Results of Proficiency Test
Transformer Oil (used)
November 2021

Organized by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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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 in accordance with the latest version of IEC60296 and ASTM D3487, every year. During the annual proficiency testing program 2021/2022 it was decided to continue the round robin for the analysis of Transformer Oil (used) and the round robin for the analysis of Furanics in Transformer Oil (used).

In this interlaboratory study 80 laboratories in 41 different countries registered for participation for the PT on Transformer Oil (used) and 51 laboratories in 30 different countries registered for participation for the PT on Furanics in Transformer Oil (used).

In total 81 laboratories in 42 different countries registered for participation in one or more proficiency tests. See appendix 2 for the number of participants per country. In this report the results of the proficiency tests on Transformer Oil (used) and Furanics in Transformer Oil (used) 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 an ISO/IEC17025 accredited laboratory.
It was decided to send for the PT on Transformer Oil (used) one sample in a 1L bottle labelled #21241 and for the PT on Furanics in Transformer Oil (used) one sample in a 100mL glass bottle labelled #21242.
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 110 liters of Transformer Oil (used) was obtained from a third party. After homogenization 106 amber glass bottles of 1L were filled and labelled #21241.
The homogeneity of the subsamples was checked by determination of Density at 20 °C in accordance with ISO3675 on 8 stratified randomly selected subsamples.

	Density at 20°C in kg/m^3
sample #21241-1	868.42
sample #21241-2	868.43
sample #21241-3	868.44
sample #21241-4	868.44
sample #21241-5	868.43
sample #21241-6	868.43
sample #21241-7	868.43
sample #21241-8	868.47

Table 1: homogeneity test results of subsamples #21241

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)	0.04
reference test method	ISO3675:98
0.3 x R (reference test method)	0.36

Table 2: evaluation of the repeatability of subsamples #21241

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 700 milliliters of Transformer Oil (which was highly positive on Furanics) was mixed with approximately 7 liters of Transformer Oil (fresh). After homogenization 70 amber glass bottles of 100mL were filled and labelled #21242.
The homogeneity of the subsamples was checked by determination of Density at 20 °C in accordance with ISO3675 on 8 stratified randomly selected subsamples.

	Density at 20°C in kg/m^3
sample #21242-1	874.31
sample #21242-2	874.30
sample #21242-3	874.29
sample #21242-4	874.3o
sample #21242-5	874.28
sample #21242-6	874.28
sample #21242-7	874.29
sample #21242-8	874.29

Table 3: homogeneity test results of subsamples #21242

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	ISO3675:98
0.3 x R (reference method)	0.36

Table 4: evaluation of the repeatability of subsamples #21242

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 the appropriate set of PT samples was sent on October 27, 2021. 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 #21241: 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 (Potentiometric) and for the Breakdown Voltage determination.
On sample #21242 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 appendix 1 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 appendix 1. 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	good
1 <	|z|	< 2	satisfactory
2 <	|z|	< 3	questionable
3 <	|z|		unsatisfactory

4 EVALUATION

In this proficiency test some problems were encountered with the dispatch of the samples. For the PT on Transformer Oil (used) seven participants reported test results after the final reporting date and four 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 77 participants reported 822 numerical test results. Observed were 35 outlying test results, which is 4.3%. 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 3.

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). If applicable, a designation in parentheses is added to designate the year of reapproval (e.g. D1298:12b(2017)). In the test results tables of appendix 1 only the method number (sub) and year of adoption or revision (e.g. D1298:12b) will be used.

sample #21241

Total Acid Number (Potentiometric): This determination may be problematic depending on the test method used. Four statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in full agreement with the requirements of ASTM D664-A:18e2, IP- 60mL but not in agreement with the requirements of ASTM D664-A:18e2 (BEP-60mL/125mL and IP-125mL) nor with the requirements of EN62021-1:03.

Total Acid Number (Colorimetric): This determination was problematic 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 D974:21, but not at all in agreement with the very strict requirements of EN62021-2:07.

Breakdown Voltage: In the specification of IEC60296:12 both the test method IEC60156 and the test method EN60156 were mentioned for the determination of the Breakdown Voltage. However, the specification IEC60296:12 is replaced with IEC60296:20, and in this specification only the test method IEC60156 is mentioned. Therefore, it was decided to use the test method IEC60156 for the evaluation of the test results of the Breakdown Voltage in this PT. This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in full agreement with the requirements of IEC60156:18. See also the discussion in paragraph 5. No significant effect is observed when the test results with stirring and without stirring were evaluated separately.

Density at 20°C: This determination may be problematic depending on the test method used. Six statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ISO3675:98 and D1298:12b(2017), but is not in agreement with the requirements of ASTM D4052:18a and ISO12185:96.

DD-Factor at 90°C: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier is in agreement with the requirements of EN60247:04.

Specific Resistance at 90°C: This determination was problematic. No statistical outliers were observed. The calculated reproducibility is not in agreement with the requirements of EN60247:04.

Flash Point C.O.C.: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D92:18.

Flash Point PMcc: This determination was not problematic. 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: This determination was problematic depending on the test method used. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not at all 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.
This determination was problematic. Two 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 D445:21e1 and ISO3104-A:20 but is in agreement with the requirements of ASTM D7042:21a.

Water: This determination was problematic depending on the test method used. Three statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of EN60814:98 but is in agreement with the requirements of ASTM D1533:12 and ASTM D6304-C:20.

sample #21242
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 the estimated reproducibilities calculated with the Horwitz equation.

Total Furanic Compounds: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier 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-Acetyl Furan: This determination was not problematic. Four 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: This determination was not problematic. One statistical outlier was observed. The calculated reproducibility after rejection of the statistical outlier 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-Furfurylalcohol: This determination may be problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the estimated reproducibility calculated with the Horwitz equation and not in agreement with the strict requirements of IEC61198:93.

5-Hydroxy Methyl-2-Furfural: This determination was not problematic. 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.

5-Methyl-2-Furfural: This determination was not problematic. Two 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.

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 test methods (in casu ASTM, EN and ISO test methods) or based on previous proficiency tests or estimated using the Horwitz equation are presented in the next tables.

Parameter	unit	n	average	2.8 * sd	R(lit)
Total Acid Number (Potentiometric)	mg KOH/kg	41	0.017	0.016	0.010
Total Acid Number (Colorimetric)	mg KOH/kg	36	0.015	0.014	0.04
Breakdown Voltage	kV/2.5 mm	73	39.9	33.5	33.5
Density at 20°C	kg/m^3	51	868.4	0.8	1.2
Di-electric Dissipation Factor 90°C		63	0.020	0.023	0.031
Specific Resistance at 90°C	GΩm	53	26.4	31.5	27.7
Flash Point C.O.C.	°C	24	156.7	13.9	18
Flash Point PMcc	°C	36	145.7	8.9	10.3
Interfacial Surface Tension	mN/m	57	25.7	7.3	2.6
Kinematic Viscosity at 40°C	mm^2/s	39	9.579	0.228	0.172
Water	mg/kg	65	23.24	8.30	7.23

Table 5: reproducibilities of tests on sample #21241

Component	unit	n	average	2.8 * sd	R(target)
Total Furanic Compounds	mg/kg	34	2.28	0.99	2.02
2-Acetyl Furan	mg/kg	42	0.48	0.18	0.24
2-Furfural	mg/kg	45	0.43	0.16	0.22
2-Furfurylalcohol	mg/kg	43	0.46	0.28	0.23
5-Hydroxy Methyl-2-Furfural	mg/kg	41	0.53	0.24	0.26
5-Methyl-2-Furfural	mg/kg	44	0.45	0.21	0.23

Table 6: reproducibilities of tests on sample #21242

Without further statistical calculations, it can be concluded that for most 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 2021 WITH PREVIOUS PTS

	November 2021	November 2020	November 2019	November 2018	November 2017
Number of reporting laboratories	77	70	70	75	74
Number of test results	822	581	678	805	667
Number of statistical outliers	35	24	24	41	35
Percentage of statistical outliers	4.3%	4.1%	3.5%	5.1%	5.2%

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 2021	November 2020	November 2019	November 2018	November 2017
Total Acid Number (Potentiometric)	-	-	-	--	--
Total Acid Number (Colorimetric)	++	++	+	+/-	++
Breakdown Voltage	+/-	-	-	--	+/-
Density at 20°C	+	+	-	+/-	+
Di-electric 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.
2-Furfural	+	+/-	++	+	++
2-Furfurylalcohol	-	n.e.	-	+/-	n.e.
5-Hydroxymethyl-2-Furfural	+/-	n.e.	n.e.	+	n.e.
5-Methyl-2-Furfural	+/-	n.e.	+	+	n.e.

Table 8: comparison determinations against 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

5 Discussion

Evaluation of the Breakdown Voltage in Transformer Oil (fresh and used)

In iis PTs from 2016 till 2020 the target reproducibility for Breakdown Voltage was determined using test method EN60156:95 according to the iis memo 1702 (see lit. 14). In iis memo 1702 the determination of the target reproducibility is based on a graphical representation. However, test method IEC60156:18 describes that this graphical representation is for information only and that it does not represent acceptance criteria. Therefore, it was decided not to continue with iis memo 1702 for the estimation of the target reproducibility and to go further with the precision as mentioned in test method IEC60156:18.

In test method IEC60156:18 (paragraph 12.2) the reproducibility is described as “experience has shown that the reproducibility of individual dielectric breakdown values is in the range of ±30%”. This can be interpreted in different ways and therefore the calculation of the target reproducibility can be done differently:

1) The target reproducibility is estimated as 30% of the mean. This results in the following calculation: R(target) = 0.3 * mean of the PT.
2) The relative standard deviation (RSD) is estimated as 30%. This results in the following calculation: R(target) = 0.3 * mean of the PT * 2.8.

To verify both calculations iis started an investigation. The calculated R(target) was compared to observed reproducibility (R(calc)) from iis PTs from 2001 -2021, see Figure 1 below. We also added the R(target) calculated according to iis memo 1702 which was used from 2016-2020. NB: In the graph is calculation 1 = reproducibility 30% and RSD 30% is calculation 2.

The target reproducibility describes the observed precision best when R(target) = R(calc).

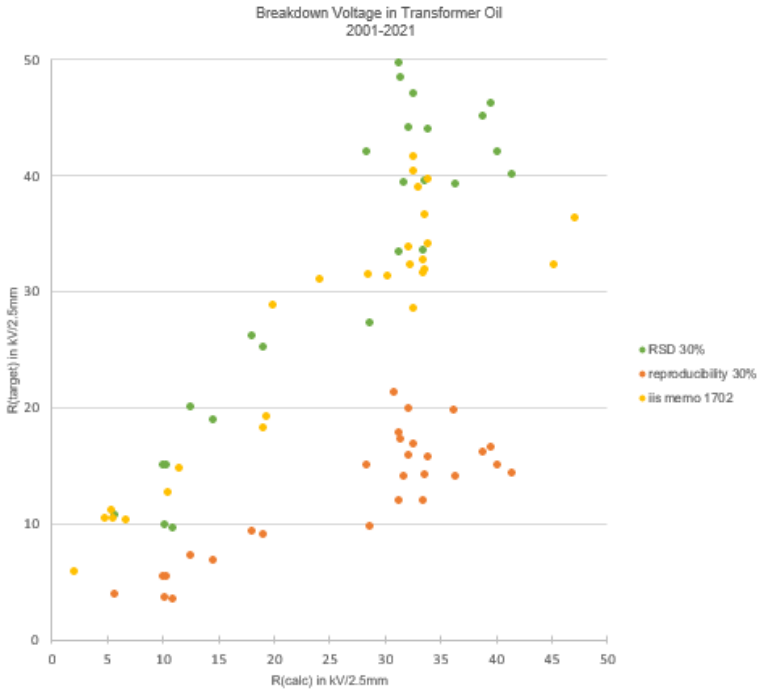


Figure 1: The target reproducibility vs the calculated reproducibility of the Breakdown Voltage in iis PTs from 2001 to 2021

It can be concluded that the target reproducibility based on a relative standard deviation of 30% is more in line with the target reproducibility based iis memo 1702. And that the best precision (R(target) = R(calc)) is best described with R(target) = 0.3 * mean of the PT * 2.8. The target reproducibility based on a reproducibility of 30% gives an underestimation when compared to the observed reproducibility.
Therefore, iis decided that starting from the 2021 PT the target reproducibility will be determined using the calculation of the relative standard deviation estimated as 30%: R(target) = 0.3 * mean of the PT * 2.8.

