Results of Proficiency Test
Transformer Oil (fresh)
November 2016

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

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CONTENTS

1 INTRODUCTION

Since 2001, the Institute for Interlaboratory Studies organizes a proficiency test for the analysis of Transformer Oil (fresh) every year. During the annual program 2016/2017, it was decided to continue the round robin for Transformer Oil (fresh) in accordance with the latest applicable version of the specification IEC60296 and of ASTM D3487.
In this interlaboratory study, 55 laboratories from 30 different countries have registered for participation. See appendix 2 for a list of number of participants per country.
In this report, the results of the 2016 Transformer Oil (fresh) proficiency test 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 organiser of this proficiency test. Sample analyses for fit-for-use and homogeneity testing were subcontracted to an ISO/IEC 17025 accredited laboratory. It was decided to send a bottle of 1 litre of Transformer Oil (fresh), labelled #16250. Participants were requested to report rounded and unrounded results. The unrounded results were preferably used for statistical evaluation.

2.1 ACCREDITATION

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, is accredited in agreement with ISO/IEC 17043:2010 (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 April 2014 (iis-protocol, version 3.3). This protocol is electronically available from the FAQ-page of the iis website www.iisnl.com.

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

The necessary bulk material was obtained from a local supplier. The 200 litre bulk material was homogenised in a pre-cleaned drum. After homogenisation, 60 subsamples were transferred to 1 litre amber glass bottles and labelled #16250. The homogeneity of the subsamples #16250 was checked by determination of Density in accordance with ASTM D4052 on 8 stratified randomly selected samples.

	Density at 20°C in kg/m^3
Sample #16250-1	876.38
Sample #16250-2	876.37
Sample #16250-3	876.38
Sample #16250-4	876.38
Sample #16250-5	876.37
Sample #16250-6	876.38
Sample #16250-7	876.38
Sample #16250-8	876.37

Table 1: homogeneity test results of subsamples #16250

From the above test results, the repeatability was calculated and compared with 0.3 times the corresponding reproducibility of the target method in agreement with the procedure of ISO 13528, Annex B2 in the next table.

	Density at 20°C in kg/m^3
r (sample #16250)	0.01
reference test method	ISO3675:98
0.3 x $R_{(reference\ test\ method)}$	0.36

Table 2: evaluation of the repeatability of subsamples #16250

The calculated repeatability of sample #16250 was less than 0.3 times the corresponding reproducibility of the reference method. Therefore, homogeneity of the subsamples #16250 was assumed.

To each of the participating laboratories, 1*1 litre bottle (labelled #16250) was sent on November 2, 2016.

2.5 STABILITY OF THE SAMPLES

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

2.6 ANALYSES

The participants were asked to determine tests mentioned in either ASTM D3487 or IEC 60296 on sample #16250: Acidity (Total, both potentiometric and colorimetric), Appearance, Breakdown Voltage, Color ASTM, Density at 20°C, Di-electric loss at 90°C (Di-electric Dissipation Factor and Specific Resistance), Flash Point (both COC and PMcc), Interfacial Surface Tension, Kinematic Viscosity at 40°C, Water and DBPC Additive.

To get comparable results a detailed report form, on which the units were prescribed as well as the reference test methods and a letter of instructions were prepared and made available on the data entry portal www.kpmd.co.uk/sgs-iis/. The laboratories were also requested to confirm the sample receipt on the same data entry portal. An SDS was added to the sample package.

3 RESULTS

During five weeks after sample dispatch, the 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.
Additional or corrected test results are used for data analysis and original 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 organisation 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’ (iis-protocol, April 2014 version 3.3).
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 judgment 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.

In accordance to ISO 5725 the original test results per determination were submitted subsequently to Dixon's, Grubbs' and Rosner's outlier tests. 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 the averages and the 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. When the uncertainty passed the evaluation, no remarks are made in the report. However, when the uncertainty failed the evaluation it is mentioned in the report and it will have consequences for the evaluation of the test results.

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

3.2 GRAPHICS

In order to visualise the data against the reproducibilities from literature, Gauss plots were made, using the sorted data for each determination (see appendix 1). On the Y-axis the reported analysis 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 standard. 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 was projected over the Kernel Density Graph.

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, e.g. ASTM reproducibilities, the z-scores were calculated using a target standard deviation. This results in an evaluation independent of the spread of this interlaboratory study.
The target standard deviation was calculated from the literature reproducibility by division with 2.8.

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 in accordance with:

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

The $z_{(target)}$ scores are listed in the 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 maybe 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 despatch of the samples to the Middle East and South Africa. One participant reported the results after the final reporting date and four participants did not report at all. Not all participants were able to report results for all tests.

In total 51 participants reported 383 numerical results. Observed were 29 outlying results, which is 7.6% of the numerical results. In proficiency studies, outlier percentages of 3% - 7.5% are quite normal.

4.1 EVALUATION PER TEST

In this section, the reported test results are discussed per test. The specified test methods and requirements were taken into account for explaining the observed differences when possible and applicable. These methods are also in the tables together with the reported data. The abbreviations, used in these tables, are listed in appendix 3.

Not all original 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.

Acidity, Potentiometric: This determination may be problematic for a number of laboratories. Three laboratories reported a possible false positive result. These three test results were statistical outliers.
No significant conclusions were drawn as the Acidity was below the quantification limit (0.014 g KOH/kg) of the test method EN62021-1:03. The reproducibility stated in ASTM D664:11ae1 can be used from a value of 0.1 g KOH/kg, and is thus not applicable for this sample.

Acidity, Colorimetric : This determination was not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in agreement with the requirements of ASTM D974:2014e2.

Appearance: All reporting laboratories agreed on the appearance of the oil being 'Bright and Clear' or remarked in similar words to this.

Color ASTM: The majority of the reporting participants agreed that the color was lower than 0.5.

Breakdown Voltage: This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in good agreement with the requirements of EN60156:95.
The reproducibility of EN60156:95 was determined from Figure 3 of method EN60156:95. The black line in Figure 3 shows the relative standard deviation (=SD/mean or RSDr) as a function of the value of the mean based on six breakdown measurements. To calculate the repeatability RSDr was multiplied with a factor 2.8. The reproducibility can be estimated from the repeatability by multiplication with a factor 3, which is an empirical factor.

Density at 20°C: This determination was problematic for a number of laboratories. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in full agreement with the requirements of ISO3675:98.

DD-Factor: This determination was not problematic. Three statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of EN60247:04.

