.52 | |
| 862 | IEC60156 | 42.9 | | 0.31 | |
| 901 | EN60156 | 30.5 | | -0.75 | |
| 912 | IEC60156 | 33 | | -0.53 | |
| 963 | IEC60156 | 38.8 | | -0.04 | |
| 974 | IEC60156 | 44 | | 0.40 | |
| 975 | EN60156 | 40.2 | | 0.08 | |
| 1135 | IEC60156 | 41 | | 0.14 | |
| 1146 | IEC60156 | 39 | | -0.03 | |
| 1156 | EN60156 | 56.7 | | 1.48 | |
| 1178 | IEC60156 | 46.2 | | 0.59 | |
| 1264 | IEC60156 | 71.6 | | 2.74 | |
| 1304 | IEC60156 | 33.3 | | -0.51 | |
| 1306 | IEC60156 | 5.7 | | -2.85 | |
| 1352 | IEC60156 | 42.6 | | 0.28 | |
| 1374 | IEC60156 | 30.2 | | -0.77 | |
| 1430 | EN60156 | 34.1 | | -0.44 | |
| 1435 | IEC60156 | 43.2 | | 0.33 | |
| 1439 | | ----- | | ----- | |
| 1440 | IEC60156 | 40.15 | | 0.07 | |
| 1442 | IEC60156 | 54.5 | | 1.29 | |
| 1458 | IEC60156 | 28.3 | | -0.93 | |
| 1461 | IEC60156 | 50.4 | | 0.94 | |
| 1478 | EN60156 | 41.1 | | 0.15 | |
| 1505 | IEC60156 | 25.3 | | -1.19 | |
| 1513 | IEC60156 | 34.7 | | -0.39 | |
| 1529 | IEC60156 | 45.6 | | 0.53 | |
| 1545 | IEC60156 | 34.0 | | -0.45 | |
| 1554 | | ----- | | ----- | |
| 1560 | IEC60156 | 47 | | 0.65 | |
| 1624 | IEC60156 | 38.5 | | -0.07 | |
| 1660 | IEC60156 | 54.2 | | 1.26 | |
| 1687 | IEC60156 | 47.0 | | 0.65 | |
| 1702 | IEC60156 | 30.3 | | -0.76 | |
| 1719 | IEC60156 | 34.2 | | -0.43 | |
| 1743 | IEC60156 | 29 | | -0.87 | |
| 1801 | EN60156 | 22.3 | | -1.44 | |
| 1816 | EN60156 | 41.7 | | 0.20 | |
| 1885 | IEC60156 | 36.1 | | -0.27 | |
| 1888 | EN60156 | 41.8 | | 0.21 | |
| 1890 | IEC60156 | 50.1 | | 0.92 | |
| 1891 | IEC60156 | 22.0 | | -1.47 | |
| 1923 | EN60156 | 35.0 | | -0.36 | |
| 1924 | EN60156 | 34.2 | | -0.43 | |
| 1925 | EN60156 | 33.8 | | -0.47 | |
| 1955 | IEC60156 | 26.2333 | | -1.11 | |
| 1958 | IEC60156 | 30.2 | | -0.77 | |
| 3031 | IEC60156 | 42.7 | | 0.29 | |
| 6002 | EN60156 | 30.1 | | -0.78 | |
| 6015 | | ----- | | ----- | |
| 6031 | IEC60156 | 31.0 | | -0.70 | |
| 6036 | EN60156 | 52.18 | | 1.09 | |
| 6053 | IEC60156 | 25.4 | | -1.18 | |
| 6085 | IEC60156 | 28.9 | | -0.88 | |
| 6088 | IEC60156 | 33.5 | | -0.49 | |
| 6099 | IEC60156 | 48.0 | | 0.74 | |
| 6124 | IEC60156 | 31.4 | | -0.67 | |
| 6141 | IEC60156 | 30.9 | | -0.71 | |
| 6167 | IEC60156 | 45.5 | | 0.53 | |
| 6239 | IEC60156 | 24.7 | | -1.24 | |
| 6264 | IEC60156 | 37 | | -0.19 | |
| 6275 | IEC60156 | 45 | | 0.48 | |
| 6278 | IEC60156 | 24.5 | | -1.26 | |
| 6280 | IEC60156 | 56.5 | | 1.46 | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | IEC60156 | 45.2 | | 0.50 | |
| 6367 | IEC60156 | 55.9 | C | 1.41 | first reported 79.8 |
| 6372 | IEC60156 | 50.2 | | 0.93 | |
| 6382 | IEC60156 | 55.4 | | 1.37 | |
| 6393 | EN60156 | 56.9 | | 1.49 | |
| 6402 | IEC60156 | 47.1 | | 0.66 | |
| 6414 | IEC60156 | 38.4 | | -0.08 | |
| 6422 | IEC60156 | 28.0 | | -0.96 | |
| 6434 | IEC60156 | 40.5 | | 0.10 | |
| 6446 | IEC60156 | 32.80 | | -0.55 | |
| 6465 | IEC60156 | 30.9 | | -0.71 | |
| 6484 | EN60156 | 55 | | 1.33 | |
| 6495 | EN60156 | 29 | | -0.87 | |
| 6501 | | ----- | | ----- | |
| 6527 | IEC60156 | 64.5 | | 2.14 | |
| 6541 | IEC60156 | 64.50 | | 2.14 | |
| 6542 | | ----- | | ----- | |
| 6549 | EN60156 | 53 | | 1.16 | |
| 6556 | IEC60156 | 48.22 | | 0.76 | |

|  |  |
|--|--|
| normality | OK |
| n | 85 |
| outliers | 0 |
| mean (n) | 39.295 |
| st.dev. (n) | 11.3043 |
| R(calc.) | 31.652 |
| st.dev.(IEC60156:18) | 11.7885 |
| R(IEC60156:18) | 33.008 |





Kernel Density
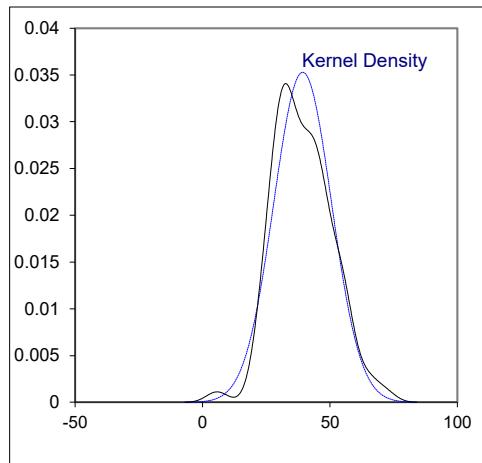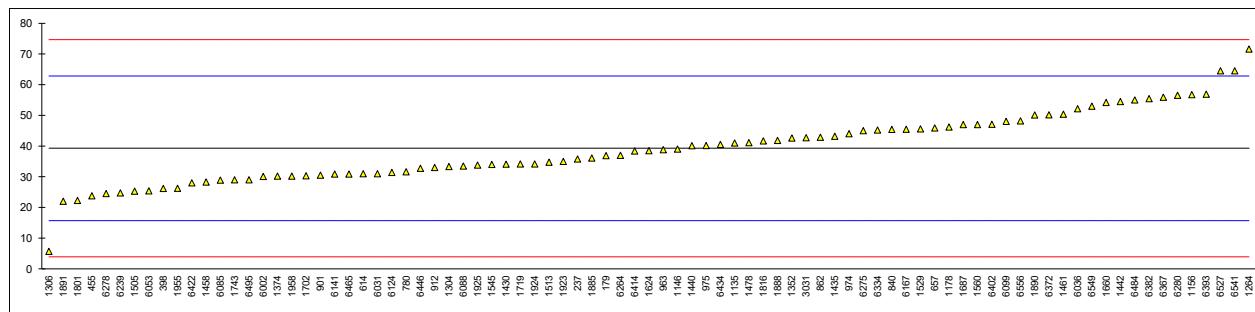
Determination of Density at 20 °C on sample #23241; results in kg/m$^3$

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 179 | D4052 | 865.2 | C | -0.06 | first reported 0.8652 kg/m$^3$ |
| 237 | D4052 | 868.7 | R(0.01) | 19.54 | |
| 325 | D4052 | 865.3 | C | 0.50 | first reported 0.8653 kg/m$^3$ |
| 331 | | ----- | | ----- | |
| 398 | ISO12185 | 865.2 | | -0.06 | |
| 445 | | ----- | | ----- | |
| 455 | ISO3675 | 865.19 | | -0.12 | |
| 511 | D4052 | 865.2 | | -0.06 | |
| 614 | D4052 | 865.4 | | 1.06 | |
| 657 | D4052 | 865.2 | | -0.06 | |
| 780 | ISO12185 | 865.2 | | -0.06 | |
| 840 | ISO12185 | 865.18 | | -0.17 | |
| 862 | D4052 | 865.2 | | -0.06 | |
| 901 | | ----- | | ----- | |
| 912 | ISO12185 | 865.3 | C | 0.50 | reported 0.8653 kg/m$^3$ |
| 963 | D4052 | 875.2 | R(0.01) | 55.94 | |
| 974 | D4052 | 865.2 | | -0.06 | |
| 975 | D4052 | 865.2 | | -0.06 | |
| 1135 | ISO12185 | 865.2 | | -0.06 | |
| 1146 | D4052 | 865.2 | | -0.06 | |
| 1156 | | ----- | | ----- | |
| 1178 | ISO12185 | 865.6 | | 2.18 | |
| 1264 | D7042 | 865.28 | | 0.39 | |
| 1304 | | ----- | | ----- | |
| 1306 | | ----- | | ----- | |
| 1352 | D7042 | 865.3 | | 0.50 | |
| 1374 | D4052 | 864.8 | | -2.30 | |
| 1430 | D4052 | 865.7 | C | 2.74 | first reported 0.8657 kg/m$^3$ |
| 1435 | D4052 | 865.3 | | 0.50 | |
| 1439 | | ----- | | ----- | |
| 1440 | ISO3675 | 854 | R(0.01) | -62.78 | |
| 1442 | D7042 | 864.90 | | -1.74 | |
| 1458 | D4052 | 865.2 | | -0.06 | |
| 1461 | ISO3675 | 865.5 | | 1.62 | |
| 1478 | ISO12185 | 865.3 | | 0.50 | |
| 1505 | D7042 | 851.3 | C,R(0.01) | -77.90 | first reported 866.58 |
| 1513 | ISO12185 | 865.345 | | 0.75 | |
| 1529 | In house | 865 | | -1.18 | |
| 1545 | ISO3675 | 864.9 | | -1.74 | |
| 1554 | ISO12185 | 865.18 | | -0.17 | |
| 1560 | | ----- | | ----- | |
| 1624 | | ----- | | ----- | |
| 1660 | D7042 | 864.9 | C | -1.74 | first reported 0.8649 kg/m$^3$ |
| 1687 | ISO12185 | 865.17 | | -0.23 | |
| 1702 | ISO12185 | 863.89 | C,R(0.01) | -7.40 | first reported 864.3 |
| 1719 | | ----- | | ----- | |
| 1743 | | ----- | | ----- | |
| 1801 | ISO3675 | 866.0 | C | 4.42 | reported 0.866 kg/m$^3$ |
| 1816 | | ----- | | ----- | |
| 1885 | | ----- | | ----- | |
| 1888 | | ----- | | ----- | |
| 1890 | ISO12185 | 865.1 | | -0.62 | |
| 1891 | | ----- | | ----- | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | D7042 | 865.3 | | 0.50 | |
| 1958 | D4052 | 869.4 | C,R(0.01) | 23.46 | reported 0.8694 kg/m$^3$ |
| 3031 | ISO12185 | 861.11 | C,R(0.01) | -22.97 | first reported 874.3 |
| 6002 | ISO12185 | 864.9 | | -1.74 | |
| 6015 | ISO12185 | 865.2 | | -0.06 | |
| 6031 | D1298 | 864.8 | | -2.30 | |
| 6036 | | 865.7 | | 2.74 | |
| 6053 | | ----- | | ----- | |
| 6085 | D7042 | 865.10 | | -0.62 | |
| 6088 | ISO3675 | 863.33 | C,R(0.01) | -10.53 | first reported 862.33 |
| 6099 | ISO12185 | 864.8 | | -2.30 | |
| 6124 | D7042 | 865.1 | C | -0.62 | first reported 0.8651 kg/m$^3$ |
| 6141 | D4052 | 863 | R(0.01) | -12.38 | |
| 6167 | | ----- | | ----- | |
| 6239 | D4052 | 865.2 | C | -0.06 | first reported 0.8652 kg/m$^3$ |
| 6264 | D7042 | 851.8 | R(0.01) | -75.10 | |
| 6275 | D1298 | 867.4 | R(0.01) | 12.26 | |
| 6278 | D1298 | 865.30 | | 0.50 | |
| 6280 | ISO12185 | 850 | R(0.01) | -85.18 | |