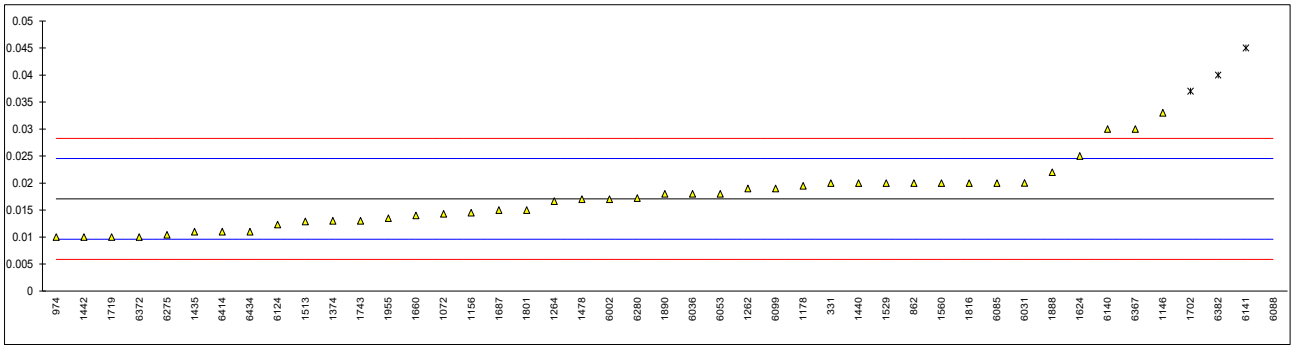
APPENDIX 1

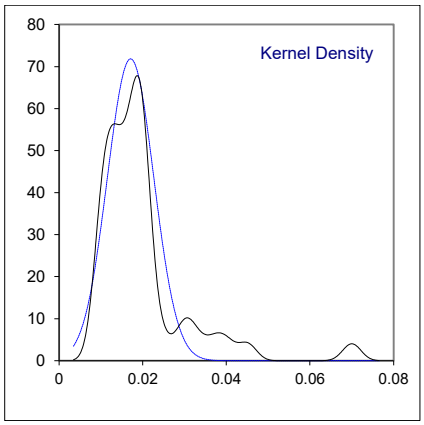
Determination of Total Acid Number (Potentiometric) on sample #21241; results in mg KOH/g

lab	method	value	mark	z(targ)	End point	Vol. solv.	remarks
179	D664	<0.01		-----	Inflection Point	60 mL	
237	D664-A	<0.1		-----	Inflection Point	125 mL	
325		-----		-----	---	---	
331	D664Mod.	0.02		0.78	Inflection Point	60 mL	
398		-----		-----	---	---	
445		-----		-----	---	---	
455		-----		-----	---	---	
511		-----		-----	---	---	
614		-----		-----	---	---	
657	D664-A	<0.1		-----	Inflection Point	60 mL	
862	D664-A	0.02		0.78	Inflection Point	60 mL	
902		-----		-----	---	---	
912		-----		-----	---	---	
913		-----		-----	---	---	
963		-----		-----	---	---	
974	D664-A	0.01		-1.90	Inflection Point	125 mL	
975		-----		-----	---	---	
1072	In house	0.0143		-0.75	Inflection Point	60 mL	
1135		-----		-----	---	---	
1146	D664	0.033		4.27	Buffer End Point pH 10	125 mL	
1156	EN62021-1	0.0145		-0.69	Buffer End Point pH 11	---	
1178	EN62021-1	0.0195		0.65	---	---	
1262	EN62021-1	0.019		0.51	Buffer End Point pH 11	60 mL	
1264	D664-A	0.01667		-0.11	Inflection Point	60 mL	
1304		-----		-----	---	---	
1306		-----		-----	---	---	
1352		-----		-----	---	---	
1374	D664-A	0.013		-1.09	Inflection Point	60 mL	
1430		-----		-----	---	---	
1435	D664-A	0.011		-1.63	---	---	
1440	EN62021-1	0.02		0.78	Buffer End Point pH 11	60 mL	
1442	IEC62021-1	0.010		-1.90	Inflection Point	60 mL	
1444		-----		-----	---	---	
1458		-----		-----	---	---	
1461		-----		-----	---	---	
1478	IEC62021-1	0.0170		-0.02	Buffer End Point pH 11	---	
1505		-----		-----	---	---	
1513	IEC62021-1	0.0129		-1.12	Buffer End Point pH 11	---	
1529	IEC62021-1	0.020		0.78	Buffer End Point pH 11	20 mL	
1545		-----		-----	---	---	
1560	IEC62021-1	0.02		0.78	Buffer End Point pH 11	60 mL	
1624	IEC62021-1	0.025		2.12	Buffer End Point pH 11	60 mL	
1660	IEC62021-1	0.014		-0.83	Buffer End Point pH 11	60 mL	
1687	D664-A	0.015		-0.56	Buffer End Point pH 10	60 mL	
1702	IEC62021-1	0.037	R(0.05)	5.34	Buffer End Point pH 11	60 mL	
1719	D664-A	0.01		-1.90	Inflection Point	60 mL	
1743	IEC62021-1	0.013		-1.09	Buffer End Point pH 11	60 mL	
1801	EN62021-1	0.015		-0.56	Buffer End Point pH 11	125 mL	
1816	EN62021-1	0.020		0.78	Inflection Point	60 mL	
1885		-----		-----	Buffer End Point pH 11	60 mL	
1888	EN62021-1	0.022		1.32	Buffer End Point pH 11	60 mL	
1890	ISO6619	0.018		0.25	---	---	
1891		-----		-----	---	---	
1955	D664-A	0.0135		-0.96	---	---	
6002	D664-A	0.017		-0.02	Buffer End Point pH 11	60 mL	
6015		-----		-----	---	---	
6031	D664-A	0.02003		0.79	Inflection Point	60 mL	
6036	EN62021-1	0.018		0.25	---	---	
6053	IEC62021-1	0.018		0.25	Buffer End Point pH 11	60 mL	
6085	D8045	0.02		0.78	Inflection Point	60 mL	
6088	IEC62021-1	0.07	C,R(0.01)	14.19	Inflection Point	60 mL	First reported 0.04
6099	IEC62021-1	0.019		0.51	Buffer End Point pH 11	60 mL	
6124	D664-A	0.0123		-1.28	Buffer End Point pH 11	60 mL	
6140	EN62021-1	0.030		3.46	---	---	
6141	D664-A	0.045	R(0.05)	7.48	Buffer End Point pH 10	80 mL	
6166		-----		-----	---	---	
6167		-----		-----	---	---	
6275	IEC62021-1	0.0104		-1.79	Buffer End Point pH 11	60 mL	
6278		-----		-----	---	---	
6280	IEC62021-1	0.0172		0.03	Inflection Point	125 mL	
6334		-----		-----	---	---	
6367	EN62021-1	0.03		3.46	---	60 mL	
6372	IEC62021-1	0.01		-1.90	Inflection Point	50 mL	
6382	EN62021-1	0.04	R(0.05)	6.14	Inflection Point	60 mL	

lab	method	value	mark	z(targ)	End point	Vol. solv.	remarks
6385		-----		-----	---	---	
6393		-----		-----	---	---	
6402		-----		-----	---	---	
6414	D664-A	0.011		-1.63	Inflection Point	50 mL	
6422		-----		-----	---	---	
6434	EN62021-1	0.011		-1.63	Buffer End Point pH 11	40 mL	

			only D664	only EN/IEC 62021-1
	normality	suspect	OK	not OK
	n	41	13	26
	outliers	4	2	1
	mean (n)	0.0171	0.0146	0.0193
	st.dev. (n)	0.00555	0.00382	0.00774
	R(calc.)	0.0155	0.0107	0.0217
	st.dev.(D664-A:18e2, BEP 60mL)	0.00373	0.00320	---
	R(D664-A:18e2, BEP 60mL)	0.0104	0.0089	---
	Compare			
	R(EN62021-1:03)	0.0060	---	0.0068
	R(D664-A:18e2, IP 125mL)	0.0031	0.0027	---
	R(D664-A:18e2, IP 60mL)	0.0143	0.0126	---
	R(D664-A:18e2, BEP 125mL)	0.0044	0.0037	---



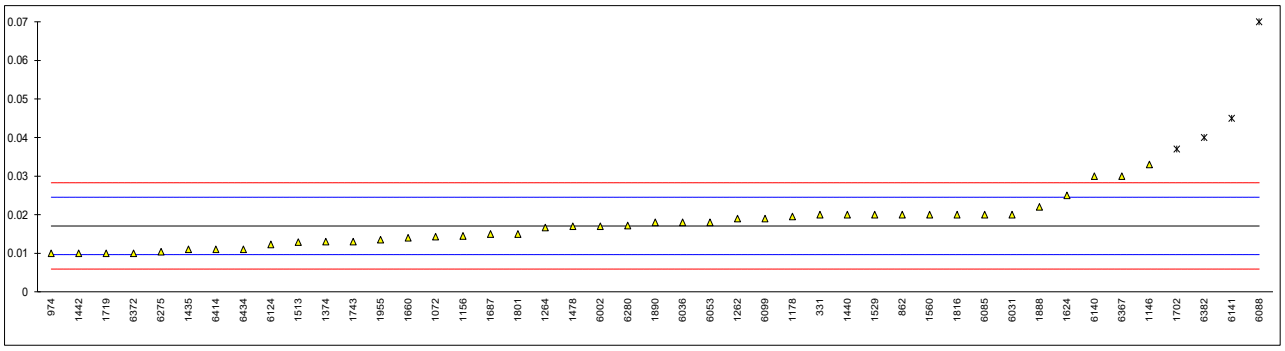


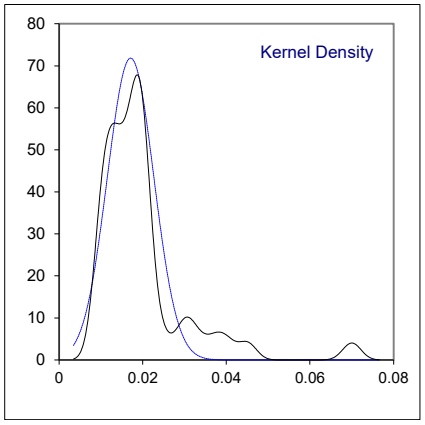
Determination of Total Aid Number (Colorimetric) on sample #21241; results in mg KOH/g

lab	method	value	mark	z(targ)	remarks
179	D974	<0.02		-----	
237	D974	0.013		-0.11	
325		-----		-----	
331		-----		-----	
398		-----		-----	
445		-----		-----	
455	D974	0.02		0.38	
511	D974	0.02		0.38	
614	D974	0.022		0.52	
657	D974	<0.02		-----	
862	D974	0.018		0.24	
902	D974	0.01		-0.32	
912	D974	0.0091		-0.39	
913		-----		-----	
963	D974	0.0155		0.06	
974	D974	0.01		-0.32	
975		-----		-----	
1072	IEC62021-2	0.0140		-0.04	
1135	D974	0.02		0.38	
1146		-----		-----	
1156		-----		-----	
1178		-----		-----	
1262	ISO6618	0.022		0.52	
1264	D974	0.015301		0.05	
1304	In house	0.006		-0.60	
1306	D974	0.00974		-0.34	
1352	IEC62021-2	0.02301		0.59	
1374		-----		-----	
1430	EN62021-2	0.0090		-0.39	
1435		-----		-----	
1440	ISO6618	0.012	C	-0.18	First reported 0.06
1442		-----		-----	
1444		-----		-----	
1458	D974	0.013		-0.11	
1461		-----		-----	
1478		-----		-----	
1505	D974	0.007		-0.53	
1513	IEC62021-2	0.0118		-0.20	
1529		-----		-----	
1545	D974	0.022	C	0.52	First reported 0.038
1560		-----		-----	
1624		-----		-----	
1660		-----		-----	
1687		-----		-----	
1702		-----		-----	
1719		-----		-----	
1743	ISO6618	0.014		-0.04	
1801		-----		-----	
1816		-----		-----	
1885	D974	0.018		0.24	
1888		-----		-----	
1890		-----		-----	
1891	IEC62021-2	0.01		-0.32	
1955	IEC62021-2	0.01155		-0.22	
6002	EN62021-2	0.015		0.03	
6015		-----		-----	
6031	D974	0.019085		0.31	
6036		-----		-----	
6053		-----		-----	
6085		-----		-----	
6088		-----		-----	
6099		-----		-----	
6124		-----		-----	
6140		-----		-----	
6141	D974	0.054	R(0.01)	2.76	
6166	D974	0.01		-0.32	
6167		-----		-----	
6275	D974	0.01166		-0.21	
6278	D974	0.014		-0.04	
6280	IEC62021-2	0.0183		0.26	
6334	IEC62021-2	0.024		0.66	
6367		-----		-----	
6372		-----		-----	
6382		-----		-----	
6385	D974	0.010		-0.32	

lab	method	value	mark	z(targ)	remarks
6393	EN62021-2	0.01		-0.32	
6402		0.2464	R(0.01)	16.22	
6414		-----		-----	
6422	IEC62021-2	0.019		0.31	
6434		-----		-----	

		Only ASTM D974/ISO6618/IP139	Only EN/IEC 62021-2
normality	OK	OK	OK
n	36	24	11
outliers	2	1	0
mean (n)	0.0146	0.0148	0.0151
st.dev. (n)	0.00499	0.00472	0.00530
R(calc.)	0.0140	0.0132	0.0148
st.dev.(D974:21)	0.01429	0.01429	--
R(D974:21)	0.04	0.04	--
Compare			
R(EN62021-2:07)	0.0029	--	0.0030