Spec. Resistance: This determination was very problematic. The reported test results vary over a large range: 5.5 - 5900 GΩm. Two statistical outliers were observed. The calculated reproducibility after the rejection of the statistical outliers is not at all in agreement with the requirements of EN60247:04.

Please note that it is well known that specific resistance of new oils can vary over a wide range. This is due to randomly tiny amount of impurities (maybe present in the air or in the test cell) which can dramatically change the value. In used oils, however, due to already present ion flow of the polar compounds, these problems are not observed.

Flash Point (COC): This determination was not problematic. No statistical outliers were observed. The calculated reproducibility is in agreement with the requirements of ASTM D92:2016a.

Flash Point (PMcc): This determination was not problematic. Two statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ISO2719:2016-procedure A.

Interf. Surf. Tension: This determination was problematic for a number of laboratories. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in full agreement with the requirements of ASTM D971:2012. One should be aware that ISO6295 is obsolete since February 2005.

Kinematic Viscosity: This determination was not problematic. Two statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D445:15a, but not in agreement with the requirements of ISO3104:94.
When the test results, performed according to ISO3104 and ASTM D445, were evaluated separately, the calculated reproducibility was smaller, but still not in agreement with the requirements of ISO3104:94. Also test results were reported according to ASTM D7042 (Stabinger viscosity) and ASTM D7279 (Houillon viscosity).

Water: This determination was problematic for a number of laboratories. Seven statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of EN60814:98.

DBPC anti-oxidant: The group of participants agreed that DBPC (2.6-di-tert-butyl-p-cresol) is not present above the limit of quantification of 100 mg/kg.

4.2 PERFORMANCE EVALUATION FOR THE GROUP OF LABORATORIES

A comparison has been made between the reproducibility as declared by the relevant standard and the reproducibility as found for the group of participating laboratories. The average results per sample, calculated reproducibilities and reproducibilities, derived from literature standards (in casu ASTM, ISO, EN and IEC standards) are compared in the next table.

Parameter	unit	n	average	2.8 * sd	R(lit)
Acidity, Total (Potentiometric Titration)	g KOH/kg	27	0.005	0.009	(0.002)
Acidity, Total (Colorimetric Titration)	g KOH/kg	17	0.005	0.009	0.040
Appearance		32	B&C	n.a.	n.a.
Color ASTM		39	L0.5	n.a.	n.a.
Breakdown Voltage	kV/2.5 mm	47	70.8	30.9	59.4
Density at 20°C	kg/m^3	34	876.40	0.62	1.20
Di-electric Dissipation Factor at 90°C		35	0.0006	0.0012	0.0017
Specific Resistance at 90°C	GΩm	30	906	2312	951
Flash Point (COC)	°C	12	159.5	19.7	18.0
Flash Point (PMcc)	°C	29	152.1	7.8	10.8
Interfacial Surface Tension	mN/m	29	48.3	5.0	4.8
Kinematic Viscosity at 40°C	mm^2/s	30	9.85	0.14	0.14
Water	mg/kg	36	7.2	4.3	4.0
DBPC Antioxidant Additive	mg/kg	13	<100	n.a.	n.a.

Table 3: Reproducibilities of tests on sample #16250

() = Results between brackets were near or below detection limit, these results should be used with care

B&C = Bright and Clear

Without further statistical calculations, it can be concluded that for some tests there is a good compliance of the group of participating laboratories with the relevant standards. The problematic tests have been discussed in paragraph 4.1

4.3 COMPARISON OF THE NOVEMBER 2016 PROFICIENCY TEST WITH PREVIOUS PTS.

	November 2016	November 2015	November 2014	November 2013	October 2012
Number of reporting labs	51	49	52	60	59
Number of results reported	383	330	340	491	427
Statistical outliers	29	26	13	32	30
Percentage outliers	7.6%	7.9%	3.8%	6.5%	7.0%

Table 4: 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 against the target requirements. The conclusions are given the following table:

Parameter	November 2016	November 2015	November 2014	November 2013	October 2012
Acidity, Total (Potentiometric)	(--)	(--)	(--)	(--)	(--)
Acidity, Total (Colorimetric)	++	n.e.	n.e.	n.e.	n.e.
Breakdown Voltage	++	++	++	--	--
Density at 20°C	++	+	+/-	+/-	+
Di-electric Dissipation Factor	+	++	++	++	++
Specific Resistance	--	--	--	--	-
Flash Point (COC)	+/-	n.e.	n.e.	n.e.	n.e.
Flash Point (PMcc)	+	+/-	-	+/-	n.e.
Interfacial Surface Tension	+/-	--	+/-	--	--
Kinematic Viscosity at 40°C	+/-	-	--	--	n.e.
Water	+/-	-	-	-	-

Table 5: comparison determinations against the standard
() = Results between brackets were near or below detection limit, these results should be used with care

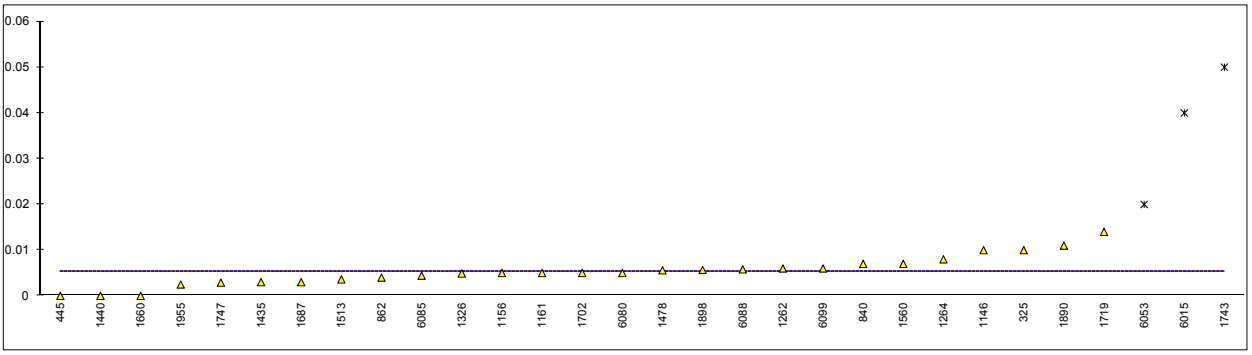
The performance of the determinations against the requirements of the respective standards is listed in the above table. The following performance categories were used:

++: group performed much better than the standard
+ : group performed better than the standard
+/-: group performance equals the standard
- : group performed worse than the standard
-- : group performed much worse than the standard
n.e: not evaluated