| lab | method | value | mark | z(targ) | remarks |
|-----:|--------|-------|------|--------:|---------|
| 6334 | | ----- | | ----- | |
| 6367 | ISO3675 | 865 | | -1.18 | |
| 6372 | ISO3675 | 864.1 | | -6.22 | |
| 6382 | DIN51757 | 865.16 | | -0.29 | |
| 6393 | ISO12185 | 865.3 | | 0.50 | |
| 6402 | | ----- | | ----- | |
| 6414 | | 866 | | 4.42 | |
| 6422 | | ----- | | ----- | |
| 6434 | ISO12185 | 865.1 | | -0.62 | |
| 6446 | ISO12185 | 865.2 | | -0.06 | |
| 6465 | ISO3675 | 865.5 | | 1.62 | |
| 6484 | ISO12185 | 864.9 | | -1.74 | |
| 6495 | ISO3675 | 865.7 | | 2.74 | |
| 6501 | | ----- | | ----- | |
| 6527 | | ----- | | ----- | |
| 6541 | | ----- | | ----- | |
| 6542 | | ----- | | ----- | |
| 6549 | | ----- | | ----- | |
| 6556 | ISO3675 | 832 | C,R(0.01) | -185.98 | first reported 0.832 kg/m$^3$ |

|  |  |  | ISO12185/D4052 only | ISO3675/D1298 only |
|--|--|--|--|--|
| | normality | not OK | not OK | OK |
| | n | 53 | 32 | 10 |
| | outliers | 13 | 7 | 4 |
| | mean (n) | 865.211 | 865.202 | 865.199 |
| | st.dev. (n) | 0.3030 | 0.1834 | 0.5354 |
| | R(calc.) | 0.848 | 0.513 | 1.499 |
| | st.dev.(ISO12185:96) | 0.1786 | 0.1786 | --- |
| | R(ISO12185:96) | 0.5 | 0.5 | --- |
| Compare: | | | | |
| | R(D4052:22) | 0.50 | 0.50 | --- |
| | R(ISO3675:98) | 1.2 | --- | 1.2 |
| | R(D1298:12bR17e1) | 1.2 | --- | 1.2 |
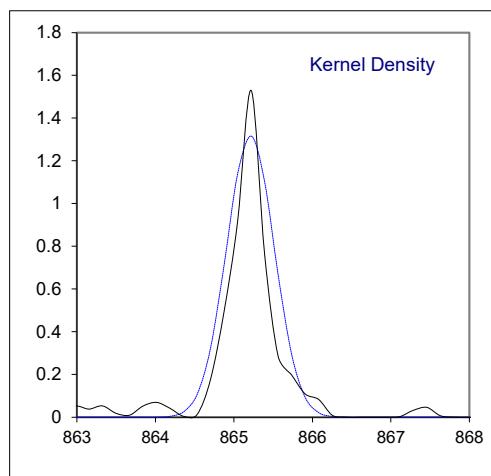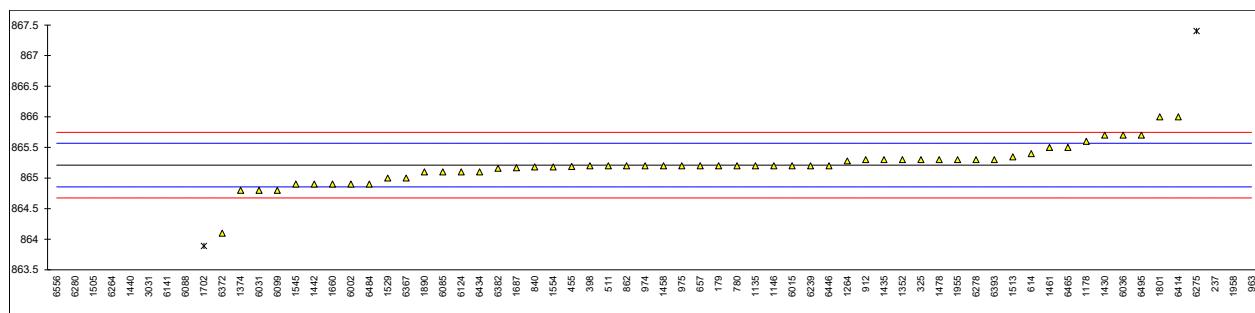
## Determination of Di-electric Dissipation Factor (DDF) at 90 °C on sample #23241

| lab | method | value | mark | z(targ) | frequency (Hz) | remarks |
|-----|--------|-------|------|---------|----------------|---------|
| 179 | | ----- | | ----- | ----- | |
| 237 | IEC60247 | 0.040863 | | 0.95 | 50 | |
| 325 | | ----- | | ----- | ----- | |
| 331 | | ----- | | ----- | ----- | |
| 398 | IEC60247 | 0.027526 | | -0.04 | 60 | |
| 445 | | ----- | | ----- | ----- | |
| 455 | | ----- | | ----- | ----- | |
| 511 | D924 | 0.0326 | | 0.33 | ----- | |
| 614 | | ----- | | ----- | ----- | |
| 657 | IEC60247 | 0.031350 | | 0.24 | 50 | |
| 780 | GOST6581 | 0.0103 | | -1.32 | 50 | |
| 840 | | ----- | | ----- | ----- | |
| 862 | IEC60247 | 0.0335 | | 0.40 | 50 | |
| 901 | IEC60247 | 0.0285 | | 0.03 | ----- | |
| 912 | EN60247 | 0.0217 | | -0.47 | ----- | |
| 963 | IEC60247 | 0.0080 | | -1.49 | 60 | |
| 974 | IEC60247 | 0.020 | | -0.60 | 50 | |
| 975 | EN60247 | 0.020993 | | -0.53 | ----- | |
| 1135 | IEC60247 | 0.0419 | | 1.02 | 50 | |
| 1146 | | ----- | | ----- | ----- | |
| 1156 | | ----- | | ----- | ----- | |
| 1178 | IEC60247 | 0.02282 | | -0.39 | ----- | |
| 1264 | IEC60247 | 0.02563 | | -0.18 | 60 | |
| 1304 | IEC60247 | 0.040846 | | 0.94 | 50 | |
| 1306 | IEC60247 | 0.035785 | | 0.57 | ----- | |
| 1352 | IEC60247 | 0.02102 | | -0.52 | 50 | |
| 1374 | IEC60247 | 0.038 | | 0.73 | ----- | |
| 1430 | EN60247 | 0.012228 | | -1.17 | 50 | |
| 1435 | IEC60247 | 0.0349820 | | 0.51 | ----- | |
| 1439 | | ----- | | ----- | ----- | |
| 1440 | | ----- | | ----- | ----- | |
| 1442 | IEC60247 | 0.02951 | | 0.11 | 55 | |
| 1458 | IEC60247 | 0.041648 | | 1.00 | 50 | |
| 1461 | IEC60247 | 0.030601 | | 0.19 | ----- | |
| 1478 | IEC60247 | 0.030983 | | 0.21 | ----- | |
| 1505 | IEC60247 | 0.020925 | | -0.53 | ----- | |
| 1513 | IEC60247 | 0.036808 | | 0.65 | ----- | |
| 1529 | IEC60247 | 0.03718 | C | 0.67 | ----- | first reported 0.3718 |
| 1545 | | ----- | | ----- | ----- | |
| 1554 | | ----- | | ----- | ----- | |
| 1560 | IEC60247 | 0.03656 | | 0.63 | 50 | |
| 1624 | IEC60247 | 0.036414 | | 0.62 | 50 | |
| 1660 | IEC60247 | 0.019624 | | -0.63 | 60 | |
| 1687 | IEC60247 | 0.031724 | | 0.27 | 50 | |
| 1702 | IEC60247 | 0.02443 | | -0.27 | ----- | |
| 1719 | IEC60247 | 0.0338 | | 0.42 | ----- | |
| 1743 | IEC60247 | 0.0375 | | 0.70 | ----- | |
| 1801 | EN60247 | 0.02467 | | -0.25 | ----- | |
| 1816 | EN60247 | 0.014 | | -1.04 | ----- | |
| 1885 | IEC60247 | 0.03006 | | 0.15 | 60 | |
| 1888 | IEC60247 | 0.035790 | | 0.57 | 50 | |
| 1890 | IEC60247 | 0.036361 | | 0.61 | 50Hz | |
| 1891 | IEC60247 | 0.0364 | | 0.62 | ----- | |
| 1923 | EN60247 | 0.02625 | | -0.14 | ----- | |
| 1924 | EN60247 | 0.03132 | | 0.24 | ----- | |
| 1925 | EN60247 | 0.030605 | | 0.19 | ----- | |
| 1955 | IEC60247 | 0.03566 | | 0.56 | ----- | |
| 1958 | IEC60247 | 0.026524 | | -0.12 | 60 | |
| 3031 | IEC60247 | 0.043231 | | 1.12 | 50 | |
| 6002 | EN60247 | 0.0184 | | -0.72 | 90 | |
| 6015 | EN60247 | 0.0359495 | | 0.58 | 50 | |
| 6031 | IEC60247 | 0.019594 | | -0.63 | 50.0 | |
| 6036 | EN60247 | 0.009224 | | -1.40 | 50 | |
| 6053 | | ----- | | ----- | ----- | |
| 6085 | IEC60247 | 0.029725 | | 0.12 | 55 | |
| 6088 | IEC60247 | 0.0234 | | -0.35 | 50 | |
| 6099 | IEC60247 | 0.013146 | | -1.11 | ----- | |
| 6124 | IEC60247 | 0.039500 | | 0.85 | 50 | |
| 6141 | IEC60247 | 0.027437 | | -0.05 | 60 | |
| 6167 | | ----- | | ----- | ----- | |
| 6239 | IEC60247 | 0.039231 | | 0.83 | ----- | |
| 6264 | IEC60247 | 0.018857 | | -0.68 | 55 | |
| 6275 | IEC60247 | 0.0291 | | 0.07 | ----- | |
| 6278 | IEC60247 | 0.023955 | | -0.31 | ----- | |
| 6280 | IEC60247 | 0.040878 | | 0.95 | ----- | |

| lab | method | value | mark | z(targ) | frequency (Hz) | remarks |
|-----|--------|-------|------|---------|----------------|---------|
| 6334 | IEC60247 | 0.0243035 | | -0.28 | 50 | |
| 6367 | IEC60247 | 0.0237 | | -0.33 | 50 | |
| 6372 | IEC60247 | 0.02640 | | -0.13 | 50 | |
| 6382 | IEC60247 | 0.03417 | | 0.45 | ----- | |
| 6393 | | ----- | | ----- | ----- | |
| 6402 | | ----- | | ----- | ----- | |
| 6414 | IEC60247 | 0.02181 | | -0.47 | 50 | |
| 6422 | | ----- | | ----- | ----- | |
| 6434 | IEC60247 | 0.01294 | | -1.12 | ----- | |
| 6446 | IEC60247 | 0.03157 | | 0.26 | ----- | |
| 6465 | IEC61620 | 0.0115700 | | -1.22 | 50 | |
| 6484 | EN60247 | 0.01261 | | -1.15 | 50 | |
| 6495 | EN60247 | 0.01185 | | -1.20 | ----- | |
| 6501 | | ----- | | ----- | ----- | |
| 6527 | IEC60247 | 0.0342 | | 0.45 | ----- | |
| 6541 | IEC60247 | 0.05 | | 1.62 | ----- | |
| 6542 | | ----- | | ----- | ----- | |
| 6549 | EN60247 | 0.0341 | | 0.45 | ----- | |
| 6556 | IEC60247 | 0.013952 | | -1.05 | ----- | |

|  |  |
|---|---|
| normality | OK |
| n | 74 |
| outliers | 0 |
| mean (n) | 0.028090 |
| st.dev. (n) | 0.0095966 |
| R(calc.) | 0.026870 |
| st.dev.(EN60247:04) | 0.0135000 |
| R(EN60247:04) | 0.037800 |