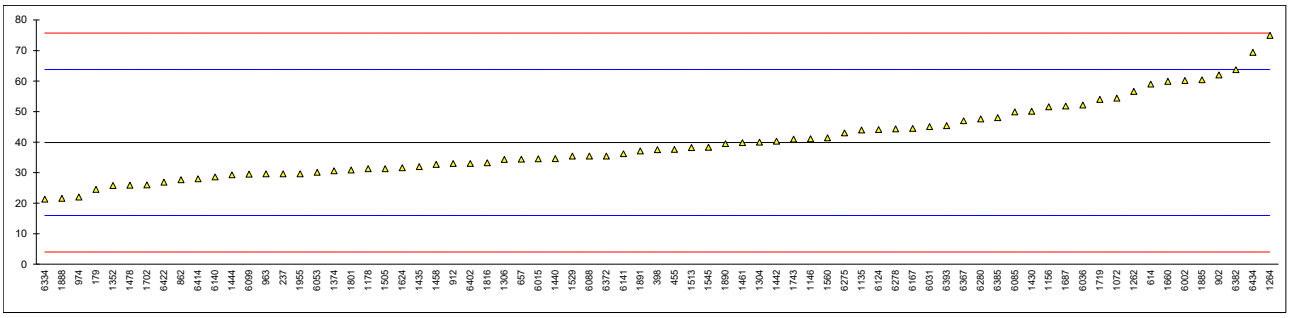


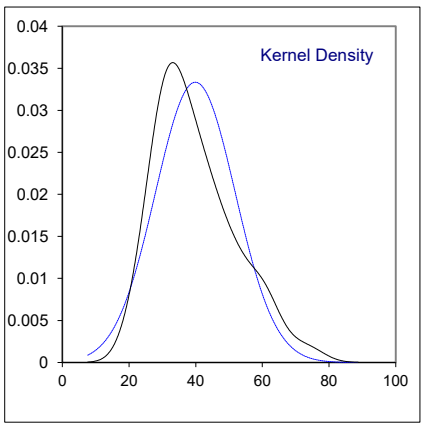
Determination of Breakdown Voltage on sample #21241, results in kV/2.5 mm

lab	method	value	mark	z(targ)	stirred	remarks
179	D877	24.5		-1.29	Yes	
237	IEC60156	29.6		-0.86	Yes	
325		-----		-----	---	
331		-----		-----	Yes	
398	EN60156	37.5		-0.20	---	
445		-----		-----	---	
455	EN60156	37.6		-0.19	---	
511		-----		-----	---	
614	EN60156	59		1.60	Yes	
657	IEC60156	34.4		-0.46	No	
862	IEC60156	27.7		-1.02	Yes	
902	EN60156	62		1.85	Yes	
912	EN60156	33		-0.57	---	
913		-----		-----	---	
963	IEC60156	29.6		-0.86	---	
974	EN60156	22		-1.49	Yes	
975		-----		-----	---	
1072	EN60156	54.4		1.21	Yes	
1135	IEC60156	44		0.34	---	
1146	IEC156	41.1		0.10	Yes	
1156	EN60156	51.6		0.98	---	
1178	IEC60156	31.3		-0.72	---	
1262	EN60156	56.6		1.40	Yes	
1264	EN60156	75		2.94	No	
1304	IEC60156	40.0		0.01	Yes	
1306	IEC60156	34.3		-0.47	---	
1352	IEC60156	25.8		-1.18	No	
1374	IEC60156	30.6		-0.78	Yes	
1430	EN60156	50.1		0.85	Yes	
1435	IEC60156	32		-0.66	---	
1440	EN60156	34.6		-0.44	Yes	
1442	IEC60156	40.3		0.04	Yes	
1444	IEC60156	29.3		-0.88	Yes	
1458	IEC60156	32.7		-0.60	Yes	
1461		39.8		-0.01	Yes	
1478	IEC60156	25.9		-1.17	Yes	
1505	IEC60156	31.3		-0.72	Yes	
1513	IEC60156	38.2		-0.14	Yes	
1529	IEC60156	35.4		-0.37	Yes	
1545	IEC60156	38.3		-0.13	---	
1560	IEC60156	41.4		0.13	Yes	
1624	IEC60156	31.6		-0.69	No	
1660	IEC60156	59.9		1.67	Yes	
1687	EN60156	51.8		1.00	No	
1702	IEC60156	26.0		-1.16	Yes	
1719	IEC60156	54		1.18	Yes	
1743	IEC60156	41		0.09	No	
1801	EN60156	30.9		-0.75	Yes	
1816	EN60156	33.2		-0.56	Yes	
1885	IEC60156	60.4		1.72	No	
1888	IEC60156	21.6		-1.53	Yes	
1890	IEC60156	39.5		-0.03	Yes	
1891	IEC60156	37.1		-0.23	Yes	
1955	IEC60156	29.6		-0.86	---	
6002	EN60156	60.2		1.70	Yes	
6015	EN60156	34.55		-0.45	Yes	
6031	IEC60156	45.1		0.44	No	
6036	EN60156	52.18		1.03	No	
6053	IEC60156	30.1		-0.82	Yes	
6085	IEC60156	49.9		0.84	Yes	
6088	IEC60156	35.4		-0.37	Yes	
6099	IEC60156	29.5		-0.87	No	
6124	IEC60156	44.1		0.35	Yes	
6140	EN60156	28.6		-0.94	Yes	
6141	IEC60156	36.2		-0.31	Yes	
6166		-----		-----	---	
6167	IEC60156	44.5		0.39	Yes	
6275	IEC60156	43		0.26	No	
6278	IEC60156	44.35		0.37	No	
6280	IEC60156	47.6		0.65	Yes	
6334	IEC60156	21.3		-1.55	Yes	
6367	IEC60156	47		0.60	Yes	
6372	IEC60156	35.4		-0.37	Yes	
6382	IEC60156	63.7		1.99	Yes	
6385	D877	48		0.68	No	

lab	method	value	mark	z(targ)	stirred	remarks
6393	EN60156	45.4		0.46	Yes	
6402	IEC156	33.0		-0.57	Yes	
6414	IEC60156	28.0		-0.99	Yes	
6422	IEC60156	26.9		-1.08	Yes	
6434	EN60156	69.4	C	2.47	Yes	First reported 81.3

		Only 'stirred'	Only 'not stirred'
normality	OK	OK	OK
n	73	49	13
outliers	0	0	0
mean (n)	39.875	39.387	44.779
st.dev. (n)	11.9621	12.2651	13.4306
R(calc.)	33.494	34.342	37.606
st.dev.(IEC60156:18)	11.9625	11.8160	13.4338
R(IEC60156:18)	33.495	33.085	37.615



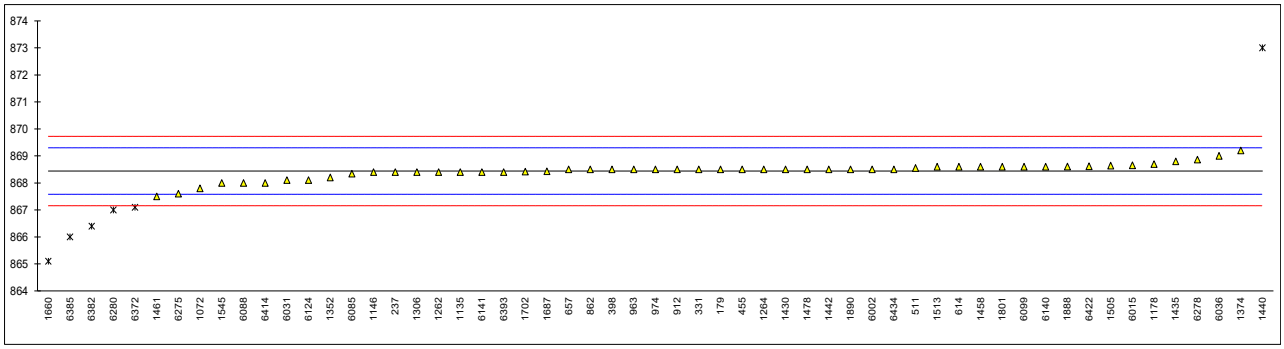


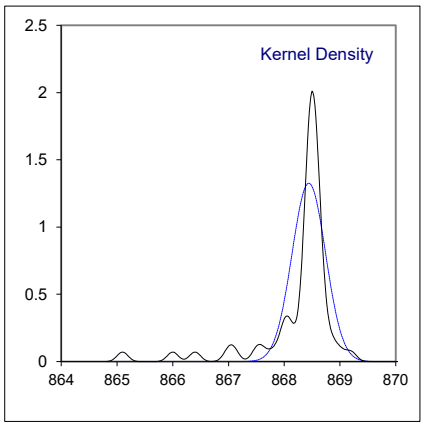
Determination of Density at 20°C on sample #21241; results in kg/m^3

lab	method	value	mark	z(targ)	remarks
179	D4052	868.5		0.14	
237	D4052	868.4		-0.10	
325		-----		-----	
331	ISO12185	868.5		0.14	
398	ISO12185	868.5		0.14	
445		-----		-----	
455	ISO3675	868.5		0.14	
511	D4052	868.55		0.25	
614	D4052	868.6		0.37	
657	D4052	868.50		0.14	
862	D4052	868.5		0.14	
902		-----		-----	
912	D4052	868.5		0.14	
913		-----		-----	
963	D4052	868.5		0.14	
974	D4052	868.5		0.14	
975		-----		-----	
1072	ISO3675	867.8		-1.50	
1135	ISO3675	868.4	C	-0.10	First reported 0.8684 kg/m^3
1146	D4052	868.4		-0.10	
1156		-----		-----	
1178	ISO12185	868.7		0.60	
1262	D4052	868.4		-0.10	
1264	D4052	868.50		0.14	
1304		-----		-----	
1306	D4052	868.4		-0.10	
1352	D7042	868.2		-0.56	
1374	D4052	869.2		1.77	
1430	D4052	868.5		0.14	
1435	D4052	868.8		0.84	
1440	ISO3675	873	C,R(0.01)	10.64	Reported 0.873 kg/m^3
1442	ISO12185	868.50		0.14	
1444		-----		-----	
1458	D4052	868.6		0.37	
1461		867.5		-2.20	
1478	ISO12185	868.5		0.14	
1505	D7042	868.64	C	0.46	First reported 872.0
1513	ISO12185	868.598		0.37	
1529		-----		-----	
1545	ISO3675	868.0		-1.03	
1560		-----		-----	
1624		-----		-----	
1660	D7042	865.1	C,R(0.01)	-7.80	Reported 0.8651 kg/m^3
1687	ISO12185	868.43		-0.03	
1702	ISO12185	868.42		-0.05	
1719		-----		-----	
1743		-----		-----	
1801	ISO3675	868.6		0.37	
1816		-----		-----	
1885		-----		-----	
1888	D4052	868.606		0.38	
1890	ISO12185	868.5		0.14	
1891		-----		-----	
1955		-----		-----	
6002	ISO12185	868.5		0.14	
6015	ISO12185	868.65		0.49	
6031	D1298	868.1		-0.80	
6036		869		1.30	
6053		-----		-----	
6085	D7042	868.34		-0.24	
6088	ISO3675	868		-1.03	
6099	ISO12185	868.6		0.37	
6124	D7042	868.1		-0.80	
6140	ISO3675	868.6		0.37	
6141	D4052	868.4		-0.10	
6166		-----		-----	
6167		-----		-----	
6275	D4052	867.6		-1.96	
6278	D1298	868.859392		0.98	
6280		867	C,R(0.01)	-3.36	First reported 0.867 kg/m^3
6334		-----		-----	
6367		-----		-----	
6372	ISO3675	867.1	R(0.01)	-3.13	
6382	DIN51757	866.4	R(0.01)	-4.76	
6385	D1298	866	R(0.01)	-5.70	

lab	method	value	mark	z(targ)	remarks
6393	ISO12185	868.4	C	-0.10	First reported 862.4
6402		-----		-----	
6414		868	C	-1.03	First reported 0.868 kg/m^3
6422	D4052	868.615		0.40	
6434	ISO12185	868.5		0.14	

normality	not OK
n	51
outliers	6
mean (n)	868.441
st.dev. (n)	0.3006
R(calc.)	0.842
st.dev.(ISO3675:98)	0.4286
R(ISO3675:98)	1.2
Compare	
R(D4052:18a)	0.5
R(ISO12185:96)	0.5
R(D1298:12b)	1.2