APPENDIX 1

Determination of Acidity, Total (Potentiometric Titration) on sample #16250; results in g KOH/kg

lab	method	value	mark	z(targ)	remarks
179	D664-A	<0.01		-----	
237	D664-A	<0.1		-----	
273		-----		-----	
325	D664-A	0.01		-----	
360		-----		-----	
445	D664-A	0.00		-----	
446		-----		-----	
614		-----		-----	
840	IEC62021-1	0.007		-----	
862	IEC62021-1	0.004		-----	
912		-----		-----	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146	D664-A	0.010		-----	
1156	IEC62021-1	0.005		-----	
1161	D664-A	0.005		-----	
1262	EN62021-1	0.006		-----	
1264	D664-A	0.008		-----	
1304		-----		-----	
1306		-----		-----	
1326	IEC62021-1	0.0049		-----	
1435	IEC62021-1	0.003		-----	
1440	EN62021-1	0.00		-----	
1442		-----		-----	
1444		-----		-----	
1461		-----		-----	
1478	IEC62021-1	0.0056		-----	
1513	IEC62021-1	0.0036		-----	
1516		-----		-----	
1560	IEC62021-1	0.007		-----	
1568		-----		-----	
1626		-----		-----	
1628		-----		-----	
1660	IEC62021-1	0.00		-----	
1687	D664-A	0.003		-----	
1702	IEC62021-1	0.005		-----	
1719	D664-A	0.014		-----	
1743	IEC62021-1	0.05	R(0.01)	-----	possible false positive result?
1747	EN62021-1	0.0029		-----	
1760		-----		-----	
1777	IEC62021-1	<0.01		-----	
1890	ISO6619	0.011		-----	
1898	EN62021-1	0.005685		-----	
1947		-----		-----	
1955	D664-A	0.0025		-----	
2122		-----		-----	
4043		-----		-----	
6015	D664-A	0.04	R(0.01)	-----	possible false positive result?
6048		-----		-----	
6053	IEC62021-1	0.02	C,R(0.01)	-----	first reported: 0.03, possible false positive result?
6080	D664-A	0.005		-----	
6085	D664-A	0.00442		-----	
6088	IEC62021-1	0.0058		-----	
6099	IEC62021-1	0.006	C	-----	first reported: 0.018
	normality	OK			
	n	27			
	outliers	3			
	mean (n)	0.0053			
	st.dev. (n)	0.00329			Compare R(D664:11ae1) = (0.1418, n.a. with value <0.1))
	R(calc.)	0.0092			
	R(EN62021-1:03)	(0.0015)			quantification limit > 0.014 g KOH/kg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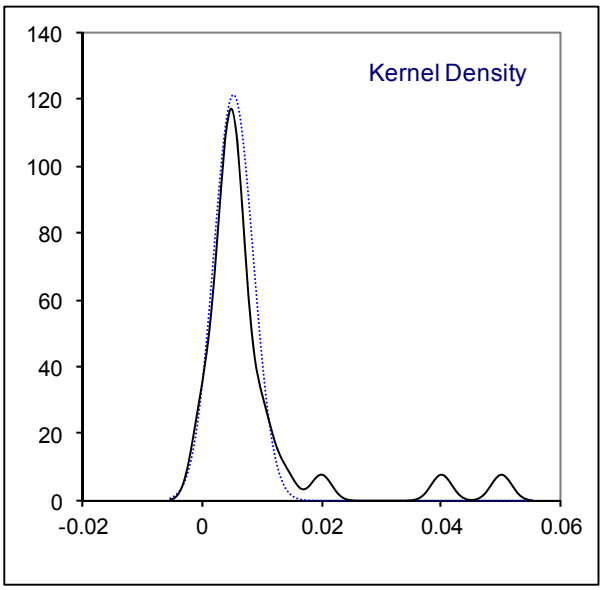
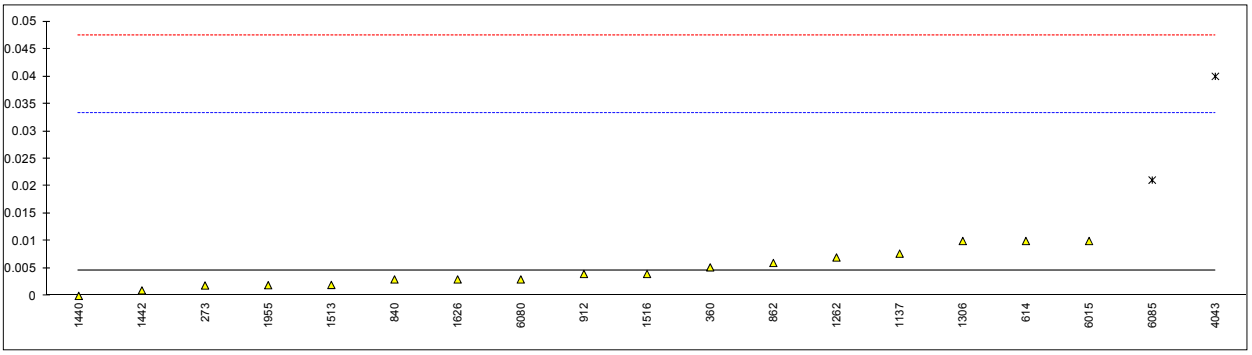
0.05
0.04
0.03
0.02
0.01
0
445
1440
1660
1955
1747
1435
1687
1513
862
6085
1326
1156
1161
1702
6080
1478
1898
6088
1262
6099
840
1560
1264
1146
325
1890
1719
6053
6015
1743


Kernel Density
140
120
100
80
60
40
20
0
-0.02
0
0.02
0.04
0.06

Determination of Acidity, Total (Colorimetric Titration) on sample #16250; results in g KOH/kg