Determination of Specific Resistance at 90 °C on sample #23241; results in GΩm

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 179 | | ----- | | ----- | |
| 237 | IEC60247 | 7.98 | | -1.25 | |
| 325 | | ----- | | ----- | |
| 331 | | ----- | | ----- | |
| 398 | IEC60247 | 15.16 | | 0.02 | |
| 445 | | ----- | | ----- | |
| 455 | | ----- | | ----- | |
| 511 | | ----- | | ----- | |
| 614 | | ----- | | ----- | |
| 657 | IEC60247 | 11.22 | | -0.68 | |
| 780 | | ----- | | ----- | |
| 840 | | ----- | | ----- | |
| 862 | | ----- | | ----- | |
| 901 | | ----- | | ----- | |
| 912 | EN60247 | 11.3 | | -0.67 | |
| 963 | D1169 | 24.3 | | 1.64 | |
| 974 | | ----- | | ----- | |
| 975 | EN60247 | 25.41 | | 1.83 | |
| 1135 | IEC60247 | 8.8 | | -1.11 | |
| 1146 | | ----- | | ----- | |
| 1156 | | ----- | | ----- | |
| 1178 | IEC60247 | 28.6 | | 2.40 | |
| 1264 | IEC60247 | 19.53 | | 0.79 | |
| 1304 | IEC60247 | 12.67 | | -0.42 | |
| 1306 | IEC60247 | 11.51 | | -0.63 | |
| 1352 | IEC60247 | 17.54 | | 0.44 | |
| 1374 | IEC60247 | 8.70 | | -1.13 | |
| 1430 | | ----- | | ----- | |
| 1435 | IEC60247 | 10.88 | | -0.74 | |
| 1439 | | ----- | | ----- | |
| 1440 | | ----- | | ----- | |
| 1442 | IEC60247 | 14.94 | | -0.02 | |
| 1458 | IEC60247 | 14.31 | | -0.13 | |
| 1461 | | ----- | | ----- | |
| 1478 | IEC60247 | 14.81 | | -0.04 | |
| 1505 | IEC60247 | 13.5099 | | -0.27 | |
| 1513 | | ----- | | ----- | |
| 1529 | IEC60247 | 10.5 | | -0.81 | |
| 1545 | | ----- | | ----- | |
| 1554 | | ----- | | ----- | |
| 1560 | IEC60247 | 10.52 | | -0.80 | |
| 1624 | IEC60247 | 10.16 | | -0.87 | |
| 1660 | IEC60247 | 30.26 | | 2.69 | |
| 1687 | IEC60247 | 16.73 | | 0.30 | |
| 1702 | IEC60247 | 10.07 | | -0.88 | |
| 1719 | IEC60247 | 16.2 | | 0.20 | |
| 1743 | IEC60247 | 8.25 | | -1.21 | |
| 1801 | | ----- | | ----- | |
| 1816 | | ----- | | ----- | |
| 1885 | IEC60247 | 17.25 | | 0.39 | |
| 1888 | IEC60247 | 24.86 | | 1.74 | |
| 1890 | IEC60247 | 11.78 | | -0.58 | |
| 1891 | IEC60247 | 9.57 | | -0.97 | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | IEC60247 | 10.5225 | | -0.80 | |
| 1958 | IEC60247 | 10.84 | | -0.75 | |
| 3031 | IEC60247 | 8.505 | | -1.16 | |
| 6002 | EN60247 | 17.3 | | 0.40 | |
| 6015 | EN60247 | 10.550 | | -0.80 | |
| 6031 | IEC60247 | 19.09 | | 0.71 | |
| 6036 | | ----- | | ----- | |
| 6053 | | ----- | | ----- | |
| 6085 | | ----- | | ----- | |
| 6088 | IEC60247 | 20 | | 0.88 | |
| 6099 | IEC60247 | 23.78 | | 1.54 | |
| 6124 | IEC60247 | 9.19 | C | -1.04 | first reported 0.00919 |
| 6141 | IEC60247 | 12.05 | | -0.53 | |
| 6167 | | ----- | | ----- | |
| 6239 | IEC60247 | 13.965 | | -0.19 | |
| 6264 | IEC60247 | 22.43 | | 1.31 | |
| 6275 | IEC60247 | 13 | | -0.36 | |
| 6278 | IEC60247 | 9.5975 | | -0.97 | |
| 6280 | IEC60247 | 9.69 | | -0.95 | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | IEC60247 | 14.33 | | -0.13 | |
| 6367 | | ----- | | ----- | |
| 6372 | IEC60247 | 11.2 | | -0.68 | |
| 6382 | | ----- | | ----- | |
| 6393 | | ----- | | ----- | |
| 6402 | | ----- | | ----- | |
| 6414 | IEC60247 | 19.8 | | 0.84 | |
| 6422 | | ----- | | ----- | |
| 6434 | IEC60247 | 22 | | 1.23 | |
| 6446 | IEC60247 | 11.84 | | -0.57 | |
| 6465 | | ----- | | ----- | |
| 6484 | EN60247 | 20.6 | | 0.98 | |
| 6495 | EN60247 | 25.55 | | 1.86 | |
| 6501 | | ----- | | ----- | |
| 6527 | IEC60247 | 10.14 | | -0.87 | |
| 6541 | | ----- | | ----- | |
| 6542 | | ----- | | ----- | |
| 6549 | | ----- | | ----- | |
| 6556 | IEC60247 | 19.865 | | 0.85 | |

|  |  |
|--|--|
| normality | OK |
| n | 54 |
| outliers | 0 |
| mean (n) | 15.058 |
| st.dev. (n) | 5.7998 |
| R(calc.) | 16.240 |
| st.dev.(EN60247:04) | 5.6469 |
| R(EN60247:04) | 15.811 |
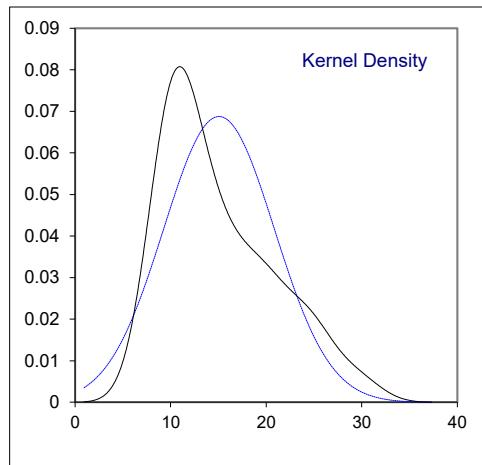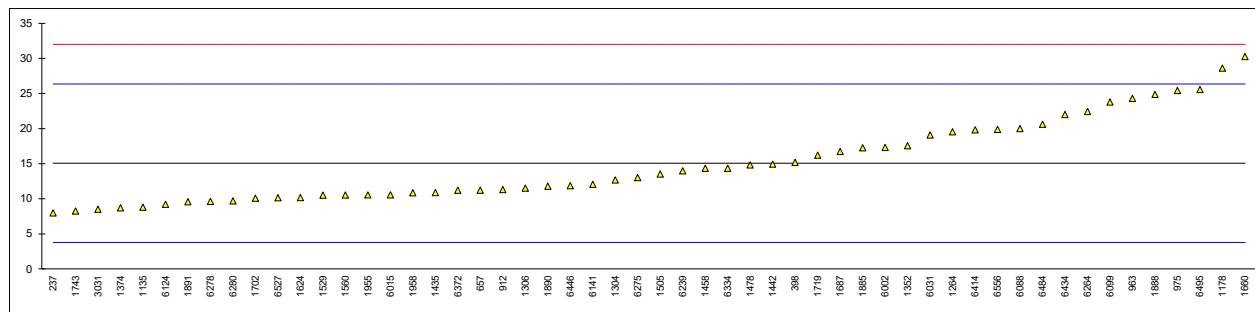
Determination of Flash Point C.O.C. on sample #23241; results in °C

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 179 | | ----- | | ----- | |
| 237 | D92 | 156 | | -0.10 | |
| 325 | D92 | 154 | | -0.41 | |
| 331 | D92 | 160 | | 0.52 | |
| 398 | D92 | 150 | | -1.03 | |
| 445 | | ----- | | ----- | |
| 455 | | ----- | | ----- | |
| 511 | | ----- | | ----- | |
| 614 | | ----- | | ----- | |
| 657 | D92 | 156 | | -0.10 | |
| 780 | D92 | 154 | | -0.41 | |
| 840 | D92 | 152 | | -0.72 | |
| 862 | | ----- | | ----- | |
| 901 | | ----- | | ----- | |
| 912 | | ----- | | ----- | |
| 963 | D92 | 158 | | 0.21 | |
| 974 | D92 | 154 | | -0.41 | |
| 975 | D92 | 156.0 | | -0.10 | |
| 1135 | D92 | 152.0 | | -0.72 | |
| 1146 | | ----- | | ----- | |
| 1156 | | ----- | | ----- | |
| 1178 | ISO2592 | 162.0 | | 0.83 | |
| 1264 | D92 | 152 | | -0.72 | |
| 1304 | | ----- | | ----- | |
| 1306 | D92 | 150.5 | | -0.96 | |
| 1352 | | ----- | | ----- | |
| 1374 | | ----- | | ----- | |
| 1430 | D92 | 158 | | 0.21 | |
| 1435 | D92 | 152.0 | | -0.72 | |
| 1439 | | ----- | | ----- | |
| 1440 | | ----- | | ----- | |
| 1442 | ISO2592 | 161.0 | | 0.68 | |
| 1458 | | ----- | | ----- | |
| 1461 | ISO2592 | 156 | | -0.10 | |
| 1478 | | ----- | | ----- | |
| 1505 | | ----- | | ----- | |
| 1513 | | ----- | | ----- | |
| 1529 | | ----- | | ----- | |
| 1545 | | ----- | | ----- | |
| 1554 | ISO2592 | 162 | | 0.83 | |
| 1560 | | ----- | | ----- | |
| 1624 | | ----- | | ----- | |
| 1660 | D92 | 156 | | -0.10 | |
| 1687 | | ----- | | ----- | |
| 1702 | | ----- | | ----- | |
| 1719 | | ----- | | ----- | |
| 1743 | ISO2592 | 164 | | 1.14 | |
| 1801 | | ----- | | ----- | |
| 1816 | | ----- | | ----- | |
| 1885 | | ----- | | ----- | |
| 1888 | | ----- | | ----- | |
| 1890 | | ----- | | ----- | |
| 1891 | | ----- | | ----- | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | | ----- | | ----- | |
| 1958 | D92 | 168 | | 1.77 | |
| 3031 | | ----- | | ----- | |
| 6002 | ISO2592 | 164.3 | | 1.19 | |
| 6015 | ISO2592 | 159.0 | | 0.37 | |
| 6031 | D92 | 156 | | -0.10 | |
| 6036 | | ----- | | ----- | |
| 6053 | | ----- | | ----- | |
| 6085 | | ----- | | ----- | |
| 6088 | | ----- | | ----- | |
| 6099 | | ----- | | ----- | |
| 6124 | | ----- | | ----- | |
| 6141 | D92 | 174 | R(0.05) | 2.70 | |
| 6167 | | ----- | | ----- | |
| 6239 | | ----- | | ----- | |
| 6264 | | ----- | | ----- | |
| 6275 | | ----- | | ----- | |
| 6278 | | ----- | | ----- | |
| 6280 | | ----- | | ----- | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | | ----- | | ----- | |
| 6367 | | ----- | | ----- | |
| 6372 | | ----- | | ----- | |
| 6382 | | ----- | | ----- | |
| 6393 | | ----- | | ----- | |
| 6402 | | ----- | | ----- | |
| 6414 | | ----- | | ----- | |
| 6422 | | ----- | | ----- | |
| 6434 | | ----- | | ----- | |
| 6446 | ISO2592 | 150 | | -1.03 | |
| 6465 | | ----- | | ----- | |
| 6484 | | ----- | | ----- | |
| 6495 | | ----- | | ----- | |
| 6501 | | ----- | | ----- | |
| 6527 | | ----- | | ----- | |
| 6541 | | ----- | | ----- | |
| 6542 | | ----- | | ----- | |
| 6549 | | ----- | | ----- | |
| 6556 | | ----- | | ----- | |