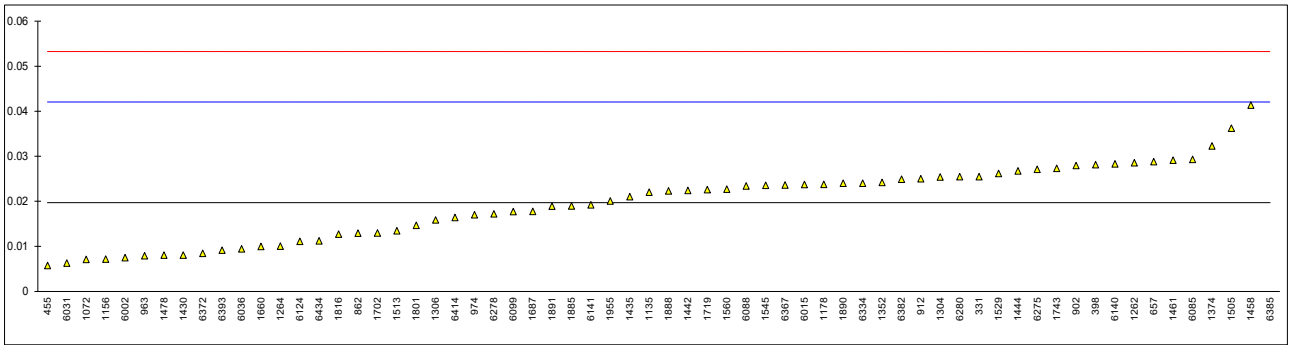


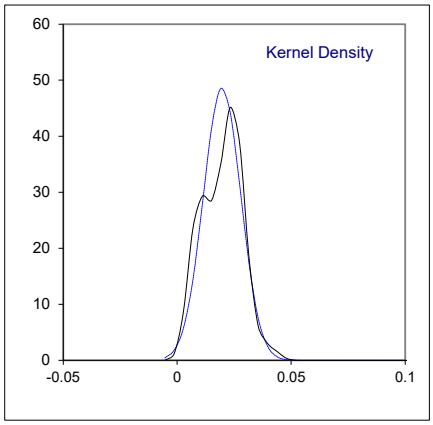
Determination of Di-electric Dissipation Factor (DDF) at 90°C on sample #21241

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
325		-----		-----	
331	D924	0.025489		0.52	
398	EN60247	0.028133		0.75	
445		-----		-----	
455	EN60247	0.005736		-1.25	
511		-----		-----	
614		-----		-----	
657	IEC60247	0.028794		0.81	
862	IEC60247	0.0129		-0.61	
902	EN60247	0.027951		0.74	
912	IEC60247	0.0250		0.48	
913		-----		-----	
963	IEC60247	0.0079		-1.05	
974	EN60247	0.0170		-0.24	
975		-----		-----	
1072	EN60247	0.00709		-1.12	
1135	IEC60247	0.0220		0.21	
1146		-----		-----	
1156	EN60247	0.00714		-1.12	
1178	IEC60247	0.02375		0.36	
1262	EN60247	0.02857		0.79	
1264	EN60247	0.010046		-0.86	
1304	IEC60247	0.025414		0.51	
1306	IEC60247	0.015859		-0.34	
1352	IEC60247	0.02419		0.40	
1374	IEC60247	0.032308		1.13	
1430	EN60247	0.008063		-1.04	
1435	IEC60247	0.0210		0.12	
1440		-----		-----	
1442	IEC60247	0.02239		0.24	
1444	IEC60247	0.026766		0.63	
1458	IEC60247	0.041394		1.94	
1461		0.029115		0.84	
1478	IEC60247	0.008053		-1.04	
1505	IEC60247	0.036265		1.48	
1513	IEC60247	0.01345		-0.56	
1529	IEC60247	0.02618		0.58	
1545	IEC60247	0.02355		0.35	
1560	IEC60247	0.022717		0.27	
1624		-----		-----	
1660	IEC60247	0.009976		-0.87	
1687	EN60247	0.01774		-0.17	
1702	IEC60247	0.01294		-0.60	
1719	IEC60247	0.0226		0.26	
1743	IEC60247	0.0273		0.68	
1801	EN60247	0.01468		-0.45	
1816	EN60247	0.0127		-0.62	
1885	IEC60247	0.01896		-0.06	
1888	EN60247	0.022308		0.23	
1890	IEC60247	0.024023		0.39	
1891	IEC60247	0.01893		-0.07	
1955	IEC60247	0.0200665		0.03	
6002	EN60247	0.00748		-1.09	
6015	EN60247	0.0237285		0.36	
6031	IEC60247	0.006248		-1.20	
6036	EN60247	0.009429		-0.92	
6053		-----		-----	
6085	IEC60247	0.029329		0.86	
6088	IEC60247	0.0234		0.33	
6099	IEC60247	0.017717		-0.18	
6124	IEC60247	0.0110925		-0.77	
6140	EN60247	0.028309		0.77	
6141	IEC60247	0.019202		-0.04	
6166		-----		-----	
6167		-----		-----	
6275	IEC60247	0.027113		0.66	
6278	IEC60247	0.017215		-0.22	
6280	IEC60247	0.025483		0.52	
6334	IEC60247	0.02403		0.39	
6367	IEC60247	0.0236		0.35	
6372	IEC60247	0.00842		-1.01	
6382	IEC60247	0.02490		0.47	
6385	D924	1.029	R(0.01)	90.16	

lab	method	value	mark	z(targ)	remarks
6393	EN60247	0.00914		-0.94	
6402		-----		-----	
6414	IEC60247	0.01642		-0.29	
6422		-----		-----	
6434	EN60247	0.01122		-0.76	

normality	OK
n	63
outliers	1
mean (n)	0.019681
st.dev. (n)	0.0082067
R(calc.)	0.022979
st.dev.(EN60247:04)	0.0111948
R(EN60247:04)	0.031346



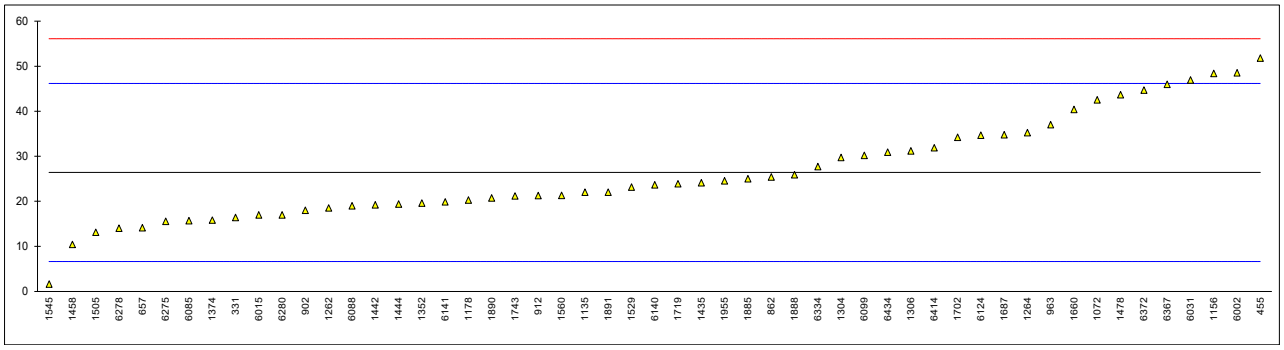


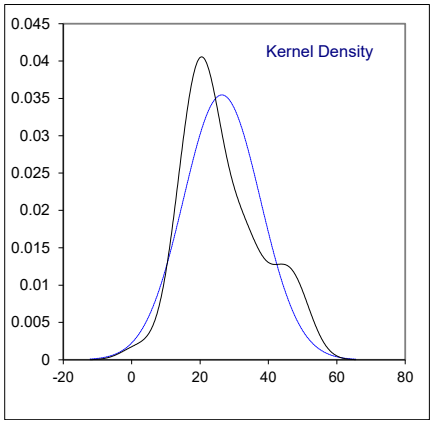
Determination of Specific Resistance at 90°C on sample #21241; results in GΩm

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
325		-----		-----	
331	D924	16.39		-1.01	
398		-----		-----	
445		-----		-----	
455	EN60247	51.79	C	2.56	Reported 51.79x10^{9} GΩm
511		-----		-----	
614		-----		-----	
657	IEC60247	14.12		-1.24	
862	IEC60247	25.41		-0.10	
902	EN60247	18		-0.85	
912	IEC60247	21.27		-0.52	
913		-----		-----	
963	IEC60247	37		1.07	
974		-----		-----	
975		-----		-----	
1072	EN60247	42.53		1.63	
1135	IEC60247	22		-0.44	
1146		-----		-----	
1156	EN60247	48.4		2.22	
1178	IEC60247	20.3		-0.62	
1262	EN60247	18.5		-0.80	
1264	EN60247	35.255		0.89	
1304	IEC60247	29.74		0.34	
1306	IEC60247	31.20		0.48	
1352	IEC60247	19.60		-0.69	
1374	IEC60247	15.82		-1.07	
1430		-----		-----	
1435	IEC60247	24.13		-0.23	
1440		-----		-----	
1442	IEC60247	19.22		-0.73	
1444	IEC60247	19.38		-0.71	
1458	IEC60247	10.4		-1.62	
1461		-----		-----	
1478	IEC60247	43.66		1.74	
1505	IEC60247	13.108		-1.34	
1513		-----		-----	
1529	IEC60247	23.17		-0.33	
1545	IEC60247	1.627	C	-2.50	First reported 1627
1560	IEC60247	21.315		-0.51	
1624		-----		-----	
1660	IEC60247	40.41		1.42	
1687	EN60247	34.80		0.85	
1702	IEC60247	34.20		0.79	
1719	IEC60247	23.9		-0.25	
1743	IEC60247	21.2		-0.53	
1801		-----		-----	
1816		-----		-----	
1885	IEC60247	25		-0.14	
1888	EN60247	25.89		-0.05	
1890	IEC60247	20.74		-0.57	
1891	IEC60247	22.0		-0.44	
1955	IEC60247	24.5375		-0.19	
6002	EN60247	48.54		2.24	
6015	EN60247	16.960		-0.95	
6031	IEC60247	46.94		2.07	
6036		-----		-----	
6053		-----		-----	
6085	IEC60247	15.66		-1.08	
6088	IEC60247	19		-0.75	
6099	IEC60247	30.19		0.38	
6124	IEC60247	34.695		0.84	
6140	EN60247	23.65		-0.28	
6141	IEC60247	19.88		-0.66	
6166		-----		-----	
6167		-----		-----	
6275	IEC60247	15.525		-1.10	
6278	IEC60247	14		-1.25	
6280	IEC60247	16.96		-0.95	
6334	IEC60247	27.7		0.13	
6367	EN60247	46		1.98	
6372	IEC60247	44.7		1.85	
6382		-----		-----	
6385		-----		-----	

lab	method	value	mark	z(targ)	remarks
6393		-----		-----	Reported +40/-42.2
6402		-----		-----	
6414	IEC60247	31.9		0.56	
6422		-----		-----	
6434	EN60247	30.9		0.45	

normality	OK
n	53
outliers	0
mean (n)	26.400
st.dev. (n)	11.2501
R(calc.)	31.500
st.dev.(EN60247:04)	9.9001
R(EN60247:04)	27.720



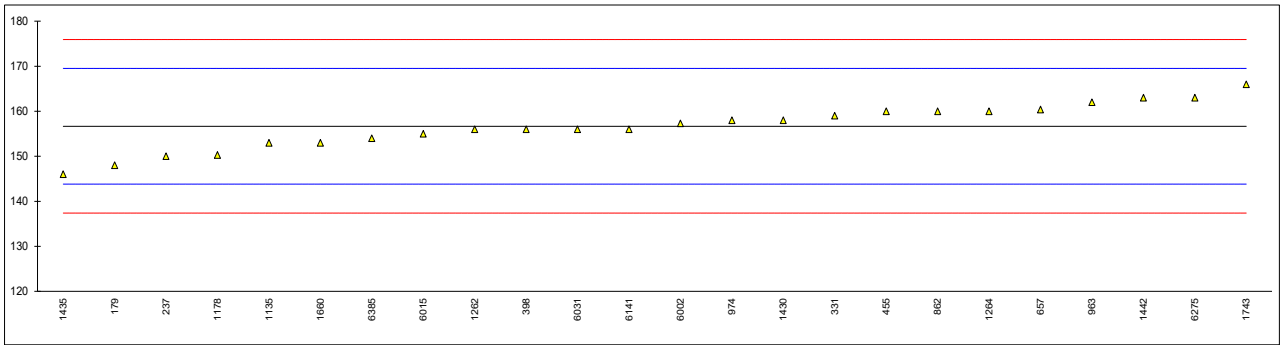


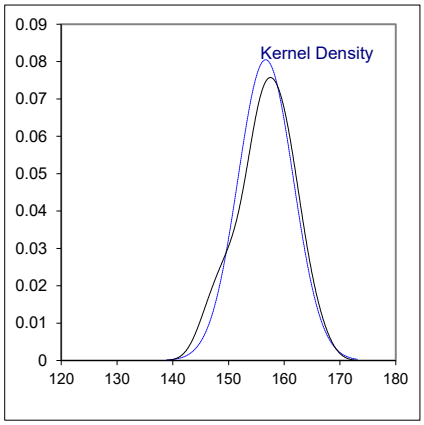
Determination of Flash Point C.O.C. on sample #21241; results in °C

lab	method	value	mark	z(targ)	remarks
179	D92	148		-1.35	
237	D92	150		-1.04	
325		-----		-----	
331	D92	159		0.36	
398	ISO2592	156		-0.10	
445		-----		-----	
455	D92	160		0.52	
511		-----		-----	
614		-----		-----	
657	D92	160.4		0.58	
862	D92	160		0.52	
902		-----		-----	
912		-----		-----	
913		-----		-----	
963	D92	162		0.83	
974	D92	158		0.21	
975		-----		-----	
1072		-----		-----	
1135	D92	153.0		-0.57	
1146		-----		-----	
1156		-----		-----	
1178	ISO2592	150.3		-0.99	
1262	ISO2592	156		-0.10	
1264	D92	160		0.52	
1304		-----		-----	
1306		-----		-----	
1352		-----		-----	
1374		-----		-----	
1430	D92	158		0.21	
1435	D92	146.0		-1.66	
1440		-----		-----	
1442	ISO2592	163.0		0.99	
1444		-----		-----	
1458		-----		-----	
1461		-----		-----	
1478		-----		-----	
1505		-----		-----	
1513		-----		-----	
1529		-----		-----	
1545		-----		-----	
1560		-----		-----	
1624		-----		-----	
1660	D92	153		-0.57	
1687		-----		-----	
1702		-----		-----	
1719		-----		-----	
1743	ISO2592	166		1.45	
1801		-----		-----	
1816		-----		-----	
1885		-----		-----	
1888		-----		-----	
1890		-----		-----	
1891		-----		-----	
1955		-----		-----	
6002	ISO2592	157.3		0.10	
6015	ISO2592	155.0		-0.26	
6031	D92	156		-0.10	
6036		-----		-----	
6053		-----		-----	
6085		-----		-----	
6088		-----		-----	
6099		-----		-----	
6124		-----		-----	
6140		-----		-----	
6141	D92	156		-0.10	
6166		-----		-----	
6167		-----		-----	
6275	D92	163		0.99	
6278		-----		-----	
6280		-----		-----	
6334		-----		-----	
6367		-----		-----	
6372		-----		-----	
6382		-----		-----	
6385	D92	154		-0.41	

lab	method	value	mark	z(targ)	remarks
6393		-----		-----	
6402		-----		-----	
6414		-----		-----	
6422		-----		-----	
6434		-----		-----	

normality	OK
n	24
outliers	0
mean (n)	156.67
st.dev. (n)	4.956
R(calc.)	13.88
st.dev.(D92:18)	6.429
R(D92:18)	18