lab	method	value	mark	z(targ)	remarks
179	D974	<0.01		-----	
237		-----		-----	
273	D974	0.0019		-0.20	
325		-----		-----	
360	D974	0.0052		0.04	
445		-----		-----	
446	D974	<0.01		-----	
614	D974	0.01		0.37	
840	D974	0.003		-0.12	
862	D974	0.006		0.09	
912	D974	0.0040		-0.05	
962		-----		-----	
963		-----		-----	
1137	D974	0.0077		0.21	
1146		-----		-----	
1156		-----		-----	
1161		-----		-----	
1262	ISO6618	0.007		0.16	
1264		-----		-----	
1304	INH-122	<0.01		-----	
1306	D974	0.01		0.37	
1326		-----		-----	
1435		-----		-----	
1440	ISO6618	0.00		-0.33	
1442	IEC62021-2	0.001		-0.26	
1444		-----		-----	
1461		-----		-----	
1478		-----		-----	
1513	IEC62021-2	0.002		-0.19	
1516	D974	0.004		-0.05	
1560		-----		-----	
1568		-----		-----	
1626	D974	0.003		-0.12	
1628		-----		-----	
1660		-----		-----	
1687		-----		-----	
1702		-----		-----	
1719		-----		-----	
1743		-----		-----	
1747		-----		-----	
1760		-----		-----	
1777	D974	<0.01		-----	
1890		-----		-----	
1898		-----		-----	
1947		-----		-----	
1955	IEC62021-2	0.00195		-0.19	
2122	EN62021-2	<0.01		-----	
4043	ISO660	0.04	G(0.01)	2.47	
6015	D974	0.01		0.37	
6048		-----		-----	
6053		-----		-----	
6080	D974	0.003		-0.12	
6085	D974	0.021099	G(0.01)	1.15	
6088		-----		-----	
6099		-----		-----	

	normality	OK	
	n	17	
	outliers	2	
	mean (n)	0.0047	
	st.dev. (n)	0.00325	
	R(calc.)	0.0091	
	R(D974:14e2)	0.0400	Compare R(IEC62021-2:07) = 0.0164, quantification limit 0.014 g KOH/kg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0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1440
1442
273
1955
1513
840
1626
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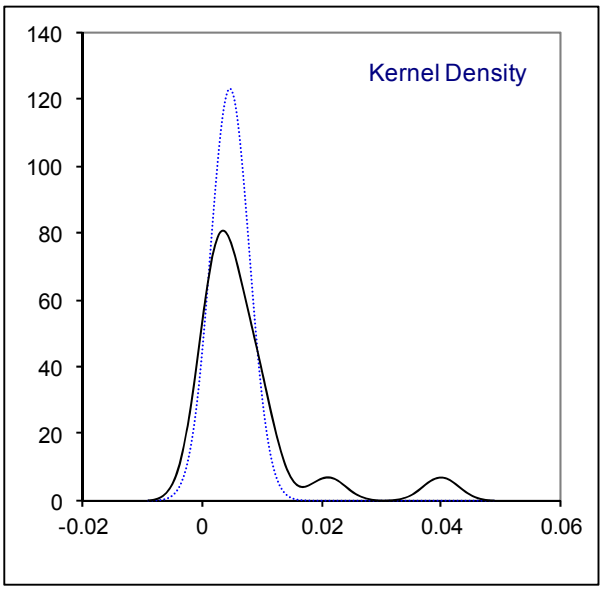
912
1516
360
862
1262
1137
1306
614
6015
6085
4043


Kernel Density
140
120
100
80
60
40
20
0
-0.02
0
0.02
0.04
0.06

Determination of Appearance on sample #16250;

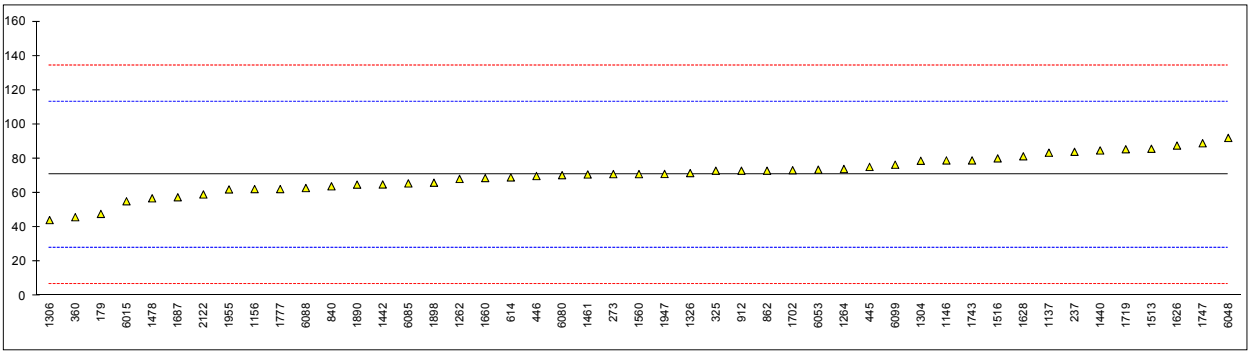
lab	method	value	remarks
179		-----	
237	Visual	Clear and Bright	
273		Bright & Clear	
325	Visual	Bright & Clear	
360	Visual	Clear and Bright	
445	Visual	C & B	
446	D4176	Pass	
614		-----	
840	Visual	Clear, free from sediment and suspended matter	
862	Visual	Colorless Transparent Liquid	
912	Visual	clear	
962		-----	
963		-----	
1137		-----	
1146		-----	
1156	Visual	CLEAR	
1161	Visual	Clear and Bright	
1262	Visual	bright and clear	
1264	Visual	Clear & Bright	
1304		-----	
1306		-----	
1326		-----	
1435	Visual	clear	
1440	Visual	Limpide	
1442	Visual	clear	
1444	D1524	clear	
1461		-----	
1478	IEC60296	clear	
1513	IEC60296	Limpid	
1516	Visual	Clean	
1560	Visual	Clear, free from sediment and suspended matter	
1568		-----	
1626	Visual	clear	
1628		-----	
1660	Visual	Clear, free from sediments	
1687		-----	
1702	IEC60296	CLEAR	
1719		-----	
1743	Visual	limpide	
1747		-----	
1760		-----	
1777	Visual	Clear	
1890	Visual	clear	
1898	Visual	Clear	
1947		-----	
1955		-----	
2122		-----	
4043		-----	
6015	Visual	as expected	
6048	Visual	bright & clear	
6053		-----	
6080	Visual	clear and Bright	
6085		-----	
6088	Visual	CLEAR AND CLEAN	
6099		-----	
	n	32	
	mean (n)	Bright and clear	