|  |  |  |
|--|--|--|
| | normality | OK |
| | n | 26 |
| | outliers | 1 |
| | mean (n) | 156.65 |
| | st.dev. (n) | 4.793 |
| | R(calc.) | 13.42 |
| | st.dev.(D92:18) | 6.429 |
| | R(D92:18) | 18 |
| Compare: | | |
| | R(ISO2592:17) | 18 |
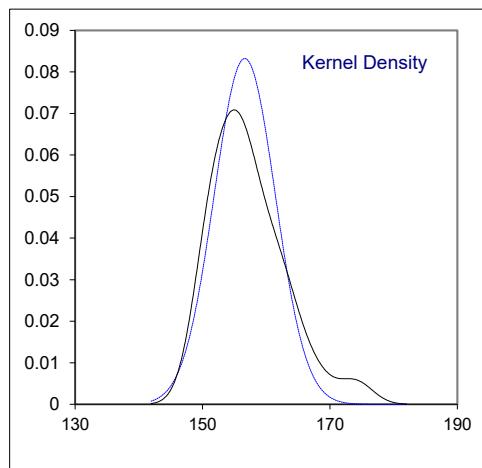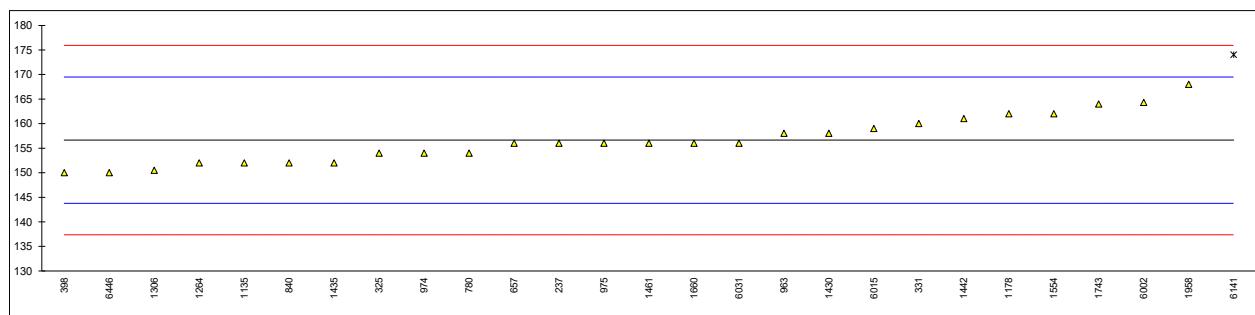
Determination of Flash Point PMcc on sample #23241; results in °C

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 179 | D93-A | 151 | | 0.96 | |
| 237 | D93-B | 148.0 | | 0.16 | |
| 325 | D93-A | 147.0 | | -0.11 | |
| 331 | D93-A | 149.6 | | 0.59 | |
| 398 | D93-A | 148 | | 0.16 | |
| 445 | | ----- | | ----- | |
| 455 | | ----- | | ----- | |
| 511 | | ----- | | ----- | |
| 614 | | ----- | | ----- | |
| 657 | D93-A | 150 | | 0.69 | |
| 780 | ISO2719-A | 144.5 | | -0.78 | |
| 840 | D3828 | 148.0 | | 0.16 | |
| 862 | | ----- | | ----- | |
| 901 | | ----- | | ----- | |
| 912 | ISO2719 | 146 | | -0.38 | |
| 963 | | ----- | | ----- | |
| 974 | D93-A | 148 | | 0.16 | |
| 975 | D93-A | 148.0 | | 0.16 | |
| 1135 | D93-A | 145.5 | | -0.51 | |
| 1146 | D93-A | 148.8 | | 0.37 | |
| 1156 | | ----- | | ----- | |
| 1178 | ISO2719-A | 156.4 | | 2.40 | |
| 1264 | D93-A | 146 | | -0.38 | |
| 1304 | In house | 146.2 | | -0.32 | |
| 1306 | | ----- | | ----- | |
| 1352 | | ----- | | ----- | |
| 1374 | D93-A | 144.9 | | -0.67 | |
| 1430 | D93-A | 145 | | -0.65 | |
| 1435 | D93-A | 147.0 | | -0.11 | |
| 1439 | | ----- | | ----- | |
| 1440 | | ----- | | ----- | |
| 1442 | ISO2719-A | 147.0 | | -0.11 | |
| 1458 | | ----- | | ----- | |
| 1461 | ISO2719-A | 145 | | -0.65 | |
| 1478 | ISO2719-A | 148.0 | | 0.16 | |
| 1505 | D3828 | 148.3 | | 0.24 | |
| 1513 | ISO2719-A | 148.0 | | 0.16 | |
| 1529 | | ----- | | ----- | |
| 1545 | ISO2719-A | 140 | | -1.98 | |
| 1554 | | ----- | | ----- | |
| 1560 | ISO2719-A | 150 | | 0.69 | |
| 1624 | | ----- | | ----- | |
| 1660 | D93-A | 148 | | 0.16 | |
| 1687 | | ----- | | ----- | |
| 1702 | ISO2719-A | 150.0 | | 0.69 | |
| 1719 | | ----- | | ----- | |
| 1743 | ISO2719-A | 141 | | -1.72 | |
| 1801 | | ----- | | ----- | |
| 1816 | | ----- | | ----- | |
| 1885 | | ----- | | ----- | |
| 1888 | D93-B | 146 | | -0.38 | |
| 1890 | | ----- | | ----- | |
| 1891 | | ----- | | ----- | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | | ----- | | ----- | |
| 1958 | D93-A | 144 | | -0.91 | |
| 3031 | | ----- | | ----- | |
| 6002 | ISO2719-A | 149.5 | | 0.56 | |
| 6015 | ISO2719-A | 150.0 | | 0.69 | |
| 6031 | D93-A | 148 | | 0.16 | |
| 6036 | | ----- | | ----- | |
| 6053 | | ----- | | ----- | |
| 6085 | | ----- | | ----- | |
| 6088 | | ----- | | ----- | |
| 6099 | | ----- | | ----- | |
| 6124 | | ----- | | ----- | |
| 6141 | | ----- | | ----- | |
| 6167 | | ----- | | ----- | |
| 6239 | D93-A | 148 | | 0.16 | |
| 6264 | D93-A | 148.5 | | 0.29 | |
| 6275 | D93-A | 148.0 | | 0.16 | |
| 6278 | | ----- | | ----- | |
| 6280 | | ----- | | ----- | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | | ----- | | ----- | |
| 6367 | | ----- | | ----- | |
| 6372 | | ----- | | ----- | |
| 6382 | ISO2719-A | 144 | | -0.91 | |
| 6393 | ISO2719-A | 145 | | -0.65 | |
| 6402 | | ----- | | ----- | |
| 6414 | D93-A | 155.0 | | 2.03 | |
| 6422 | | ----- | | ----- | |
| 6434 | | ----- | | ----- | |
| 6446 | ISO2719-A | 149 | | 0.42 | |
| 6465 | | ----- | | ----- | |
| 6484 | ISO2719-A | 145 | | -0.65 | |
| 6495 | ISO2719-A | 145.5 | | -0.51 | |
| 6501 | | ----- | | ----- | |
| 6527 | | ----- | | ----- | |
| 6541 | D93-A | 141.30 | | -1.64 | |
| 6542 | | ----- | | ----- | |
| 6549 | | ----- | | ----- | |
| 6556 | ISO2719-A | 153.58 | | 1.65 | |

|  |  |
|--|--|
| normality | suspect |
| n | 45 |
| outliers | 0 |
| mean (n) | 147.41 |
| st.dev. (n) | 3.182 |
| R(calc.) | 8.91 |
| st.dev.(ISO2719-A:16) | 3.738 |
| R(ISO2719-A:16) | 10.47 |

Compare:

|  |  |
|--|--|
| R(D93-A:20) | 10.47 |
| R(D93-B:20) | 10 |
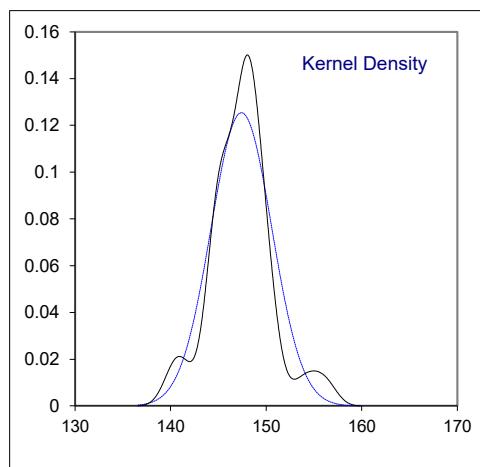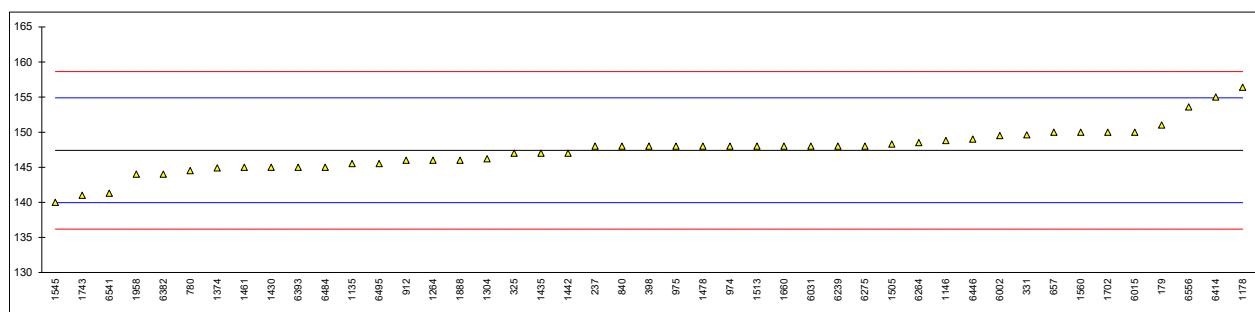
Determination of Interfacial Surface Tension on sample #23241; results in mN/m