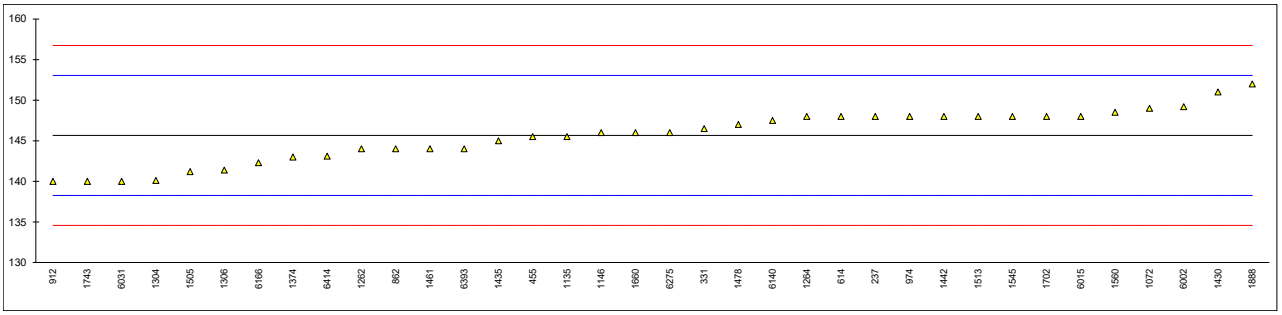


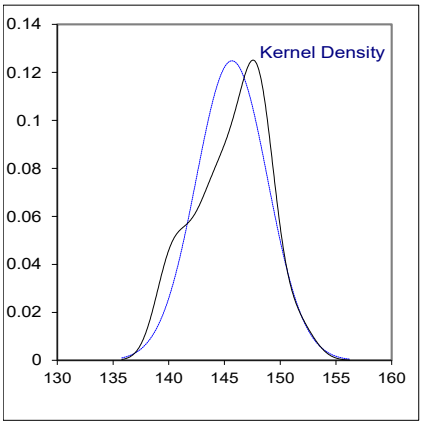
Determination of Flash Point PMcc on sample #21241; results in °C

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237	D93-B	148.0		0.63	
325		-----		-----	
331	D93-A	146.5		0.23	
398		-----		-----	
445		-----		-----	
455	ISO2719-A	145.5		-0.04	
511		-----		-----	
614	D93-A	148		0.63	
657		-----		-----	
862	D93-A	144		-0.45	
902		-----		-----	
912	ISO2719-C	140		-1.53	
913		-----		-----	
963		-----		-----	
974	D93-A	148		0.63	
975		-----		-----	
1072	ISO2719-A	149		0.90	
1135	D93-A	145.5		-0.04	
1146	D93-A	146.0		0.09	
1156		-----		-----	
1178		-----		-----	
1262	D93-A	144.0		-0.45	
1264	D93-A	148		0.63	
1304	In house	140.1		-1.51	
1306	D93-A	141.4		-1.15	
1352		-----		-----	
1374	D93-A	143.0		-0.72	
1430	D93-A	151		1.45	
1435	D93-A	145.0		-0.18	
1440		-----		-----	
1442	ISO2719-A	148.0		0.63	
1444		-----		-----	
1458		-----		-----	
1461		144	C	-0.45	First reported 156
1478	ISO2719-A	147.0		0.36	
1505	D3828	141.2		-1.21	
1513	ISO2719-A	148.0		0.63	
1529		-----		-----	
1545	ISO2719-A	148		0.63	
1560	ISO2719-A	148.5		0.77	
1624		-----		-----	
1660	D93-A	146		0.09	
1687		-----		-----	
1702	ISO2719-A	148	C	0.63	First reported 160
1719		-----		-----	
1743	ISO2719-A	140		-1.53	
1801		-----		-----	
1816		-----		-----	
1885		-----		-----	
1888	D93-B	152		1.72	
1890		-----		-----	
1891		-----		-----	
1955		-----		-----	
6002	ISO2719-A	149.2		0.96	
6015	ISO2719-A	148.0		0.63	
6031	D93-A	140		-1.53	
6036		-----		-----	
6053		-----		-----	
6085		-----		-----	
6088		-----		-----	
6099		-----		-----	
6124		-----		-----	
6140	ISO2719-A	147.5		0.50	
6141		-----		-----	
6166	IP34-A	142.3		-0.91	
6167		-----		-----	
6275	D93-A	146		0.09	
6278		-----		-----	
6280		-----		-----	
6334		-----		-----	
6367		-----		-----	
6372		-----		-----	
6382		-----		-----	
6385		-----		-----	

lab	method	value	mark	z(targ)	remarks
6393	ISO2719-A	144		-0.45	
6402		-----		-----	
6414	D93-A	143.1		-0.69	
6422		-----		-----	
6434		-----		-----	

Normality	OK
N	36
Outliers	0
mean (n)	145.66
st.dev. (n)	3.196
R(calc.)	8.95
st.dev.(ISO2719-A:16)	3.694
R(ISO2719-A:16)	10.34
Compare	
R(D93-A:20)	10.34
R(D93-B:20)	10



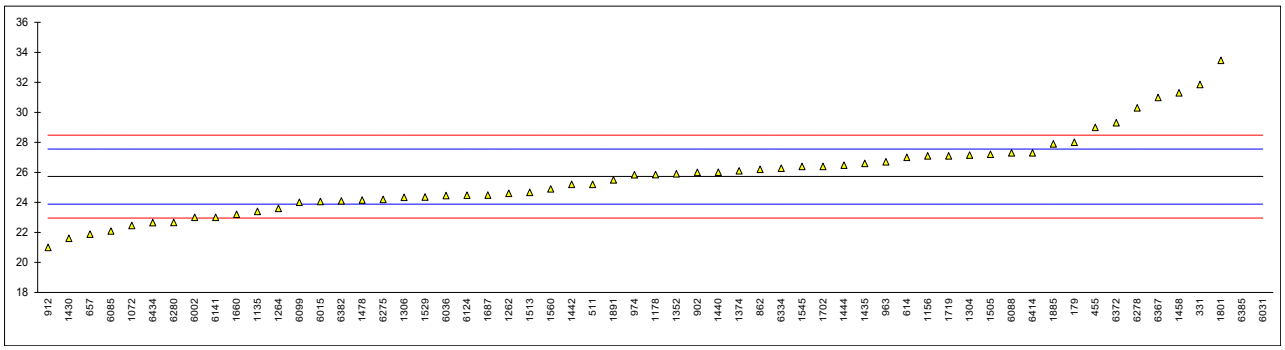


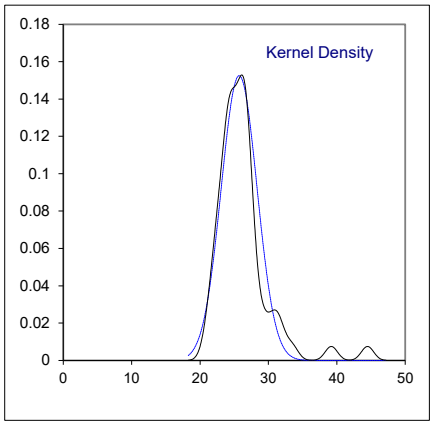
Determination of Interfacial Surface Tension on sample #21241; results in mN/m

lab	method	value	mark	z(targ)	remarks
179	D971	28		2.48	
237		-----		-----	
325		-----		-----	
331	EN14210	31.86		6.68	
398		-----		-----	
445		-----		-----	
455	D971	29		3.57	
511	D971	25.2		-0.57	
614	D971	27		1.39	
657	D971	21.88		-4.18	
862	D971	26.2		0.52	
902	D971	26		0.30	
912	D971	21	C	-5.14	First reported 18.3
913		-----		-----	
963	D971	26.7		1.06	
974	D971	25.84		0.13	
975		-----		-----	
1072	D971	22.45		-3.56	
1135	D971	23.4		-2.53	
1146		-----		-----	
1156	D971	27.1		1.50	
1178	D971	25.85		0.14	
1262	D971	24.6		-1.22	
1264	D971	23.60		-2.31	
1304	In house	27.15		1.55	
1306	D971	24.33		-1.52	
1352	D971	25.90		0.19	
1374	D971	26.10		0.41	
1430	D971	21.6		-4.49	
1435	D971	26.6		0.95	
1440	D971	26.01		0.31	
1442	EN14210	25.2		-0.57	
1444		26.48		0.82	
1458	D971	31.3		6.07	
1461		-----		-----	
1478	D971	24.16		-1.70	
1505	D971	27.2		1.61	
1513	D971	24.67		-1.15	
1529	D971	24.35		-1.49	
1545	D971	26.39		0.73	
1560	D971	24.9		-0.90	
1624		-----		-----	
1660	D971	23.2		-2.75	
1687	D971	24.48		-1.35	
1702	D971	26.39		0.73	
1719	D2285	27.1		1.50	
1743		-----		-----	
1801	D971	33.47		8.43	
1816		-----		-----	
1885	D971	27.9		2.37	
1888		-----		-----	
1890		-----		-----	
1891	D971	25.5		-0.24	
1955		-----		-----	
6002	IEC62361	23.0		-2.96	
6015	D971	24.055		-1.82	
6031	D971	44.5	C,R(0.01)	20.44	First reported 34.5
6036	IEC62361	24.4467		-1.39	
6053		-----		-----	
6085	D971	22.087		-3.96	
6088	ISO6295	27.3		1.72	
6099	ISO6295	24.0		-1.88	
6124	D971	24.47		-1.36	
6140		-----		-----	
6141	D971	23		-2.96	
6166		-----		-----	
6167		-----		-----	
6275	D971	24.2		-1.66	
6278	D971	30.3	C	4.98	First reported 36.9
6280	D971	22.66		-3.33	
6334	D971	26.28		0.61	
6367	ISO6295	31		5.74	
6372	IEC62361	29.3		3.89	
6382	ISO6295	24.1		-1.77	
6385	D971	39.2	R(0.01)	14.67	

lab	method	value	mark	z(targ)	remarks
6393		-----		-----	
6402		-----		-----	
6414	D971	27.30		1.72	
6422		-----		-----	
6434	IEC62361	22.65		-3.34	

normality	OK
n	57
outliers	2
mean (n)	25.723
st.dev. (n)	2.6153
R(calc.)	7.323
st.dev.(D971:20)	0.9187
R(D971:20)	2.572
Compare	
R(IEC62961:18)	10