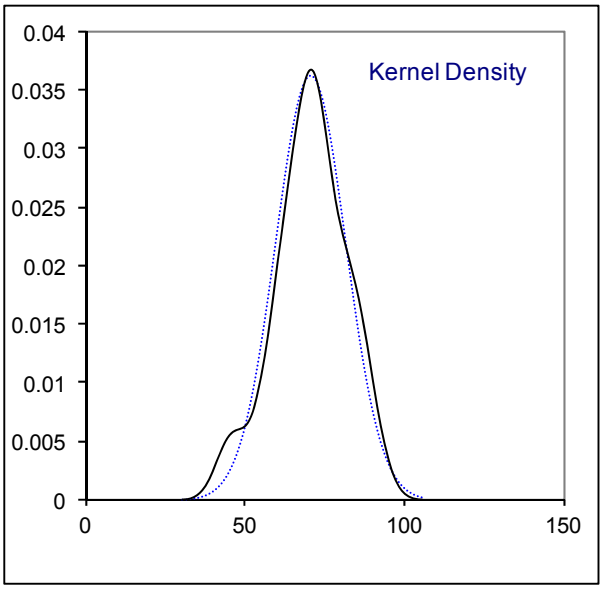
Determination of Color ASTM on sample #16250;

lab	method	value	mark	z(targ)	remarks
179	D1500	L0.5		-----	
237	D1500	L0.5		-----	
273	ISO2049	L0.5		-----	
325	D6045	L0.5		-----	
360	ISO2049	L0.5		-----	
445	ISO2049	<0.5		-----	
446	D1500	<0.5		-----	
614	D1500	<0.5		-----	
840	ISO2049	L0.5		-----	
862	D1500	L0.5		-----	
912		-----		-----	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146		-----		-----	
1156	ISO2049	0		-----	
1161	D1500	<0,5		-----	
1262	ISO2049	L 0.5		-----	
1264	D1500	<1		-----	
1304	INH-132	0.0		-----	
1306	D1500	0		-----	
1326		-----		-----	
1435	ISO2049	0.5		-----	
1440	ISO2049	0.00		-----	
1442	ISO2049	L0,5		-----	
1444	ISO2049	0.3		-----	
1461		-----		-----	
1478	ISO2049	0.1		-----	
1513	ISO2049	L0,5		-----	
1516	ISO2049	0		-----	
1560	ISO2049	L0.5		-----	
1568		-----		-----	
1626	D1500	<0.5		-----	
1628		-----		-----	
1660	D1500	0.0		-----	
1687		-----		-----	
1702	D1500	L0.5		-----	
1719	D1524	<0.5		-----	
1743	ISO2049	L0.5		-----	
1747	ISO2049	0		-----	
1760		-----		-----	
1777	D1500	<0.5		-----	
1890		-----		-----	
1898	D1500	< 0,5		-----	
1947		-----		-----	
1955		-----		-----	
2122		-----		-----	
4043		-----		-----	
6015	ISO2049	0.5		-----	
6048	D1500	0.0		-----	
6053	ISO2049	0.5		-----	
6080	D1500	<0.5		-----	
6085	D1500	<0.5		-----	
6088	D1500	0.5		-----	
6099	D1500	0.5		-----	
	n	39			
	mean (n)	lower than 0.5			

Determination of Breakdown Voltage on sample #16250, results in kV/2.5 mm

lab	method	value	mark	z(targ)	remarks
179	D877	47.8		-1.08	
237	IEC60156	84.0		0.62	
273	EN60156	71		0.01	
325	D1816	73		0.11	
360	EN60156	45.9		-1.17	
445	IEC60156	75.2		0.21	
446	EN60156	69.9		-0.04	
614	IEC60156	69.1		-0.08	
840	IEC60156	63.9		-0.32	
862	IEC60156	73		0.11	
912	IEC60156	73		0.11	
962		-----		-----	
963		-----		-----	
1137	IEC60156	83.5		0.60	
1146	IEC60156	79		0.39	
1156	IEC60156	62.3		-0.40	
1161		-----		-----	
1262	EN60156	68.2		-0.12	
1264	IEC60156	74		0.15	
1304	INH-124	78.8		0.38	
1306	IEC60156	44.2		-1.25	
1326	IEC60156	71.6		0.04	
1435		-----		-----	
1440	EN60156	84.8		0.66	
1442	IEC60156	64.971		-0.27	
1444		-----		-----	
1461	EN60156	70.8		0.00	
1478	IEC60156	56.9		-0.65	
1513	IEC60156	85.8		0.71	
1516	IEC60156	80.2		0.44	
1560	IEC60156	71		0.01	
1568		-----		-----	
1626	IEC60156	87.66		0.80	
1628	EN60156	81.4		0.50	
1660	IEC60156	68.7		-0.10	
1687	IEC60156	57.5		-0.62	
1702	IEC60156	73.3		0.12	
1719	IEC60156	85.5		0.69	
1743	IEC60156	79		0.39	
1747	IEC60156	89		0.86	
1760		-----		-----	
1777	IEC60156	62.3		-0.40	
1890	IEC60156	64.9		-0.28	
1898	EN60156	66		-0.22	
1947	IEC60156	71.1		0.02	
1955	IEC60156	62.1		-0.41	
2122	EN60156	59.1666667		-0.55	
4043		-----		-----	
6015		55.2		-0.73	
6048	IEC60156	92.1		1.01	
6053	IEC60156	73.6		0.13	
6080	IEC60156	70.4		-0.02	
6085	EN60156	65.6		-0.24	
6088	IEC60156	62.9		-0.37	
6099	IEC60156	76.5		0.27	
	normality	OK			
	n	47			
	outliers	0			
	mean (n)	70.76			
	st.dev. (n)	11.035			
	R(calc.)	30.90			Compare R(D877:13) = 21.44
	R(EN60156:95)	59.44			Compare R(D1816:12) = 28.30

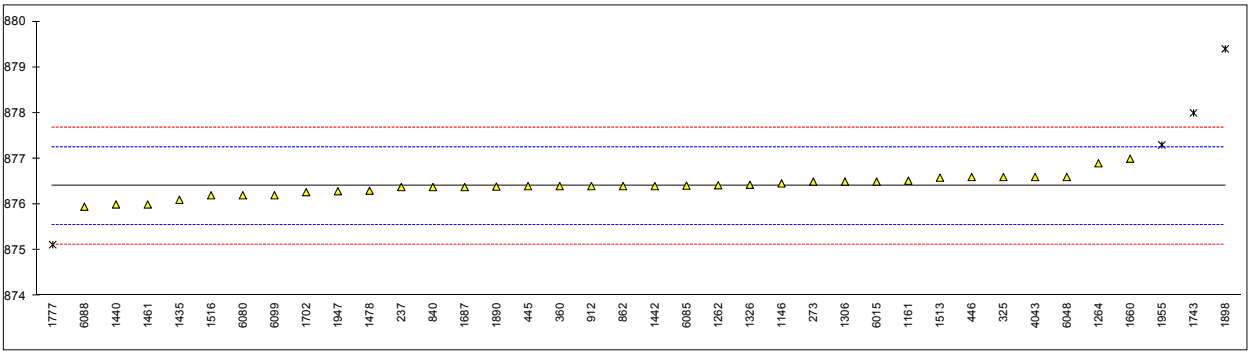

160
140
120
100
80
60
40
20
0
1306 360 179 6015 1478 1687 2122 1955 1156 1777 6088 840 1890 1442 6085 1898 1262 1660 614 446 6080 1461 273 1560 1947 1326 325 912 862 1702 6053 1264 445 6099 1304 1146 1743 1516 1628 1137 237 1440 1719 1513 1626 1747 6048