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 179 | D971 | 28.0 | | 1.88 | |
| 237 | | ----- | | ----- | |
| 325 | | ----- | | ----- | |
| 331 | | ----- | | ----- | |
| 398 | | ----- | | ----- | |
| 445 | | ----- | | ----- | |
| 455 | | ----- | | ----- | |
| 511 | D971 | 26.54 | | 0.32 | |
| 614 | D971 | 27.1 | | 0.92 | |
| 657 | D971 | 25.36 | | -0.94 | |
| 780 | | ----- | | ----- | |
| 840 | | ----- | | ----- | |
| 862 | D971 | 27 | | 0.81 | |
| 901 | D971 | 27.9 | | 1.77 | |
| 912 | D971 | 20 | | -6.66 | |
| 963 | D971 | 28.3 | | 2.20 | |
| 974 | D971 | 27.0 | | 0.81 | |
| 975 | D971 | 26.8 | | 0.60 | |
| 1135 | D971 | 25.5 | | -0.79 | |
| 1146 | | ----- | | ----- | |
| 1156 | D971 | 26.4 | | 0.17 | |
| 1178 | D971 | 27.7 | | 1.56 | |
| 1264 | D971 | 24.58 | | -1.77 | |
| 1304 | In house | 27.97 | | 1.85 | |
| 1306 | D971 | 22.66 | | -3.82 | |
| 1352 | D971 | 27.7 | | 1.56 | |
| 1374 | D971 | 26.58 | | 0.37 | |
| 1430 | D971 | 23.5 | | -2.92 | |
| 1435 | D971 | 28.5 | | 2.41 | |
| 1439 | | ----- | | ----- | |
| 1440 | D971 | 27.15 | | 0.97 | |
| 1442 | IEC62961 | 27.13 | | 0.95 | |
| 1458 | D971 | 26.8 | | 0.60 | |
| 1461 | | ----- | | ----- | |
| 1478 | D971 | 26.10 | | -0.15 | |
| 1505 | D971 | 27.8 | | 1.67 | |
| 1513 | D971 | 27.10 | | 0.92 | |
| 1529 | | 27.5 | | 1.35 | |
| 1545 | D971 | 30.44 | | 4.48 | |
| 1554 | | ----- | | ----- | |
| 1560 | D971 | 28.5 | | 2.41 | |
| 1624 | | ----- | | ----- | |
| 1660 | D971 | 25.5 | | -0.79 | |
| 1687 | D971 | 21.35 | C | -5.22 | first reported 16.17 |
| 1702 | D971 | 28.58 | | 2.50 | |
| 1719 | D971 | 26.58 | | 0.37 | |
| 1743 | IEC62961 | 23.6 | | -2.82 | |
| 1801 | D971 | 27.64 | | 1.50 | |
| 1816 | EN14210 | 22.2 | | -4.31 | |
| 1885 | D971 | 29.1 | | 3.05 | |
| 1888 | | ----- | | ----- | |
| 1890 | | ----- | | ----- | |
| 1891 | D971 | 27.3 | | 1.13 | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | | ----- | | ----- | |
| 1958 | | ----- | | ----- | |
| 3031 | D971 | 24.455 | | -1.90 | |
| 6002 | IEC62961 | 25.6 | | -0.68 | |
| 6015 | D971 | 26.610 | | 0.40 | |
| 6031 | D971 | 25.7 | | -0.57 | |
| 6036 | IEC62961 | 25.0664 | | -1.25 | |
| 6053 | | ----- | | ----- | |
| 6085 | D971 | 25.653 | | -0.62 | |
| 6088 | ISO6295 | 31.5 | | 5.62 | |
| 6099 | ISO6295 | 24.8 | | -1.53 | |
| 6124 | D971 | 26.95 | | 0.76 | |
| 6141 | D971 | 23.4 | | -3.03 | |
| 6167 | | ----- | | ----- | |
| 6239 | D971 | 26.85 | | 0.65 | |
| 6264 | D971 | 26.7 | | 0.49 | |
| 6275 | D971 | 26.9 | | 0.71 | |
| 6278 | D971 | 29.9 | C | 3.91 | first reported 32.2 |
| 6280 | D971 | 23.1 | | -3.35 | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | IEC62961 | 25.73 | | -0.54 | |
| 6367 | D971 | 29.6 | | 3.59 | |
| 6372 | IEC62961 | 30.2 | | 4.23 | |
| 6382 | ISO6295 | 26.68 | | 0.47 | |
| 6393 | D971 | 23.8 | | -2.60 | |
| 6402 | | ----- | | ----- | |
| 6414 | D971 | 26.79 | | 0.59 | |
| 6422 | | ----- | | ----- | |
| 6434 | IEC62961 | 24.65 | | -1.69 | |
| 6446 | D971 | 27.95 | | 1.83 | |
| 6465 | ISO6295 | 24.05 | | -2.33 | |
| 6484 | D971 | 23.2 | | -3.24 | |
| 6495 | D971 | 27.3 | | 1.13 | |
| 6501 | | ----- | | ----- | |
| 6527 | D971 | 23.6 | | -2.82 | |
| 6541 | D971 | 27.50 | | 1.35 | |
| 6542 | D971 | 23.60 | | -2.82 | |
| 6549 | | ----- | | ----- | |
| 6556 | EN14210 | 20.88 | | -5.72 | |

|  |  |  |
|--|--|--|
| normality | OK | |
| n | 68 | |
| outliers | 0 | |
| mean (n) | 26.238 | |
| st.dev. (n) | 2.2829 | |
| R(calc.) | 6.392 | |
| st.dev.(D971:20) | 0.9371 | |
| R(D971:20) | 2.624 | |
| Compare: | | |
| R(IEC62961:18) | 10 | |





Kernel Density
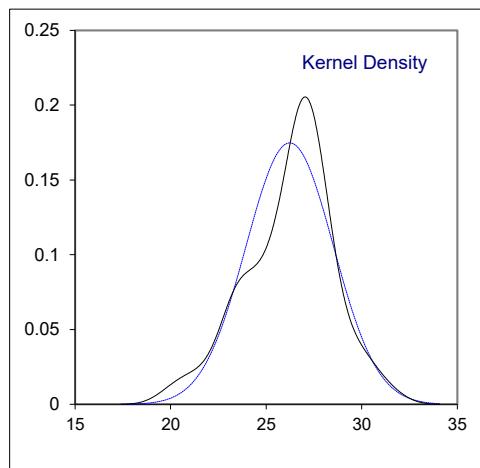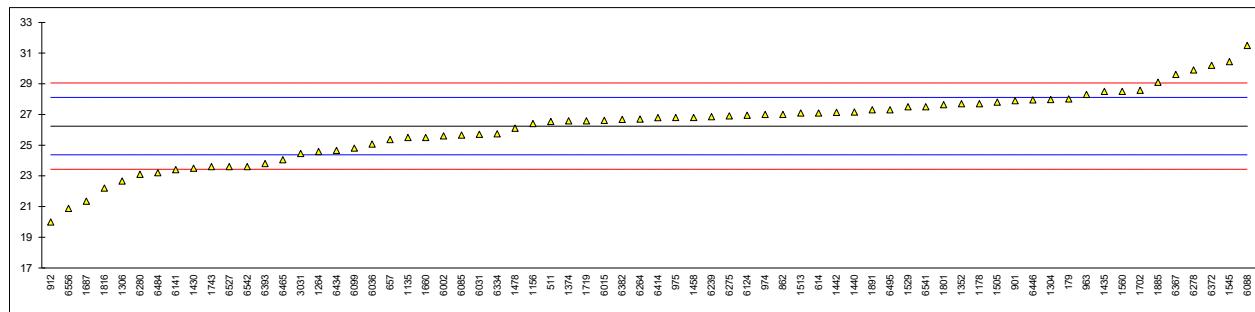
## Determination of Kinematic Viscosity at 40 °C on sample #23241; results in mm²/s

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 179 | D445 | 8.927 | G(0.01) | -10.07 | |
| 237 | D445 | 9.476 | | -1.12 | |
| 325 | D445 | 9.494 | | -0.83 | |
| 331 | | ----- | | ----- | |
| 398 | D445 | 9.5083 | C | -0.59 | first reported 9.8795 |
| 445 | | ----- | | ----- | |
| 455 | | ----- | | ----- | |
| 511 | | ----- | | ----- | |
| 614 | D7042 | 9.5003 | | -0.73 | |
| 657 | | ----- | | ----- | |
| 780 | D445 | 9.456 | | -1.45 | |
| 840 | D7042 | 9.5264 | | -0.30 | |
| 862 | D445 | 9.500 | | -0.73 | |
| 901 | | ----- | | ----- | |
| 912 | D445 | 9.247 | DG(0.05) | -4.85 | |
| 963 | D445 | 9.497 | | -0.78 | |
| 974 | D445 | 9.649 | | 1.70 | |
| 975 | D445 | 9.663 | | 1.93 | |
| 1135 | D445 | 9.512 | | -0.53 | |
| 1146 | D445 | 9.5065 | | -0.62 | |
| 1156 | | ----- | | ----- | |
| 1178 | D7042 | 9.4980 | | -0.76 | |
| 1264 | D7042 | 9.7425 | | 3.22 | |
| 1304 | | ----- | | ----- | |
| 1306 | D445 | 9.1636 | G(0.05) | -6.21 | |
| 1352 | D7042 | 9.5320 | | -0.21 | |
| 1374 | D445 | 9.493 | | -0.84 | |
| 1430 | D7279 corr. to D445 | 9.501 | | -0.71 | |
| 1435 | D7042 | 9.596 | | 0.83 | |
| 1439 | | ----- | | ----- | |
| 1440 | D445 | 9.56417 | | 0.32 | |
| 1442 | D7042 | 9.57 | | 0.41 | |
| 1458 | | ----- | | ----- | |
| 1461 | | 9.6628 | | 1.92 | |
| 1478 | D7042 | 9.5246 | | -0.33 | |
| 1505 | D7042 | 9.5581 | | 0.22 | |
| 1513 | ISO3104 | 9.4165 | | -2.09 | |
| 1529 | | ----- | | ----- | |
| 1545 | | ----- | | ----- | |
| 1554 | ISO3104 | 9.511 | | -0.55 | |
| 1560 | ISO3104 | 9.474 | | -1.15 | |
| 1624 | | ----- | | ----- | |
| 1660 | D7042 | 9.5296 | | -0.25 | |
| 1687 | | ----- | | ----- | |
| 1702 | D7042 | 9.4752 | | -1.13 | |
| 1719 | | ----- | | ----- | |
| 1743 | D445 | 9.575 | | 0.49 | |
| 1801 | D445 | 9.4448 | | -1.63 | |
| 1816 | | ----- | | ----- | |
| 1885 | | ----- | | ----- | |
| 1888 | D445 | 9.63 | | 1.39 | |
| 1890 | ISO3104 | 9.4905 | | -0.88 | |
| 1891 | | ----- | | ----- | |
| 1923 | | ----- | | ----- | |
| 1924 | | ----- | | ----- | |
| 1925 | | ----- | | ----- | |
| 1955 | D7042 | 9.4962 | | -0.79 | |
| 1958 | D445 | 9.44 | | -1.71 | |
| 3031 | ISO3104 | 9.32348 | DG(0.05) | -3.61 | |
| 6002 | ISO3104 | 9.501 | | -0.71 | |
| 6015 | | ----- | | ----- | |
| 6031 | D445 | 9.591 | C | 0.75 | first reported 9.294 |
| 6036 | | ----- | | ----- | |
| 6053 | | ----- | | ----- | |
| 6085 | D7042 | 9.5257 | | -0.31 | |
| 6088 | | ----- | | ----- | |
| 6099 | | ----- | | ----- | |
| 6124 | D7042 | 9.5930 | | 0.79 | |
| 6141 | D445 | 9.6027 | | 0.94 | |
| 6167 | | ----- | | ----- | |
| 6239 | D445 | 9.5537 | | 0.15 | |
| 6264 | D7042 | 9.5387 | | -0.10 | |
| 6275 | D445 | 9.673 | | 2.09 | |
| 6278 | | ----- | | ----- | |
| 6280 | | ----- | | ----- | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | | ----- | | ----- | |
| 6367 | ISO3104 | 9.737 | | 3.13 | |
| 6372 | | ----- | | ----- | |
| 6382 | DIN51562-1 | 9.549 | | 0.07 | |
| 6393 | | ----- | | ----- | |
| 6402 | D7279 corr. to D445 | 9.437 | | -1.76 | |
| 6414 | D445 | 9.74 | | 3.18 | |
| 6422 | | ----- | | ----- | |
| 6434 | | ----- | | ----- | |
| 6446 | D445 | 9.471 | | -1.20 | |
| 6465 | D445 | 9.56 | C | 0.25 | first reported 10.15 |
| 6484 | | ----- | | ----- | |
| 6495 | ISO3104 | 9.6084 | | 1.04 | |
| 6501 | | ----- | | ----- | |
| 6527 | | ----- | | ----- | |
| 6541 | | ----- | | ----- | |
| 6542 | | ----- | | ----- | |
| 6549 | | ----- | | ----- | |
| 6556 | ISO3104 | 10.1145 | G(0.01) | 9.28 | |

|  |  |
|---|---|
| normality | OK |
| n | 49 |
| outliers | 5 |
| mean (n) | 9.5448 |
| st.dev. (n) | 0.07904 |
| R(calc.) | 0.2213 |
| st.dev.(iis memo 1401) | 0.06136 |
| R(iis memo 1401) | 0.1718 |
| Compare: | |
| R(D445:23) | 0.0289 |
| R(ISO3104-A:20) | 0.1164 |
| R(D7042:21a) | 0.2190 |