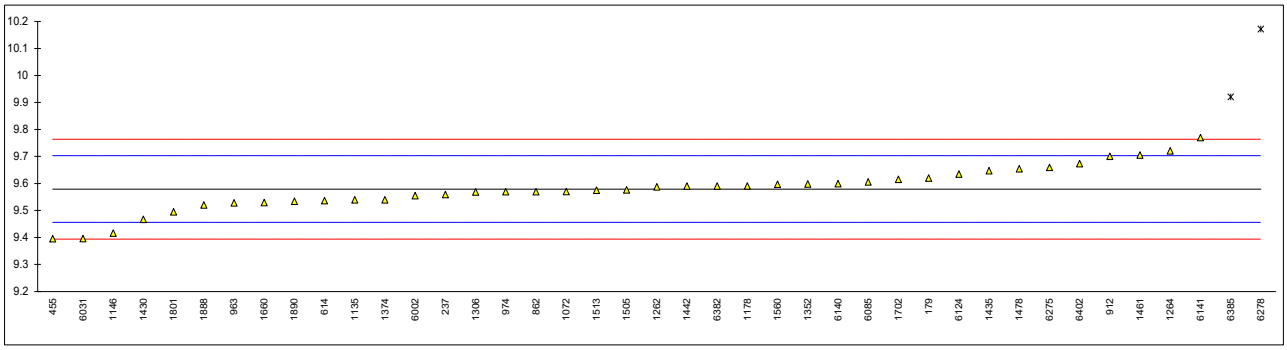


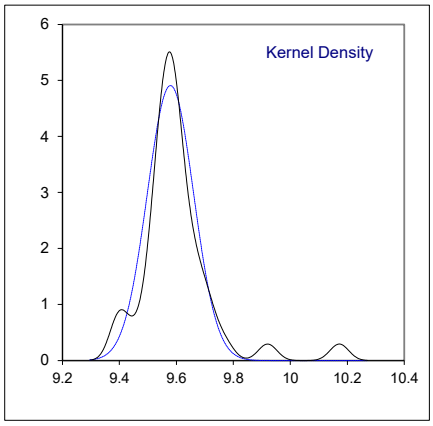
Determination of Kinematic Viscosity at 40°C on sample #21241; results in mm²/s

lab	method	value	mark	z(targ)	remarks
179	D445	9.62		0.66	
237	D445	9.559		-0.33	
325		-----		-----	
331		-----		-----	
398		-----		-----	
445		-----		-----	
455	D445	9.3952		-2.99	
511		-----		-----	
614	D7042	9.5362		-0.70	
657		-----		-----	
862	D445	9.569		-0.17	
902		-----		-----	
912	D445	9.7		1.96	
913		-----		-----	
963	D445	9.528		-0.83	
974	D445	9.569		-0.17	
975		-----		-----	
1072	ISO3104	9.57		-0.15	
1135	D445	9.539		-0.65	
1146	D445	9.416		-2.65	
1156		-----		-----	
1178	D7042	9.5907		0.19	
1262	D445	9.587		0.13	
1264	D7042	9.7202		2.29	
1304		-----		-----	
1306	D445	9.568		-0.18	
1352	D7042	9.5980		0.30	
1374	D445	9.539		-0.65	
1430	D445	9.467		-1.82	
1435	D7042	9.647		1.10	
1440		-----		-----	
1442	D7042	9.59		0.17	
1444		-----		-----	
1458		-----		-----	
1461		9.7052		2.05	
1478	D7042	9.6541		1.22	
1505	D7042	9.5759		-0.05	
1513	ISO3104	9.5751		-0.07	
1529		-----		-----	
1545		-----		-----	
1560	ISO3104	9.597		0.29	
1624		-----		-----	
1660	D7042	9.5293		-0.81	
1687		-----		-----	
1702	D7042	9.6154		0.59	
1719		-----		-----	
1743		-----	W	-----	Test result withdrawn, reported 9.280
1801	ISO3104	9.4946		-1.37	
1816		-----		-----	
1885		-----		-----	
1888	D445	9.52		-0.96	
1890	ISO3104	9.5342		-0.73	
1891		-----		-----	
1955		-----		-----	
6002	ISO3104	9.555		-0.39	
6015		-----		-----	
6031	D445	9.396		-2.98	
6036		-----		-----	
6053		-----		-----	
6085	D7042	9.6054		0.42	
6088		-----		-----	
6099		-----		-----	
6124	D7042	9.6345	C	0.90	First reported 8.2365
6140	ISO3104	9.5994		0.33	
6141	D445	9.7696		3.09	
6166		-----		-----	
6167		-----		-----	
6275	D445	9.659		1.29	
6278	D445	10.1715	C,R(0.01)	9.62	First reported 10.20162
6280		-----		-----	
6334		-----		-----	
6367		-----		-----	
6372		-----		-----	
6382	DIN51562-1	9.59		0.17	
6385	D445	9.92	R(0.01)	5.53	

lab	method	value	mark	z(targ)	remarks
6393		-----		-----	
6402		9.673		1.52	
6414		-----		-----	
6422		-----		-----	
6434		-----		-----	

normality	OK
n	39
outliers	2
mean (n)	9.5793
st.dev. (n)	0.08130
R(calc.)	0.2276
st.dev.(iis memo 1401)	0.06158
R(iis memo 1401)	0.1724
Compare	
R(D445:21e1)	0.0291
R(ISO3104-A:20)	0.1169
R(D7042:21a)	0.3646



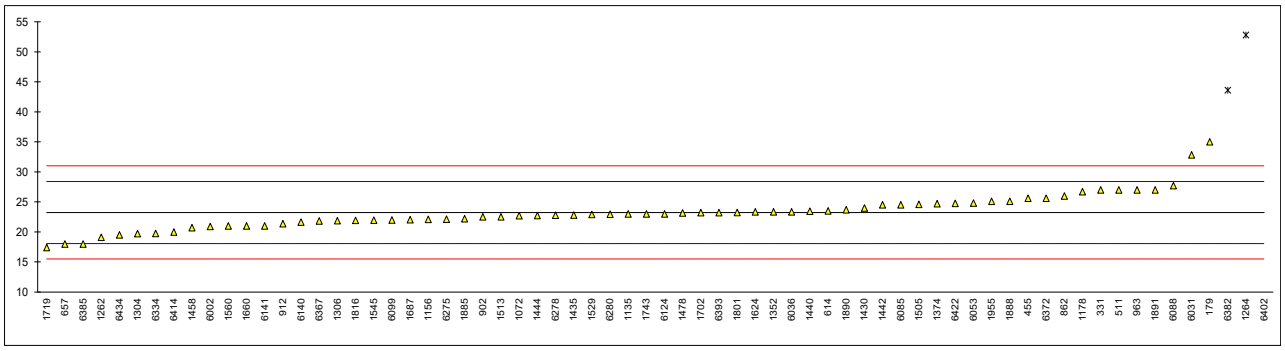


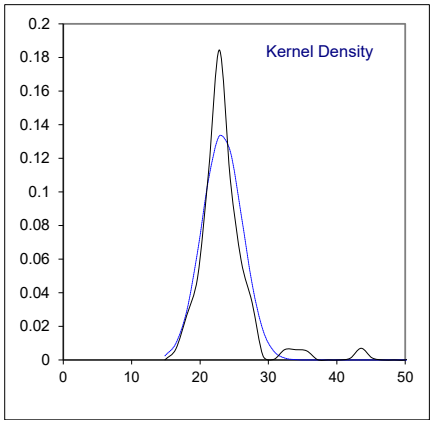
Determination of Water on sample #21241; results in mg/kg

lab	method	value	mark	z(targ)	remarks
179	D1533	35		4.55	
237		-----		-----	
325		-----		-----	
331	D6304-A	27		1.45	
398		-----		-----	
445		-----		-----	
455	IEC60814	25.6		0.91	
511	D1533	27.0	C	1.45	First reported 31.6
614	IEC60814	23.5		0.10	
657	D6304-A	18.00		-2.03	
862	D6304-A	26		1.07	
902	D1533	22.5		-0.29	
912	IS13567	21.38		-0.72	
913		-----		-----	
963	D1533	27		1.45	
974		-----		-----	
975		-----		-----	
1072	EN60814	22.7		-0.21	
1135	IEC60814	23		-0.09	
1146	D6304-C	<100		-----	
1156	EN60814	22.1		-0.44	
1178	IEC60814	26.7		1.34	
1262	EN60814	19.1		-1.60	
1264	D1533	52.8	R(0.01)	11.44	
1304	In house	19.7		-1.37	
1306	D1533	21.85		-0.54	
1352	IEC60814	23.35		0.04	
1374	IEC60814	24.7		0.56	
1430	EN60814	24		0.29	
1435	IEC60814	22.8		-0.17	
1440	EN60814	23.45		0.08	
1442	IEC60814	24.5		0.49	
1444	IEC60814	22.7220		-0.20	
1458	IEC60814	20.7		-0.99	
1461		-----		-----	
1478	IEC60814	23.15		-0.04	
1505	D1533	24.6		0.52	
1513	IEC60814	22.5		-0.29	
1529	IEC60814	22.9		-0.13	
1545	IEC60814	21.97		-0.49	
1560	IEC60814	21		-0.87	
1624	IEC60814	23.35		0.04	
1660	IEC60814	21		-0.87	
1687	EN60814	22.04		-0.47	
1702	IEC60814	23.2		-0.02	
1719	IEC60814	17.4		-2.26	
1743	IEC60814	23		-0.09	
1801	EN60814	23.25		0.00	
1816	IEC60814	21.9		-0.52	
1885	D1533	22.2		-0.40	
1888	EN60814	25.12		0.73	
1890	IEC60814	23.69		0.17	
1891	IEC60814	27.0		1.45	
1955	IEC60814	25.1		0.72	
6002	EN60814	20.9		-0.91	
6015		-----		-----	
6031	IEC60814	32.835	C	3.71	First reported 31.635 ± 4.169
6036		23.35		0.04	
6053	IEC60814	24.8		0.60	
6085	D6304-C	24.5		0.49	
6088	D1533	27.7		1.73	
6099	IEC60814	22.0		-0.48	
6124	IEC60814	23.0		-0.09	
6140	EN60814	21.63		-0.63	
6141	D1533	21		-0.87	
6166		-----		-----	
6167		-----		-----	
6275	IEC60814	22.12		-0.44	
6278	D1533	22.77		-0.18	
6280	IEC60814	22.96		-0.11	
6334	IEC60814	19.74		-1.36	
6367	IEC60814	21.8	C	-0.56	First reported 13
6372	IEC60814	25.6		0.91	
6382	EN60814	43.6	R(0.01)	7.88	
6385	D1533	18		-2.03	

lab	method	value	mark	z(targ)	remarks
6393	EN60814	23.2		-0.02	
6402		419.0	R(0.01)	153.23	
6414	IEC60814	20.0		-1.26	
6422	IEC60814	24.75		0.58	
6434	EN60814	19.5		-1.45	

normality	not OK
n	65
outliers	3
mean (n)	23.244
st.dev. (n)	2.9640
R(calc.)	8.299
st.dev.(EN60814:98)	2.5828
R(EN60814:98)	7.232
Compare	
R(D1533:12)	14
R(D6304-C:20)	13.788

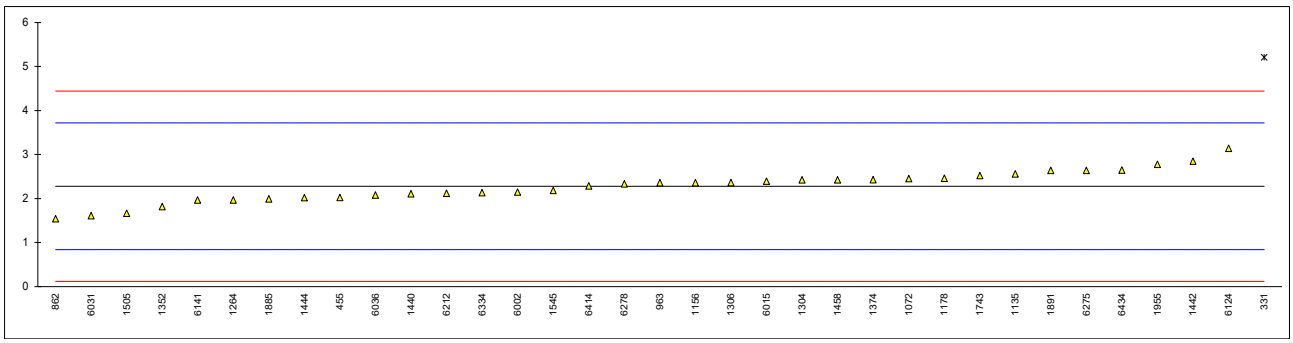


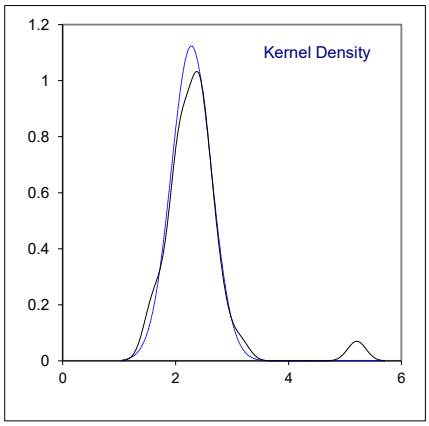


Determination of Total Furanic Compounds on sample #21242; results in mg/kg

lab	method	value	mark	z(targ)	remarks
331	EN61198	5.21	R(0.01)	4.07	
445		-----		-----	
455	EN61198	2.025		-0.35	
614		-----		-----	
862	IEC61198	1.54		-1.03	
902		-----		-----	
912		-----		-----	
963	D5837	2.36		0.11	
975		-----		-----	
1072	EN61198	2.454		0.24	
1135	IEC61198	2.56		0.39	
1156	EN61198	2.361		0.11	
1178	IEC61198	2.46185		0.25	
1264	D5837	1.96667		-0.43	
1304	In house	2.426		0.20	
1306	IEC61198	2.364266		0.12	
1352	IEC61198	1.8204		-0.64	
1374	D5837	2.43		0.21	
1430		-----		-----	
1435		-----		-----	
1440	EN61198	2.11		-0.23	
1442	IEC61198	2.85		0.79	
1444	D5837	2.020281		-0.36	
1458	IEC61198	2.428		0.21	
1478		-----		-----	
1505	D5837	1.664		-0.85	
1513		-----		-----	
1545	IEC61198	2.1857		-0.13	
1560		-----		-----	
1660		-----		-----	
1702		-----		-----	
1743	IEC61198	2.52	C	0.34	First reported 4.66
1801		-----		-----	
1885	D5837	1.991		-0.40	
1888		-----		-----	
1890		-----		-----	
1891	IEC61198	2.640		0.50	
1955	IEC61198	2.78		0.70	
6002	EN61198	2.149		-0.18	
6015	EN61198	2.3942		0.16	
6031	IEC61198	1.61029	C	-0.93	First reported 1.67170
6036	EN61198	2.082		-0.27	
6085		-----		-----	
6124	IEC61198	3.143		1.20	
6141	D5837	1.966373		-0.43	
6212	IEC61198	2.1185		-0.22	
6275	IEC61198	2.643		0.51	
6278	D5837	2.335		0.08	
6334	IEC61198	2.132		-0.20	
6414	D5837	2.29		0.02	
6434	EN61198	2.65		0.52	

normality	OK
n	34
outliers	1
mean (n)	2.2786
st.dev. (n)	0.35508
R(calc.)	0.9942
st.dev.(Horwitz)	0.72017
R(Horwitz)	2.0165
Compare	
R(IEC61198:93)	0.2279