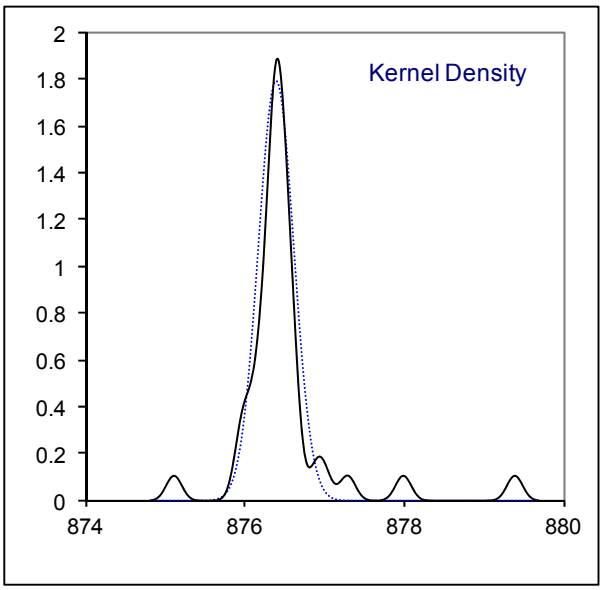

Kernel Density
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
50
100
150

Determination of Density at 20°C on sample #16250; results in kg/m^3

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237	D4052	876.38		-0.05	
273	ISO3675	876.5		0.23	
325	D4052	876.6	C	0.46	first reported: 0.8766 kg/m^3
360	ISO12185	876.4		0.00	
445	D4052	876.4		0.00	
446	D4052	876.6		0.46	
614		-----		-----	
840	ISO12185	876.38		-0.05	
862	D4052	876.4		0.00	
912	ISO3675	876.4		0.00	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146	In house	876.46		0.14	
1156		-----		-----	
1161	ISO12185	876.52		0.28	
1262	ISO3675	876.42		0.04	
1264	D4052	876.9		1.16	
1304		-----		-----	
1306	D1298	876.5		0.23	
1326	D4052	876.43		0.07	
1435	D4052	876.1		-0.70	
1440	In house	876	C	-0.94	first reported: 0.876 kg/m^3
1442	D7042	876.4		0.00	
1444		-----		-----	
1461	ISO3675	876.0		-0.94	
1478	ISO12185	876.3		-0.24	
1513	ISO12185	876.586	C	0.43	first reported: 0.876586 kg/m^3
1516	ISO3675	876.2		-0.47	
1560		-----		-----	
1568		-----		-----	
1626		-----		-----	
1628		-----		-----	
1660	D7042	877.0	C	1.40	first reported: 0.8770 kg/m^3
1687	ISO12185	876.38		-0.05	
1702	ISO12185	876.269		-0.31	
1719		-----		-----	
1743		878	R(0.01)	3.73	
1747		-----		-----	
1760		-----		-----	
1777	D4052	875.12	C,R(0.01)	-2.99	first reported: 0.87512 kg/m^3
1890	ISO12185	876.39		-0.03	
1898	ISO12185	879.4	R(0.01)	7.00	
1947	ISO12185	876.29		-0.26	
1955	D7042	877.3	R(0.05)	2.10	
2122		-----		-----	
4043	ISO6883	876.6		0.46	
6015	ISO12185	876.50		0.23	
6048	ISO12185	876.6		0.46	
6053		-----		-----	
6080	D4052	876.2		-0.47	
6085	D7042	876.41	C	0.02	first reported: 0.87641 kg/m^3
6088	ISO3675	875.95	C	-1.05	first reported: 0.87595 kg/m^3
6099	ISO12185	876.2	C	-0.47	first reported: 879.2

normality	suspect		
n	34		
outliers	4		
mean (n)	876.402		
st.dev. (n)	0.2220		
R(calc.)	0.622		Compare R(D4052:16) = R(ISO12185:96) = 0.500
R(ISO3675:98)	1.200		Compare R(D7042:16e3) = 1.300

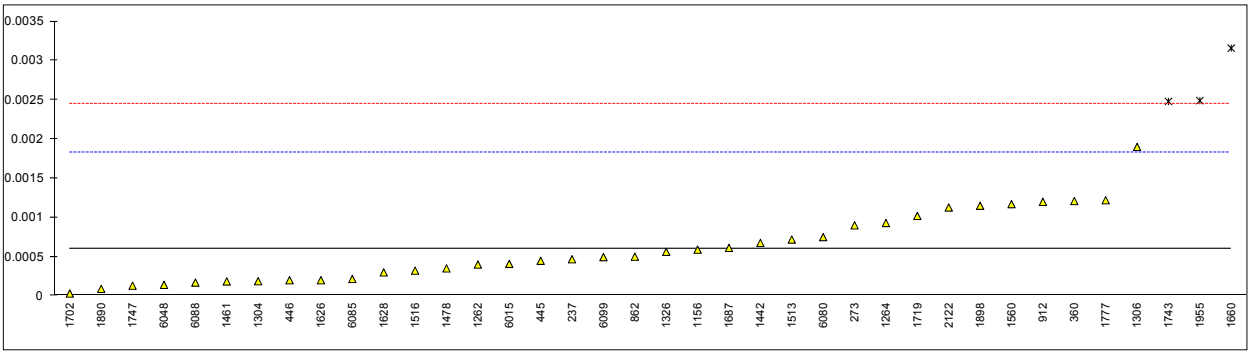

880
879
878
877
876
875
874
1777
6088
1440
1461
1435
1516
6080
6099
1702
1947
1478
237
840
1687
1890
445
360
912
862
1442
6085
1262
1326
1146
273
1306
6015
1161
1513
446
325
4043
6048
1264
1660
1955
1743
1898