Kernel Density
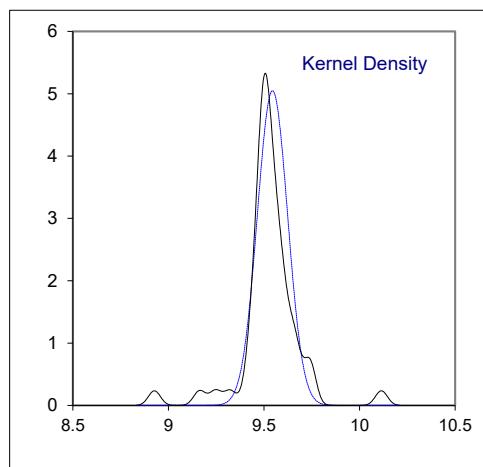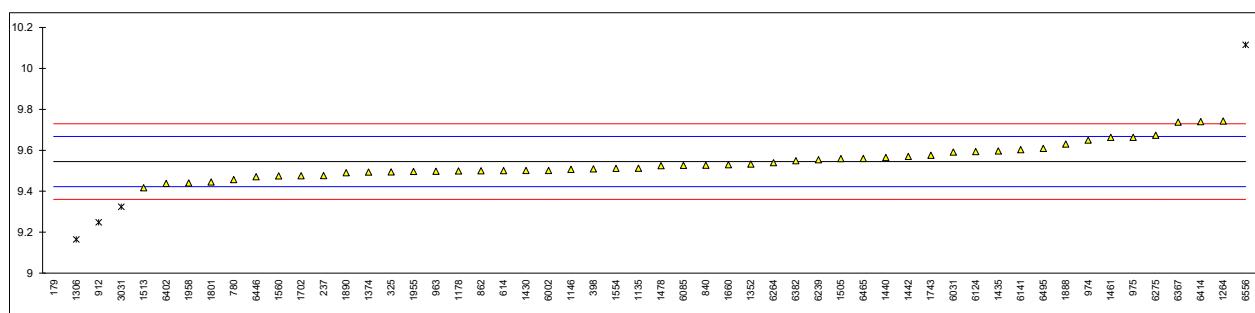
Determination of Water on sample #23241; results in mg/kg

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 179 | D1533 | 15 | R(0.01) | -3.46 | |
| 237 | D6304-C:16e1 | 25 | | 0.35 | |
| 325 | D6304-C:20 | <100 | | ----- | |
| 331 | D6304-C:20 | 32.67 | R(0.01) | 3.27 | |
| 398 | IEC60814 | 42 | R(0.01) | 6.81 | |
| 445 | | ----- | | ----- | |
| 455 | D1533 | 22.4 | | -0.64 | |
| 511 | D1533 | 27.26 | | 1.21 | |
| 614 | | ----- | | ----- | |
| 657 | IEC60814 | 22.71 | | -0.52 | |
| 780 | IEC60814 | 23 | | -0.41 | |
| 840 | IEC60814 | 22.63 | | -0.55 | |
| 862 | | ----- | | ----- | |
| 901 | D1533 | 22.1 | C | -0.75 | first reported 43.1 |
| 912 | D6304 | 20 | | -1.55 | |
| 963 | D1533 | 24 | | -0.03 | |
| 974 | | ----- | | ----- | |
| 975 | D6304-A:16e1 | 23.0 | | -0.41 | |
| 1135 | IEC60814 | 26 | | 0.73 | |
| 1146 | D6304-B:20 | 12 | R(0.01) | -4.60 | |
| 1156 | EN60814 | 24.1 | | 0.01 | |
| 1178 | IEC60814 | 25.1 | | 0.39 | |
| 1264 | D1533 | 20.1 | | -1.52 | |
| 1304 | In house | 20.7 | | -1.29 | |
| 1306 | D1533 | 20 | | -1.55 | |
| 1352 | IEC60814 | 20.00 | | -1.55 | |
| 1374 | IEC60814 | 25.4 | | 0.50 | |
| 1430 | EN60814 | 25 | | 0.35 | |
| 1435 | IEC60814 | 23.0 | | -0.41 | |
| 1439 | | ----- | | ----- | |
| 1440 | IEC60814 | 26.23 | | 0.82 | |
| 1442 | IEC60814 | 27.60 | | 1.34 | |
| 1458 | IEC60814 | 21.9 | | -0.83 | |
| 1461 | | 23.84 | | -0.09 | |
| 1478 | EN60814 | 24.85 | | 0.29 | |
| 1505 | D1533 | 24.9 | | 0.31 | |
| 1513 | IEC60814 | 23.6 | | -0.18 | |
| 1529 | IEC60814 | 23.1 | | -0.37 | |
| 1545 | IEC60814 | 24.81 | | 0.28 | |
| 1554 | | ----- | | ----- | |
| 1560 | IEC60814 | 23 | | -0.41 | |
| 1624 | IEC60814 | 24.5 | | 0.16 | |
| 1660 | IEC60814 | 21 | | -1.17 | |
| 1687 | EN60814 | 23.804 | | -0.11 | |
| 1702 | IEC60814 | 24.5 | | 0.16 | |
| 1719 | IEC60814 | 25.7 | | 0.61 | |
| 1743 | IEC60814 | 22 | | -0.79 | |
| 1801 | EN60814 | 24.75 | | 0.25 | |
| 1816 | EN60814 | 24.0 | | -0.03 | |
| 1885 | D1533 | 26.9 | | 1.07 | |
| 1888 | EN60814 | 26.27 | | 0.83 | |
| 1890 | IEC60814 | 24.53 | | 0.17 | |
| 1891 | IEC60814 | 23.3 | | -0.30 | |
| 1923 | EN60814 | 22.9 | | -0.45 | |
| 1924 | EN60814 | 22.4 | | -0.64 | |
| 1925 | EN60814 | 24.6 | | 0.20 | |
| 1955 | IEC60814 | 30.4333 | | 2.42 | |
| 1958 | EN60814 | <200 | C | ----- | reported <0.02 mg/kg; probably %m/m? iis converted to mg/kg |
| 3031 | IEC60814 | 27.7 | | 1.38 | |
| 6002 | EN60814 | 23.3 | | -0.30 | |
| 6015 | | ----- | | ----- | |
| 6031 | IEC60814 | 23.50 | | -0.22 | |
| 6036 | EN60814 | 25.1 | | 0.39 | |
| 6053 | IEC60814 | 28.4 | | 1.64 | |
| 6085 | D6304-B:20 | 30 | | 2.25 | |
| 6088 | D1533 | 24.64 | | 0.21 | |
| 6099 | IEC60814 | 25.5 | | 0.54 | |
| 6124 | IEC60814 | 25.05 | | 0.37 | |
| 6141 | D1533 | 24 | | -0.03 | |
| 6167 | | ----- | | ----- | |
| 6239 | D1533 | 32.90 | R(0.01) | 3.35 | |
| 6264 | IEC60814 | 23.6 | | -0.18 | |
| 6275 | IEC60814 | 24.24 | | 0.06 | |
| 6278 | D1533 | 23.54 | | -0.21 | |
| 6280 | IEC60814 | 26.51 | | 0.92 | |

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 6334 | IEC60814 | 24.74 | | 0.25 | |
| 6367 | IEC60814 | 24.5 | | 0.16 | |
| 6372 | IEC60814 | 24.8 | | 0.27 | |
| 6382 | EN60814 | 21.85 | | -0.85 | |
| 6393 | EN60814 | 22.14 | | -0.74 | |
| 6402 | D1533 | 21.8 | | -0.87 | |
| 6414 | IEC60814 | 23.8 | | -0.11 | |
| 6422 | IEC60814 | 24.4 | | 0.12 | |
| 6434 | IEC60814 | 19.9 | | -1.59 | |
| 6446 | ISO12937 | 22.5 | | -0.60 | |
| 6465 | IEC60814 | 24.75 | | 0.25 | |
| 6484 | EN60814 | 25.1 | | 0.39 | |
| 6495 | EN60814 | 23.2 | | -0.34 | |
| 6501 | | ----- | | ----- | |
| 6527 | IEC60814 | 23.6 | | -0.18 | |
| 6541 | IEC60814 | 26.80 | | 1.03 | |
| 6542 | IEC60814 | 24.60 | | 0.20 | |
| 6549 | ISO12937 | 24 | | -0.03 | |
| 6556 | IEC60814 | 14.62 | R(0.01) | -3.60 | |

|  |  |
|---|---|
| normality | OK |
| n | 77 |
| outliers | 6 |
| mean (n) | 24.084 |
| st.dev. (n) | 2.1005 |
| R(calc.) | 5.881 |
| st.dev.(EN60814:98) | 2.6290 |
| R(EN60814:98) | 7.361 |
| Compare: | |
| R(D1533:20) | 14 |
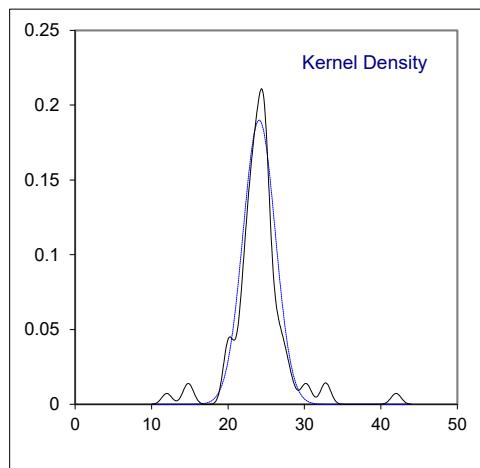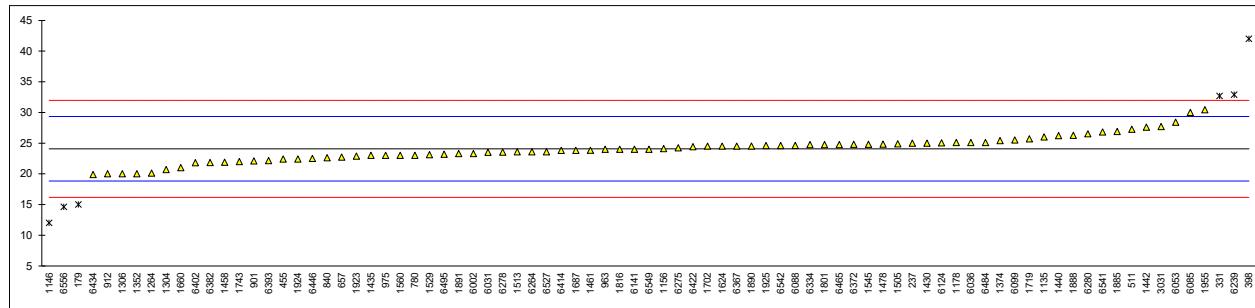
## Determination of Total Furanic Compounds on sample #23242; results in mg/kg