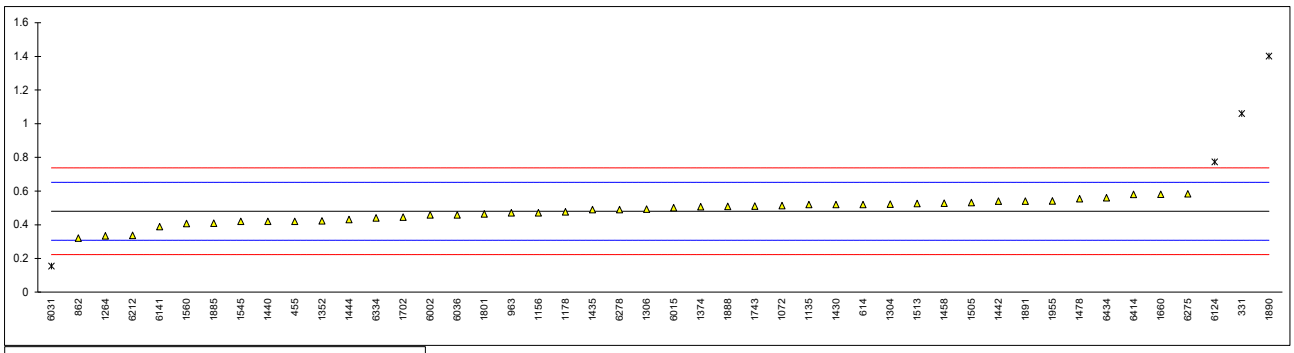

6
5
4
3
2
1
0
862
6031
1505
1352
6141
1264
1885
1444
455
6036
1440
6212
6334
6002
1545
6414
6278
963
1156
1306
6015
1304
1458
1374
1072
1178
1743
1135
1891
6275
6434
1955
1442
6124
331


Kernel Density
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6

Determination of 2-Acetyl Furan on sample #21242; results in mg/kg

lab	method	value	mark	z(targ)	remarks
331	EN61198	1.06	R(0.01)	6.76	
445		-----		-----	
455	EN61198	0.420		-0.70	
614		0.52		0.47	
862	IEC61198	0.32		-1.86	
902		-----		-----	
912		-----		-----	
963	D5837	0.471		-0.10	
975		-----		-----	
1072	EN61198	0.513		0.39	
1135	IEC61198	0.52		0.47	
1156	EN61198	0.471		-0.10	
1178	IEC61198	0.47625		-0.04	
1264	D5837	0.33392		-1.70	
1304	In house	0.522		0.49	
1306	IEC61198	0.49299		0.15	
1352	IEC61198	0.42266		-0.67	
1374	D5837	0.507		0.32	
1430		0.52		0.47	
1435		0.49		0.12	
1440	EN61198	0.42		-0.70	
1442	IEC61198	0.54		0.70	
1444	D5837	0.431307		-0.57	
1458	IEC61198	0.528		0.56	
1478		0.555		0.88	
1505	D5837	0.532		0.61	
1513		0.526		0.54	
1545	IEC61198	0.4198		-0.70	
1560		0.407		-0.85	
1660		0.581		1.18	
1702		0.445		-0.41	
1743	IEC61198	0.51		0.35	
1801		0.464		-0.19	
1885	D5837	0.409		-0.83	
1888		0.509		0.34	
1890		1.402	C,R(0.01)	10.75	First reported 0.46
1891	IEC61198	0.540		0.70	
1955	IEC61198	0.5410		0.71	
6002	EN61198	0.459		-0.24	
6015	EN61198	0.5014		0.25	
6031	IEC61198	0.15428	C,R(0.01)	-3.80	First reported 0.21569
6036	EN61198	0.459		-0.24	
6085		-----		-----	
6124	IEC61198	0.773	C,R(0.01)	3.42	First reported 0.7435
6141	D5837	0.388630		-1.06	
6212	IEC61198	0.3372		-1.66	
6275	IEC61198	0.5838		1.21	
6278	D5837	0.490		0.12	
6334	IEC61198	0.440		-0.47	
6414	D5837	0.58		1.17	
6434	EN61198	0.56		0.93	

normality	OK
n	42
outliers	4
mean (n)	0.4799
st.dev. (n)	0.06601
R(calc.)	0.1848
st.dev.(Horwitz)	0.08576
R(Horwitz)	0.2401
Compare	
R(IEC61198:93)	0.0720


1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
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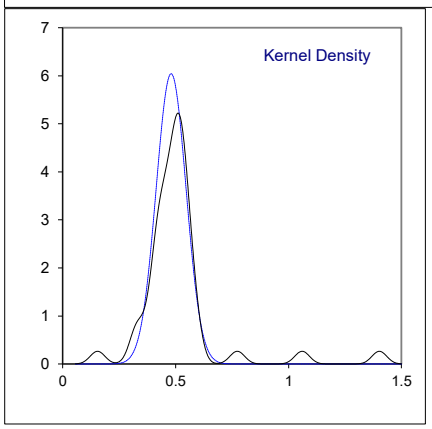
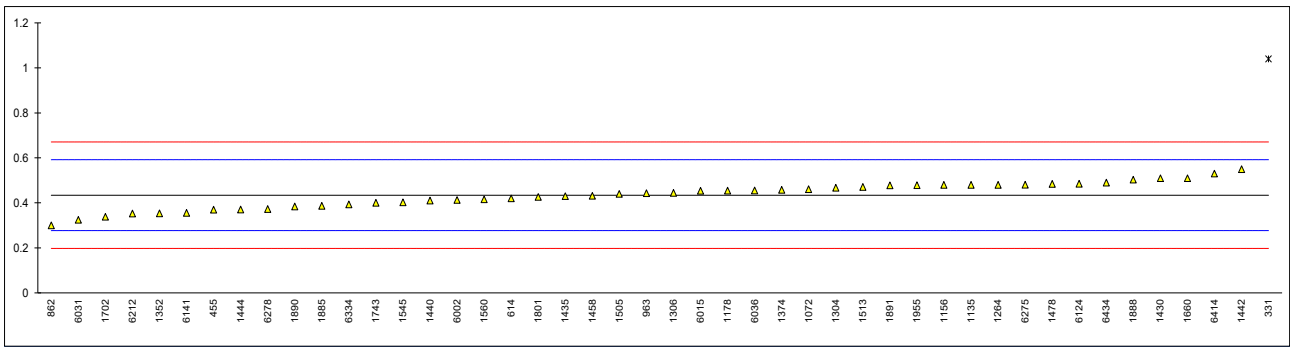

Kernel Density
7
6
5
4
3
2
1
0
0
0.5
1
1.5

Determination of 2-Furfural on sample #21242; results in mg/kg

lab	method	value	mark	z(targ)	remarks
331	EN61198	1.04	R(0.01)	7.69	
445		-----		-----	
455	EN61198	0.370		-0.82	
614		0.42		-0.18	
862	IEC61198	0.30		-1.70	
902		-----		-----	
912		-----		-----	
963	D5837	0.443		0.11	
975		-----		-----	
1072	EN61198	0.461		0.34	
1135	IEC61198	0.48		0.58	
1156	EN61198	0.480		0.58	
1178	IEC61198	0.4546		0.26	
1264	D5837	0.48009		0.58	
1304	In house	0.467		0.42	
1306	IEC61198	0.444658		0.13	
1352	IEC61198	0.35358		-1.02	
1374	D5837	0.458		0.30	
1430		0.51		0.96	
1435		0.43		-0.05	
1440	EN61198	0.41		-0.31	
1442	IEC61198	0.55		1.47	
1444	D5837	0.370690		-0.81	
1458	IEC61198	0.431		-0.04	
1478		0.484		0.63	
1505	D5837	0.440		0.07	
1513		0.471		0.47	
1545	IEC61198	0.4021		-0.41	
1560		0.416		-0.23	
1660		0.510		0.96	
1702		0.338		-1.22	
1743	IEC61198	0.40		-0.43	
1801		0.4267		-0.10	
1885	D5837	0.387		-0.60	
1888		0.503		0.87	
1890		0.384	C	-0.64	First reported 0.24
1891	IEC61198	0.478		0.56	
1955	IEC61198	0.4785		0.56	
6002	EN61198	0.413		-0.27	
6015	EN61198	0.4539		0.25	
6031	IEC61198	0.32498		-1.39	
6036	EN61198	0.455		0.26	
6085		-----		-----	
6124	IEC61198	0.4850		0.64	
6141	D5837	0.355790		-1.00	
6212	IEC61198	0.3529		-1.03	
6275	IEC61198	0.481		0.59	
6278	D5837	0.373		-0.78	
6334	IEC61198	0.393		-0.52	
6414	D5837	0.53		1.22	
6434	EN61198	0.49		0.71	

normality	OK
n	45
outliers	1
mean (n)	0.4342
st.dev. (n)	0.05744
R(calc.)	0.1608
st.dev.(Horwitz)	0.07877
R(Horwitz)	0.2206
Compare	
R(IEC61198:93)	0.0651


1.2
1
0.8
0.6
0.4
0.2
0
862
6031
1702
6212
1352
6141
455
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1890
1885
6334
1743
1545
1440
6002
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614
1801
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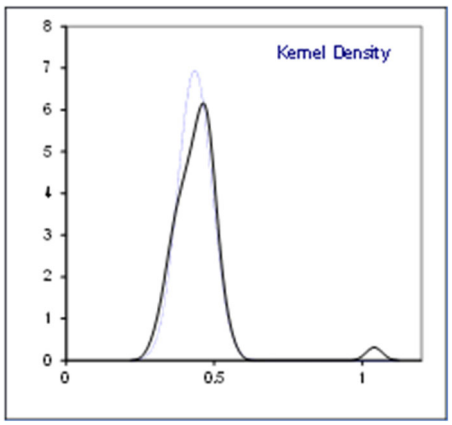
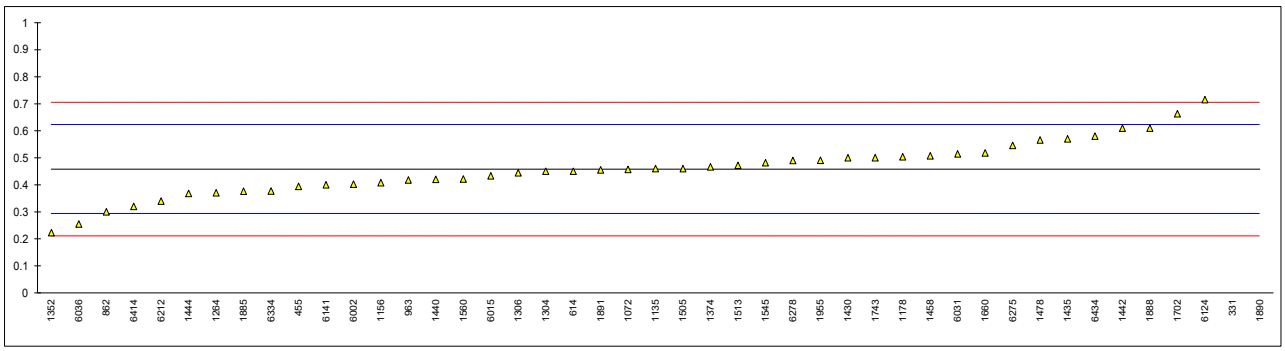
6434
1888
1430
1660
6414
1442
331