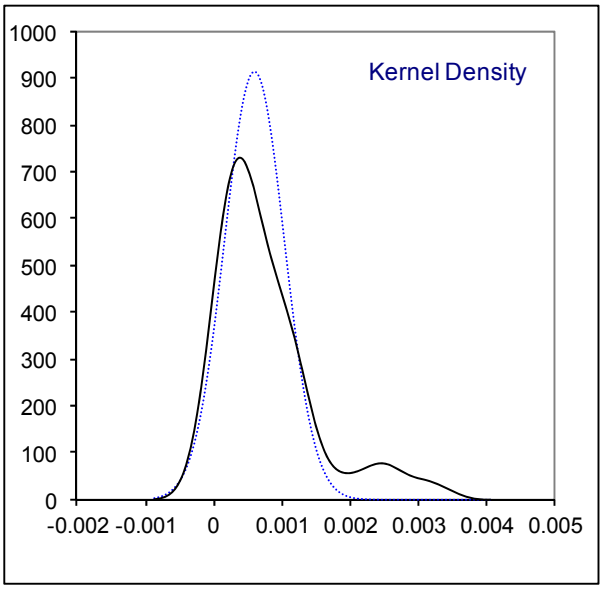

Kernel Density
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
874
876
878
880

Determination of Di-electric Dissipation Factor at 90°C on sample #16250

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237	IEC60247	0.0004675		-0.21	
273	EN60247	0.0009		0.49	
325		-----		-----	
360	EN60247	0.00121		0.99	
445	IEC60247	0.000448		-0.25	
446	EN60247	0.0002		-0.65	
614		-----		-----	
840		-----		-----	
862	IEC60247	0.0005		-0.16	
912	IEC60247	0.0012		0.97	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146		-----		-----	
1156	IEC60247	0.00059		-0.02	
1161		-----		-----	
1262	EN60247	0.00040		-0.32	
1264	IEC60247	0.000930		0.54	
1304	INH-125	0.000188		-0.67	
1306	EN60247	0.001900		2.11	
1326	IEC60247	0.000562		-0.06	
1435		-----		-----	
1440		-----		-----	
1442	IEC60247	0.000676		0.12	
1444		-----		-----	
1461	EN60247	0.000185		-0.67	
1478	IEC60247	0.000351		-0.40	
1513	IEC60247	0.000719		0.19	
1516	IEC60247	0.000322		-0.45	
1560	IEC60247	0.00117		0.93	
1568		-----		-----	
1626	IEC60247	0.00020		-0.65	
1628	EN60247	0.00030		-0.49	
1660	IEC60247	0.00316	R(0.01)	4.16	
1687	IEC60247	0.000612		0.02	
1702	IEC60247	0.00003		-0.92	
1719	IEC60247	0.00102		0.68	
1743	IEC60247	0.00248	R(0.01)	3.05	
1747	IEC60247	0.00013	C	-0.76	first reported: 0.0130
1760		-----		-----	
1777	IEC60247	0.00122		1.01	
1890	IEC60247	0.00009		-0.83	
1898	IEC60247	0.00115		0.89	
1947		-----		-----	
1955	IEC60247	0.00249	R(0.01)	3.07	
2122	EN60247	0.001128		0.86	
4043		-----		-----	
6015	EN60247	0.000409		-0.31	
6048	IEC60247	0.000141		-0.74	
6053		-----		-----	
6080	IEC60247	0.000750		0.24	
6085	EN60247	0.000216		-0.62	
6088	IEC60247	0.00017		-0.70	
6099	IEC60247	0.000495		-0.17	

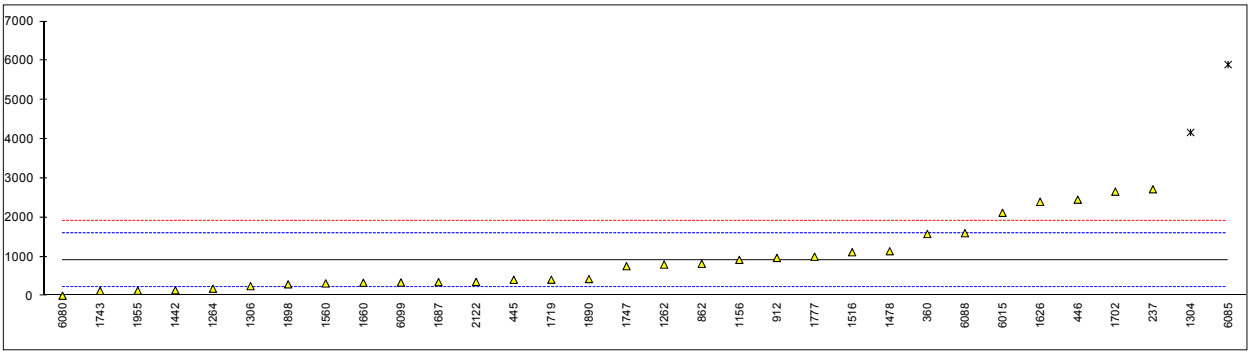
normality	OK
n	35
outliers	3
mean (n)	0.000599
st.dev. (n)	0.0004376
R(calc.)	0.001225
R(EN60247:04)	0.001725

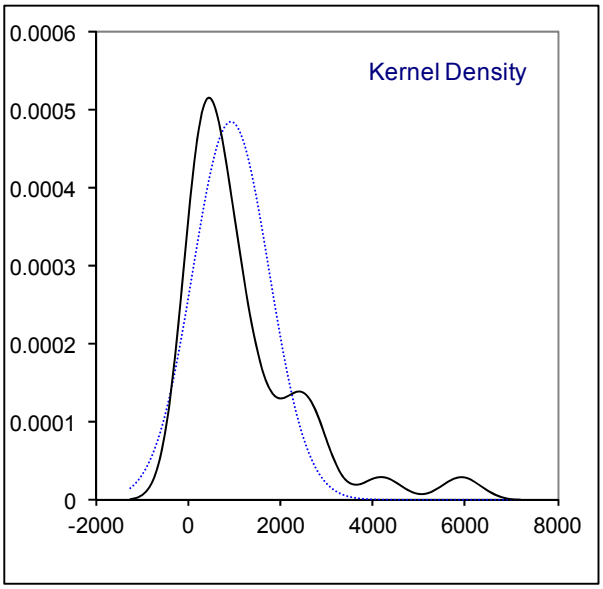

0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
1702 1890 1747 6048 6088 1461 1304 446 1626 6085 1628 1516 1478 1262 6015 445 237 6099 862 1326 1156 1687 1442 1513 6080 273 1264 1719 2122 1898 1560 912 360 1777 1306 1743 1955 1660


Kernel Density
1000
900
800
700
600
500
400
300
200
100
0
-0.002 -0.001 0 0.001 0.002 0.003 0.004 0.005