| lab | method | value | mark | z(targ) | remarks |
|-----|--------|-------|------|---------|---------|
| 331 | | ----- | | ----- | |
| 445 | | ----- | | ----- | |
| 455 | EN61198 | 1.619 | | -0.44 | |
| 614 | IEC61198 | 2.15 | | 1.64 | |
| 780 | | ----- | | ----- | |
| 840 | D5837 | 1.580 | | -0.59 | |
| 862 | IEC61198 | 1.729 | | -0.01 | |
| 912 | IEC61198 | 2.255 | | 2.05 | |
| 963 | D5837 | <0.01 | | <-6.75 | possibly a false negative test result? |
| 975 | | ----- | | ----- | |
| 1135 | IEC61198 | 0.78 | R(0.01) | -3.73 | |
| 1156 | EN61198 | 1.996 | | 1.04 | |
| 1178 | IEC61198 | 1.7878 | | 0.22 | |
| 1264 | D5837 | 1.682 | | -0.19 | |
| 1304 | In house | 1.832 | | 0.39 | |
| 1306 | IEC61198 | 1.59 | | -0.55 | |
| 1352 | IEC61198 | 1.3898 | | -1.34 | |
| 1374 | D5837 | 1.724 | | -0.03 | |
| 1430 | | ----- | | ----- | |
| 1431 | | ----- | | ----- | |
| 1435 | | ----- | | ----- | |
| 1439 | | ----- | | ----- | |
| 1440 | EN61198 | 1.7070 | | -0.10 | |
| 1442 | IEC61198 | 1.913 | | 0.71 | |
| 1458 | IEC61198 | 1.69 | | -0.16 | |
| 1478 | | ----- | | ----- | |
| 1505 | D5837 | 0.695 | R(0.05) | -4.06 | |
| 1513 | | ----- | | ----- | |
| 1529 | | ----- | | ----- | |
| 1545 | IEC61198 | 0.6935 | C,R(0.05) | -4.07 | first reported 0.2989 |
| 1560 | IEC61198 | 1.385 | | -1.36 | |
| 1660 | IEC61198 | 1.406 | | -1.28 | |
| 1702 | | ----- | | ----- | |
| 1743 | IEC61198 | 2.23 | | 1.96 | |
| 1801 | | ----- | | ----- | |
| 1872 | | ----- | | ----- | |
| 1885 | | ----- | | ----- | |
| 1888 | | ----- | | ----- | |
| 1891 | IEC61198 | 1.691 | | -0.16 | |
| 1955 | IEC61198 | 1.805025 | | 0.29 | |
| 1958 | D5837 | 1.461 | C | -1.06 | first reported 788, iis converted 1461 to 1.461 mg/kg |
| 3031 | IEC61198 | 9.537 | C,R(0.01) | 30.60 | first reported 45.6561 |
| 6002 | EN61198 | 1.80 | | 0.27 | |
| 6015 | EN61198 | 1.6386 | | -0.36 | |
| 6031 | IEC61198 | 1.51605 | | -0.84 | |
| 6036 | EN61198 | 1.673 | | -0.23 | |
| 6080 | IEC61198 | 1.482 | C | -0.98 | first reported 0.922 |
| 6085 | | ----- | | ----- | |
| 6099 | IEC61198 | 1.70 | | -0.12 | |
| 6124 | IEC61198 | 2.0792 | | 1.36 | |
| 6141 | D5837 | 10.061 | R(0.01) | 32.66 | |
| 6212 | IEC61198 | 1.87934 | | 0.58 | |
| 6239 | D5837 | 1.69268 | | -0.15 | |
| 6264 | IEC61198 | 1.685 | | -0.18 | |
| 6275 | IEC61198 | 1.8831 | | 0.60 | |
| 6278 | D5837 | 1.650 | | -0.32 | |
| 6334 | IEC61198 | 1.676 | C | -0.22 | first reported 2.815 |
| 6414 | | ----- | | ----- | |
| 6422 | IEC61198 | 1.49 | | -0.95 | |
| 6434 | IEC61198 | 1.86 | | 0.50 | |
| 6541 | | ----- | | ----- | |
| 6542 | | ----- | | ----- | |

| | | |
|---|---|---|
| normality | OK | |
| n | 36 | |
| outliers | 5 | |
| mean (n) | 1.7313 | |
| st.dev. (n) | 0.21894 | |
| R(calc.) | 0.6130 | |
| st.dev.(Horwitz 1 component) | 0.25505 | |
| R(Horwitz 1 component) | 0.7141 | |
| Compare: | | |
| R(IEC61198:93) | 0.1731 | |

Kernel Density
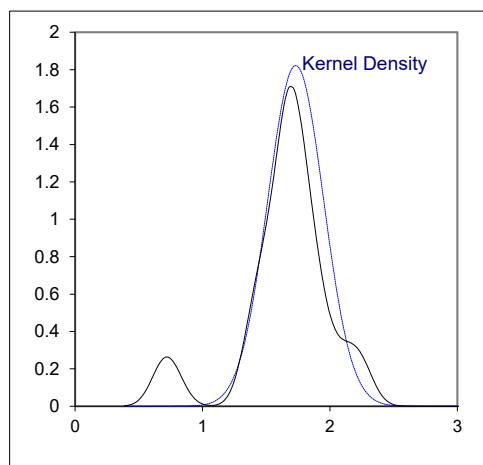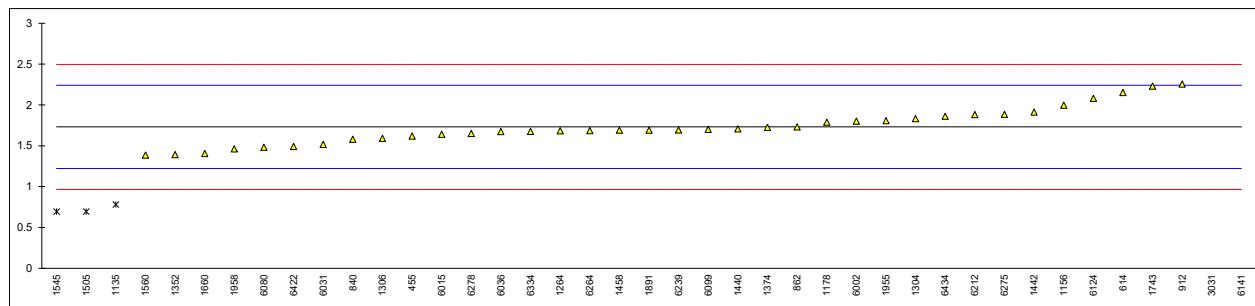
## Determination of 2-Furfural on sample #23242; results in mg/kg

| lab | method | value | mark | z(targ) | remarks |
|---|---|---|---|---|---|
| 331 | | ----- | | ----- | |
| 445 | | ----- | | ----- | |
| 455 | EN61198 | 1.524 | | -0.59 | |
| 614 | IEC61198 | 2.15 | | 1.94 | |
| 780 | INH-206 | 1.79 | | 0.49 | |
| 840 | D5837 | 1.580 | | -0.36 | |
| 862 | IEC61198 | 1.729 | | 0.24 | |
| 912 | IEC61198 | 1.831 | | 0.65 | |
| 963 | D5837 | 1.819 | | 0.60 | |
| 975 | | ----- | | ----- | |
| 1135 | IEC61198 | 0.52 | R(0.01) | -4.65 | |
| 1156 | EN61198 | 1.902 | | 0.94 | |
| 1178 | IEC61198 | 1.7878 | | 0.48 | |
| 1264 | D5837 | 1.539 | | -0.53 | |
| 1304 | In house | 1.789 | | 0.48 | |
| 1306 | IEC61198 | 1.5541 | | -0.47 | |
| 1352 | IEC61198 | 1.3898 | | -1.13 | |
| 1374 | D5837 | 1.667 | | -0.01 | |
| 1430 | | 0.5 | R(0.01) | -4.73 | |
| 1431 | D5837 | 1.050 | C | -2.51 | first reported 0.8283 |
| 1435 | IEC61198 | 1.664 | | -0.02 | |
| 1439 | | ----- | | ----- | |
| 1440 | EN61198 | 1.7070 | C | 0.15 | first reported 0.0000 |
| 1442 | IEC61198 | 1.808 | | 0.56 | |
| 1458 | IEC61198 | 1.69 | | 0.08 | |
| 1478 | IEC61198 | 1.568 | | -0.41 | |
| 1505 | D5837 | 0.068 | C,R(0.01) | -6.48 | first reported 0.684 |
| 1513 | IEC61198 | 1.600 | | -0.28 | |
| 1529 | IEC61198 | 1.87 | | 0.81 | |
| 1545 | IEC61198 | 0.5062 | C,R(0.01) | -4.70 | first reported 0.0886 |
| 1560 | IEC61198 | 1.385 | | -1.15 | |
| 1660 | IEC61198 | 1.406 | | -1.07 | |
| 1702 | IEC61198 | 1.678 | | 0.03 | |
| 1743 | IEC61198 | 2.23 | | 2.27 | |
| 1801 | EN61198 | 1.517 | | -0.62 | |
| 1872 | EN61198 | 2.30 | | 2.55 | |
| 1885 | D5837 | 1.467 | | -0.82 | |
| 1888 | EN61198 | 1.9 | | 0.93 | |
| 1891 | IEC61198 | 1.691 | | 0.09 | |
| 1955 | IEC61198 | 1.717550 | | 0.19 | |
| 1958 | D5837 | 1.297 | C | -1.51 | first reported 489, iis converted 1297 to mg/kg |
| 3031 | IEC61198 | 4.807 | C,R(0.01) | 12.68 | first reported 25.1323 |
| 6002 | EN61198 | 1.80 | | 0.53 | |
| 6015 | EN61198 | 1.5578 | | -0.45 | |
| 6031 | IEC61198 | 1.51605 | | -0.62 | |
| 6036 | EN61198 | 1.673 | | 0.01 | |
| 6080 | IEC61198 | 1.314 | C | -1.44 | first reported 0.756 |
| 6085 | | ----- | | ----- | |
| 6099 | IEC61198 | 1.51 | | -0.65 | |
| 6124 | IEC61198 | 1.9112 | | 0.98 | |
| 6141 | D5837 | 3.798 | R(0.01) | 8.61 | |
| 6212 | IEC61198 | 1.7075 | | 0.15 | |
| 6239 | D5837 | 1.62893 | | -0.17 | |
| 6264 | IEC61198 | 1.685 | | 0.06 | |
| 6275 | IEC61198 | 1.8757 | | 0.83 | |
| 6278 | D5837 | 1.353 | | -1.28 | |
| 6334 | IEC61198 | 1.543 | | -0.51 | |
| 6414 | IEC61198 | 1.72 | | 0.20 | |
| 6422 | IEC61198 | 1.49 | | -0.73 | |
| 6434 | IEC61198 | 1.74 | | 0.28 | |
| 6541 | D5837 | 3.86461 | C,R(0.01) | 8.87 | first reported 3864.61 mg/kg |
| 6542 | D5837 | 1.865119 | C | 0.79 | first reported 1865.11 mg/kg |