Kernel Density
8
7
6
5
4
3
2
1
0
0
0.5
1

Determination of 2-Furfurylalcohol on sample #21242; results in mg/kg

lab	method	value	mark	z(targ)	remarks
331	EN61198	1.03	R(0.01)	6.93	
445		-----		-----	
455	EN61198	0.394		-0.78	
614	IEC61198	0.45		-0.10	
862	IEC61198	0.30		-1.92	
902		-----		-----	
912		-----		-----	
963	D5837	0.418		-0.49	
975		-----		-----	
1072	EN61198	0.457		-0.02	
1135	IEC61198	0.46		0.02	
1156	EN61198	0.408		-0.61	
1178	IEC61198	0.5038		0.55	
1264	D5837	0.37053		-1.06	
1304	In house	0.450		-0.10	
1306	IEC61198	0.444239		-0.17	
1352	IEC61198	0.22246		-2.86	
1374	D5837	0.466		0.09	
1430	EN61198	0.50		0.51	
1435	IEC61198	0.57		1.36	
1440	EN61198	0.42		-0.46	
1442	IEC61198	0.61		1.84	
1444	D5837	0.367871		-1.10	
1458	IEC61198	0.507		0.59	
1478	IEC61198	0.566		1.31	
1505	D5837	0.460	C	0.02	First reported 0.046
1513	IEC61198	0.472		0.17	
1545	IEC61198	0.4820		0.29	
1560	IEC61198	0.421		-0.45	
1660	IEC61198	0.518		0.72	
1702	IEC61198	0.663		2.48	
1743	IEC61198	0.50		0.51	
1801		-----		-----	
1885	D5837	0.376		-1.00	
1888	EN61198	0.610		1.84	
1890	IEC61198	2.027	C,R(0.01)	19.02	First reported 0.16
1891	IEC61198	0.455		-0.04	
1955	IEC61198	0.4905		0.39	
6002	EN61198	0.402		-0.68	
6015	EN61198	0.4334		-0.30	
6031	IEC61198	0.51416		0.68	
6036	EN61198	0.255		-2.46	
6085		-----		-----	
6124	IEC61198	0.715	C	3.11	First reported 0.7365
6141	D5837	0.400008		-0.71	
6212	IEC61198	0.3400		-1.43	
6275	IEC61198	0.5458		1.06	
6278	D5837	0.490		0.39	
6334	IEC61198	0.377		-0.99	
6414	D5837	0.32		-1.68	
6434	EN61198	0.58		1.48	

normality	OK
n	43
outliers	2
mean (n)	0.4583
st.dev. (n)	0.10011
R(calc.)	0.2803
st.dev.(Horwitz)	0.08246
R(Horwitz)	0.2309
Compare	
R(IEC61198:93)	0.0687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0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1352
6036
862
6414
6212
1444
1264
1885
6334
455
6141
6002
1156
963
1440
1560
6015
1306
1304
614
1891
1072
1135
1505
1374
1513
1545
6278
1955
1430
1743
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1458
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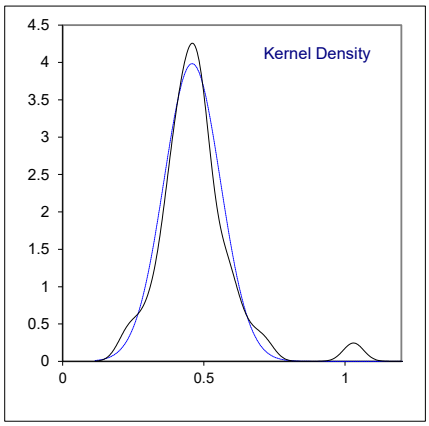
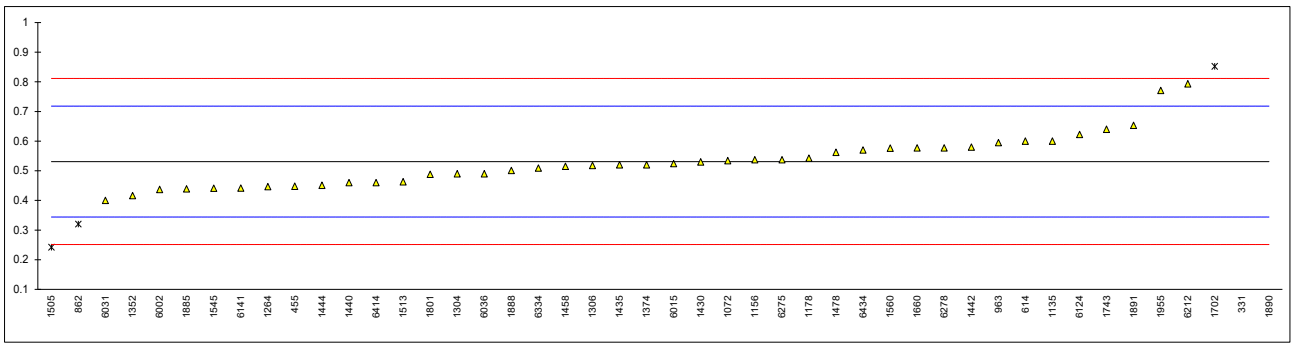
1660
6275
1478
1435
6434
1442
1888
1702
6124
331
1880


Kernel Density
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.5
1

Determination of 5-Hydroxy Methyl-2-Furfural on sample #21242; results in mg/kg

lab	method	value	mark	z(targ)	remarks
331	EN61198	1.03	R(0.01)	5.34	
445		-----		-----	
455	EN61198	0.448		-0.89	
614	IEC61198	0.60		0.74	
862	IEC61198	0.32	R(0.05)	-2.26	
902		-----		-----	
912		-----		-----	
963	D5837	0.595		0.68	
975		-----		-----	
1072	EN61198	0.534		0.03	
1135	IEC61198	0.60		0.74	
1156	EN61198	0.537		0.06	
1178	IEC61198	0.5424		0.12	
1264	D5837	0.4465		-0.91	
1304	In house	0.490		-0.44	
1306	IEC61198	0.518035		-0.14	
1352	IEC61198	0.41610		-1.23	
1374	D5837	0.520		-0.12	
1430	EN61198	0.53		-0.01	
1435	IEC61198	0.52		-0.12	
1440	EN61198	0.46		-0.76	
1442	IEC61198	0.58		0.52	
1444	D5837	0.451090		-0.86	
1458	IEC61198	0.515		-0.17	
1478	IEC61198	0.562		0.33	
1505	D5837	0.242	R(0.05)	-3.09	
1513	IEC61198	0.463		-0.73	
1545	IEC61198	0.4413		-0.96	
1560	IEC61198	0.576		0.48	
1660	IEC61198	0.577		0.49	
1702	IEC61198	0.852	R(0.05)	3.43	
1743	IEC61198	0.64		1.16	
1801	EN61198	0.48803		-0.46	
1885	D5837	0.439		-0.99	
1888	EN61198	0.501		-0.32	
1890	IEC61198	3.05	R(0.01)	26.95	
1891	IEC61198	0.653		1.30	
1955	IEC61198	0.7710		2.57	
6002	EN61198	0.437		-1.01	
6015	EN61198	0.5243		-0.07	
6031	IEC61198	0.40002		-1.40	
6036	EN61198	0.490		-0.44	
6085		-----		-----	
6124	IEC61198	0.6225		0.98	
6141	D5837	0.441394		-0.96	
6212	IEC61198	0.7932		2.80	
6275	IEC61198	0.5372		0.07	
6278	D5837	0.577		0.49	
6334	IEC61198	0.509		-0.24	
6414	D5837	0.46		-0.76	
6434	EN61198	0.57		0.42	

normality	not OK
n	41
outliers	5
mean (n)	0.5311
st.dev. (n)	0.08553
R(calc.)	0.2395
st.dev.(Horwitz)	0.09347
R(Horwitz)	0.2617
Compare	
R(IEC61198:93)	0.0797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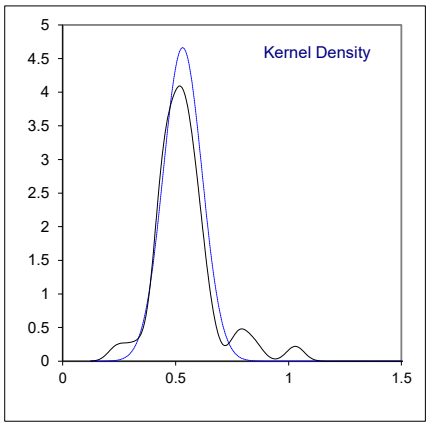
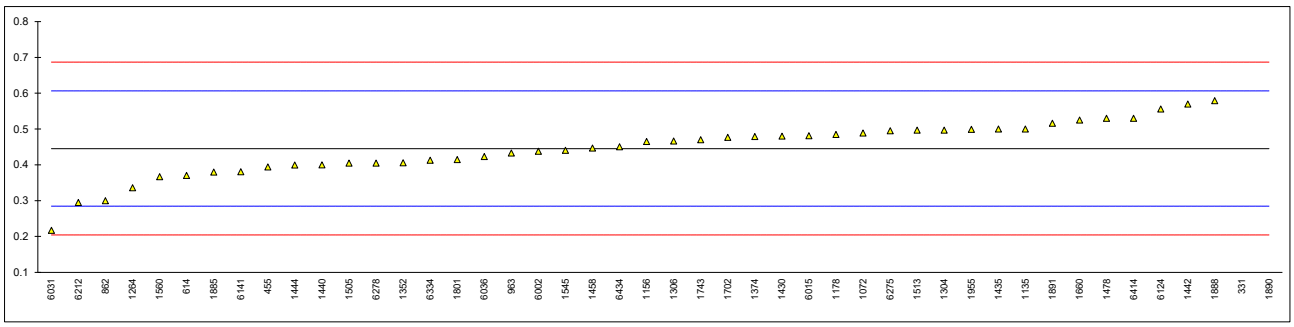
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1505 862 6031 1352 6002 1885 1545 6141 1264 455 1444 1440 6414 1513 1801 1304 6036 1888 6334 1458 1306 1435 1374 6015 1430 1072 1156 6275 1178 1478 6434 1560 1660 6278 1442 963 614 1135 6124 1743 1891 1955 6212 1702 331 1890


Kernel Density
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 0.5 1 1.5

Determination of 5-Methyl-2-Furfural sample #21242; results in mg/kg

lab	method	value	mark	z(targ)	remarks
331	EN61198	1.05	R(0.01)	7.51	
445		-----		-----	
455	EN61198	0.394		-0.64	
614	IEC61198	0.37		-0.94	
862	IEC61198	0.30		-1.81	
902		-----		-----	
912		-----		-----	
963	D5837	0.433		-0.15	
975		-----		-----	
1072	EN61198	0.489		0.54	
1135	IEC61198	0.50		0.68	
1156	EN61198	0.465		0.24	
1178	IEC61198	0.4848		0.49	
1264	D5837	0.33563		-1.36	
1304	In house	0.497		0.64	
1306	IEC61198	0.466194		0.26	
1352	IEC61198	0.40561		-0.49	
1374	D5837	0.479		0.42	
1430	EN61198	0.48		0.43	
1435	IEC61198	0.50		0.68	
1440	EN61198	0.40		-0.56	
1442	IEC61198	0.57		1.55	
1444	D5837	0.399323		-0.57	
1458	IEC61198	0.447		0.02	
1478	IEC61198	0.530		1.05	
1505	D5837	0.405		-0.50	
1513	IEC61198	0.497		0.64	
1545	IEC61198	0.4405		-0.06	
1560	IEC61198	0.367		-0.97	
1660	IEC61198	0.525		0.99	
1702	IEC61198	0.477		0.39	
1743	IEC61198	0.47	C	0.31	First reported 2.61
1801	EN61198	0.4147		-0.38	
1885	D5837	0.380		-0.81	
1888	EN61198	0.579		1.66	
1890	IEC61198	1.123	C,R(0.01)	8.42	First reported 0.71
1891	IEC61198	0.516		0.88	
1955	IEC61198	0.4990		0.67	
6002	EN61198	0.438		-0.09	
6015	EN61198	0.4813		0.45	
6031	IEC61198	0.21685		-2.84	
6036	EN61198	0.423		-0.28	
6085		-----		-----	
6124	IEC61198	0.5555		1.37	
6141	D5837	0.380551		-0.81	
6212	IEC61198	0.2952		-1.87	
6275	IEC61198	0.4952		0.62	
6278	D5837	0.405		-0.50	
6334	IEC61198	0.413		-0.40	
6414	D5837	0.53		1.05	
6434	EN61198	0.45		0.06	

normality	OK
n	44
outliers	2
mean (n)	0.4454
st.dev. (n)	0.07471
R(calc.)	0.2092
st.dev.(Horwitz)	0.08050
R(Horwitz)	0.2254
Compare	
R(IEC61198:93)	0.0668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0.6
0.5
0.4
0.3
0.2
0.1
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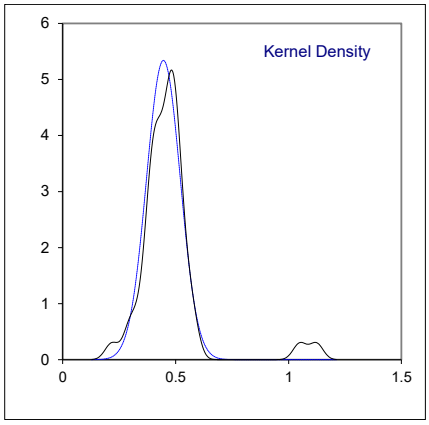
Kernel Density
6
5
4
3
2
1
0
0
0.5
1
1.5

APPENDIX 2

Number of participants per country

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

APPENDIX 3

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

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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)

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14 iis memo 1702 'Evaluation of the reproducibility of the Breakdown Voltage in Transformer Oils (fresh and used) as per EN60156:1998 based on Proficiency Tests performed from 2001 till 2016, December 2017