| | | | |
|---|---|---|---|
| | normality | suspect | |
| | n | 50 | |
| | outliers | 7 | |
| | mean (n) | 1.6698 | |
| | st.dev. (n) | 0.23044 | |
| | R(calc.) | 0.6452 | |
| | st.dev.(Horwitz) | 0.24732 | |
| | R(Horwitz) | 0.6925 | |
| Compare: | | | |
| | R(IEC61198:93) | 0.1670 | |
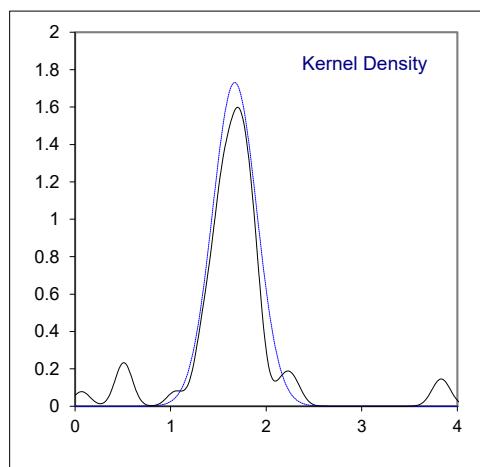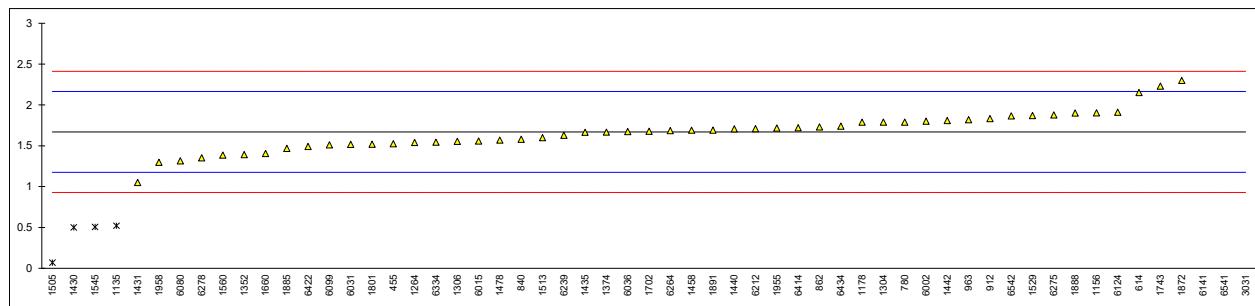
## APPENDIX 2

Other reported Furanics in sample #23242; results in mg/kg

| lab | 2-Acetyl Furan | | 2-Furfurylalcohol | | 5-Hydroxy Methyl-2-Furfural | | 5-Methyl-2-Furfural | |
|-----|---------------|---|-------------------|---|-----------------------------|---|---------------------|---|
| 331 | ----- | | ----- | | ----- | | ----- | |
| 445 | ----- | | ----- | | ----- | | ----- | |
| 455 | 0.044 | | 0.008 | | 0.01 | | 0.043 | |
| 614 | <0.01 | | <0.01 | | <0.01 | | <0.01 | |
| 780 | <0.1 | | <0.1 | | 0.76 | | 0.13 | |
| 840 | <0.05 | | <0.05 | | <0.05 | | <0.05 | |
| 862 | <0.01 | | <0.01 | | <0.01 | | <0.01 | |
| 912 | ND | | 0.241 | | 0.086 | | 0.097 | |
| 963 | <0.01 | | <0.01 | | <0.01 | | 1.819 | |
| 975 | ----- | | ----- | | ----- | | ----- | |
| 1135 | 0.00 | | 0.22 | | 0.02 | | 0.02 | |
| 1156 | 0.013 | | 0 | | 0.012 | | 0.069 | |
| 1178 | 0.00001 | | 0.00001 | | 0.00001 | | 0.00001 | |
| 1264 | 0.049 | | 0 | | 0.079 | | 0.015 | |
| 1304 | ----- | | ----- | | ----- | | 0.043 | |
| 1306 | 0 | | 0 | | 0 | | 0.0351 | |
| 1352 | ----- | | ----- | | ----- | | ----- | |
| 1374 | 0 | | 0 | | 0.015 | | 0.042 | |
| 1430 | 0.17 | | <0.04 | | <0.02 | | 0.06 | |
| 1431 | 0.0119 | | 0.038 | C | 0.0755 | | 0.0963 | |
| 1435 | <0.03 | | <0.03 | | <0.03 | | <0.03 | |
| 1439 | ----- | | ----- | | ----- | | ----- | |
| 1440 | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| 1442 | 0.018 | | <0,05 | | <0,05 | | 0.088 | |
| 1458 | <0.01 | | <0.01 | | <0.01 | | <0.01 | |
| 1478 | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| 1505 | <0,010 | | <0,010 | | <0,010 | | 0.011 | |
| 1513 | <0,05 | | <0,05 | | <0,05 | | <0,05 | |
| 1529 | 0.02 | | 0.02 | | 0.03 | | 0.04 | |
| 1545 | 0.0194 | C | 0.0141 | C | 0.0744 | C | 0.0794 | C |
| 1560 | Not detected | | Not detected | | Not detected | | Not detected | |
| 1660 | < 0.05 | | < 0.10 | | < 0.05 | | < 0.05 | |
| 1702 | Not Detected | | Not Detected | | Not Detected | | Not Detected | |
| 1743 | 0 | | 0 | | 0 | | 0 | |
| 1801 | 0.0386 | | ----- | | 0.04223 | | 0.02744 | |
| 1872 | < 0.05 | | < 0.05 | | < 0.05 | | < 0.05 | |
| 1885 | 0.035 | | 0.006 | | 0.010 | | 0.021 | |
| 1888 | <0.05 | | <0.05 | | <0.05 | | <0.05 | |
| 1891 | <0.01 | | <0.01 | | <0.01 | | <0.01 | |
| 1955 | 0.014250 | | ----- | | 0.014625 | | 0.058600 | |
| 1958 | 0.039 | C | 0.047 | C | 0.059 | C | 0.019 | C |
| 3031 | 1.518 | C | 2.596 | C | Not Detected | | 0.616 | C |
| 6002 | <0,01 | | <0,01 | | <0,01 | | <0,01 | |
| 6015 | 0.0092 | | ----- | | 0.0256 | | 0.0461 | |
| 6031 | <0.01 | | <0.01 | | <0.01 | | <0.01 | |
| 6036 | 0 | | 0 | | 0 | | 0 | |
| 6080 | 0.035 | | 0.050 | | 0.065 | | 0.016 | |
| 6085 | ----- | | ----- | | ----- | | ----- | |
| 6099 | 0.03 | | 0.00 | | 0.07 | | 0.09 | |
| 6124 | 0.0171 | | 0.0434 | | 0.0611 | | 0.0464 | |
| 6141 | 2.913 | | 0 | | 0 | | 3.35 | |
| 6212 | 0.04046 | | 0.02921 | | 0.04907 | | 0.0531 | |
| 6239 | 0.01757 | | 0.01774 | | 0.01343 | | 0.01501 | |
| 6264 | 0 | | 0 | | 0 | | 0 | |
| 6275 | 0.0035 | | 0 | | 0 | | 0.0039 | |
| 6278 | 0.014 | | 0.000 | | 0.152 | C | 0.129 | C |
| 6334 | 0.099 | C | <0.05 | C | <0.05 | | 0.034 | |
| 6414 | <0.05 | | <0.05 | | <0.05 | | 0.06 | |
| 6422 | <0.05 | | <0.05 | | <0.05 | | <0.05 | |
| 6434 | 0.06 | | 0.01 | | 0.01 | | 0.04 | |
| 6541 | 0.01798 | C | 0.84366 | C | 0.06247 | C | 0.27573 | C |
| 6542 | 0.007014 | C | 0.762511 | C | 0.056785 | C | 0.236087 | C |

Lab 1431 first reported 0.1074
Lab 1545 first reported 0.0146, 0.0076, 0.0076 and 0.1835 respectively
Lab 1958 first reported 31, 194, 52 and 22 respectively, iis converted revised test results to mg/kg
Lab 3031 first reported 7.768, 9.7085 and 3.0473 respectively
Lab 6278 first reported 0.120 and 0.176 respectively
Lab 6334 first reported 0.099 and 1.139 respectively
Lab 6541 first reported 17.98, 843.66, 62.47 and 275.73 mg/kg respectively
Lab 6542 first reported 7.01, 762.51, 56.78 and 236.08 mg/kg respectively

## APPENDIX 3

## Number of participants per country

| | | | | |
|---|---|---|---|---|
| 7 labs in | AUSTRALIA | | 1 lab in | NORWAY |
| 4 labs in | BELGIUM | | 1 lab in | PAKISTAN |
| 1 lab in | BOTSWANA | | 1 lab in | PERU |
| 6 labs in | BULGARIA | | 1 lab in | PHILIPPINES |
| 1 lab in | CHINA, People's Republic | | 2 labs in | POLAND |
| 1 lab in | CROATIA | | 1 lab in | PORTUGAL |
| 3 labs in | FRANCE | | 1 lab in | QATAR |
| 6 labs in | GERMANY | | 2 labs in | ROMANIA |
| 3 labs in | GREECE | | 1 lab in | RUSSIAN FEDERATION |
| 1 lab in | INDIA | | 3 labs in | SAUDI ARABIA |
| 3 labs in | INDONESIA | | 2 labs in | SINGAPORE |
| 1 lab in | IRELAND | | 1 lab in | SLOVAKIA |
| 2 labs in | ISRAEL | | 1 lab in | SLOVENIA |
| 3 labs in | ITALY | | 1 lab in | SOUTH AFRICA |
| 1 lab in | KOREA, Republic of | | 7 labs in | SPAIN |
| 2 labs in | KUWAIT | | 2 labs in | SWITZERLAND |
| 3 labs in | MALAYSIA | | 2 labs in | TURKIYE |
| 3 labs in | MOROCCO | | 4 labs in | UNITED ARAB EMIRATES |
| 3 labs in | NETHERLANDS | | 4 labs in | UNITED KINGDOM |
| 1 lab in | NEW ZEALAND | | 1 lab in | UNITED STATES OF AMERICA |
| 1 lab in | NIGERIA | | 1 lab in | URUGUAY |
| 1 lab in | NORTH MACEDONIA, Republic of | | 1 lab in | VIETNAM |

**APPENDIX 4**

**Abbreviations**

C           = final test result after checking of first reported suspect test result
D(0.01)    = outlier in Dixon's outlier test
D(0.05)    = straggler in Dixon's outlier test
G(0.01)    = outlier in Grubbs' outlier test
G(0.05)    = straggler in Grubbs' outlier test
DG(0.01)   = outlier in Double Grubbs' outlier test
DG(0.05)   = straggler in Double Grubbs' outlier test
R(0.01)    = outlier in Rosner's outlier test
R(0.05)    = straggler in Rosner's outlier test
E          = calculation difference between reported test result and result calculated by iis
W          = test result withdrawn on request of participant
ex         = test result excluded from statistical evaluation
n.a.       = not applicable
n.e.       = not evaluated
n.d.       = not detected
fr.        = first reported
f+?        = possibly a false positive test result?
f-?        = possibly a false negative test result?
SDS        = Safety Data Sheet


**Literature**

1      iis Interlaboratory Studies, Protocol for the Organisation, Statistics & Evaluation, June 2018
2      ISO5725:86
3      ISO5725 parts 1-6:94
4      ISO13528:05
5      M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
6      W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
7      P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
8      J.N. Miller, Analyst, 118, 455, (1993)
9      Analytical Methods Committee, Technical Brief, No 4, January 2001
10     P.J. Lowthian and M. Thompson, The Royal Society of Chemistry, Analyst, 127, 1359-1364, (2002)
11     W. Horwitz and R. Albert, J. AOAC Int, 79.3, 589-621, (1996)
12     Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, Technometrics, 25(2), 165-172, (1983)
13     iis memo 1401, Precision data of Used Oils for Kinematic Viscosity (ASTM D445)