Determination of Specific Resistance at 90°C on sample #16250; results in GΩm

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237	IEC60247	2720		5.34	
273		-----		-----	
325		-----		-----	
360	EN60247	1580		1.99	
445	IEC60247	412.61		-1.45	
446	EN60247	2455		4.56	
614		-----		-----	
840		-----		-----	
862	IEC60247	820.79		-0.25	
912	IEC60247	969.0		0.19	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146		-----		-----	
1156	IEC60247	920.3		0.04	
1161		-----		-----	
1262	EN60247	800		-0.31	
1264	IEC60247	184.53		-2.12	
1304	INH-125	4170.00	R(0.05)	9.61	
1306	EN60247	249.75		-1.93	
1326		-----		-----	
1435		-----		-----	
1440		-----		-----	
1442	IEC60247	144.06		-2.24	
1444		-----		-----	
1461		-----		-----	
1478	IEC60247	1140		0.69	
1513		-----		-----	
1516	IEC60247	1115		0.62	
1560	IEC60247	318.75		-1.73	
1568		-----		-----	
1626	IEC60247	2400		4.40	
1628		-----		-----	
1660	IEC60247	336.3		-1.68	
1687	IEC60247	353.41		-1.63	
1702	IEC60247	2660		5.17	
1719	IEC60247	414.025	C	-1.45	reported: 141.025 E9 GΩm (a possible unit error?)
1743	IEC60247	130		-2.28	
1747	IEC60247	758.35	C	-0.43	first reported: 7583.5
1760		-----		-----	
1777	IEC60247	1000		0.28	
1890	IEC60247	429.5		-1.40	
1898	IEC60247	295.56		-1.80	
1947		-----		-----	
1955	IEC60247	134		-2.27	
2122	EN60247	358.56		-1.61	
4043		-----		-----	
6015	EN60247	2120		3.58	
6048		-----		-----	
6053		-----		-----	
6080	IEC60247	5.55		-2.65	
6085	EN60247	5900	R(0.01)	14.71	
6088	IEC60247	1600		2.04	
6099	IEC60247	342		-1.66	
	normality	suspect			
	n	30			
	outliers	2			
	mean (n)	905.57			
	st.dev. (n)	825.842			
	R(calc.)	2312.36			
	R(EN60247:04)	950.85			


7000
6000
5000
4000
3000
2000
1000
0
6080
1743
1955
1442
1264
1306
1898
1560
1660
6099
1687
2122
445
1719
1890
1747
1262
862
1156
912
1777
1516
1478
360
6088
6015
1626
446
1702
237
1304
6085

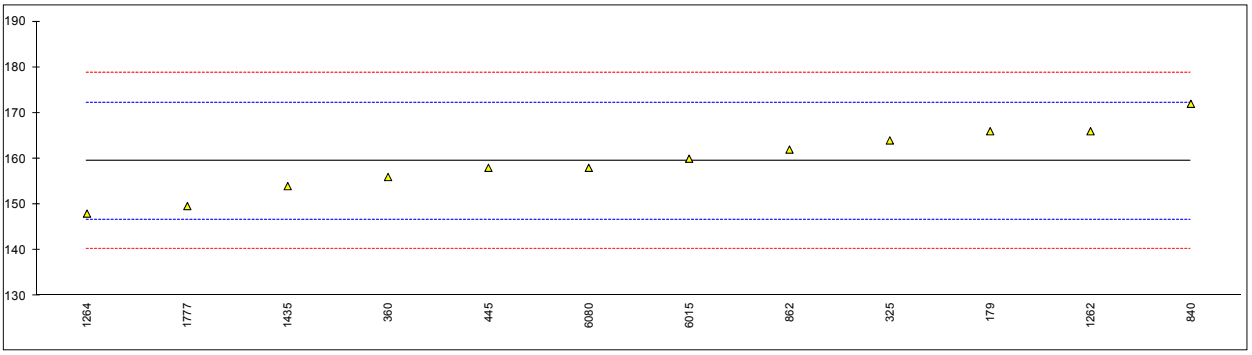

Kernel Density
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
-2000
0
2000
4000
6000
8000

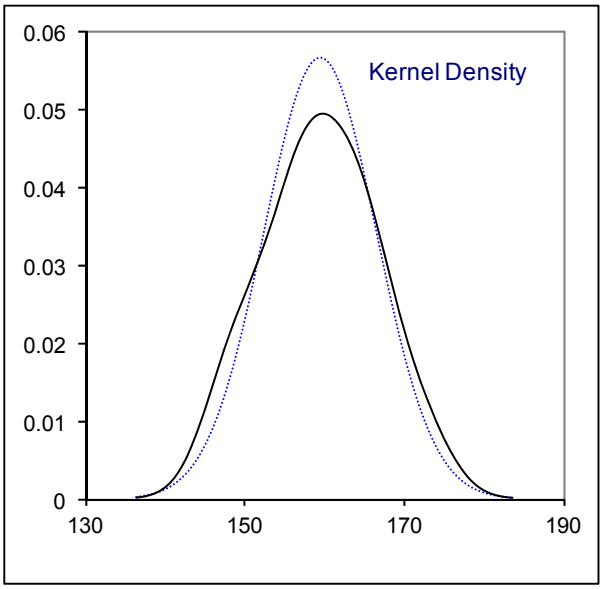
Determination of Flash Point COC on sample #16250; results in °C

lab	method	value	mark	z(targ)	remarks
179	D92	166		1.02	
237		-----		-----	
273		-----		-----	
325	D92	164		0.70	
360	D92	156		-0.54	
445	D92	158.0		-0.23	
446		-----		-----	
614		-----		-----	
840	ISO2592	172		1.95	
862	D92	162		0.39	
912		-----		-----	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146		-----		-----	
1156		-----		-----	
1161		-----		-----	
1262	ISO2592	166		1.02	
1264	D92	148	C	-1.78	first reported as PMcc
1304		-----		-----	
1306		-----		-----	
1326		-----		-----	
1435	D92	154		-0.85	
1440		-----		-----	
1442		-----		-----	
1444		-----		-----	
1461		-----		-----	
1478		-----		-----	
1513		-----		-----	
1516		-----		-----	
1560		-----		-----	
1568		-----		-----	
1626		-----		-----	
1628		-----		-----	
1660		-----		-----	
1687		-----		-----	
1702		-----		-----	
1719		-----		-----	
1743		-----		-----	
1747		-----		-----	
1760		-----		-----	
1777	D92	149.65		-1.53	
1890		-----		-----	
1898		-----		-----	
1947		-----		-----	
1955		-----		-----	
2122		-----		-----	
4043		-----		-----	
6015	ISO2592	160		0.08	
6048		-----		-----	
6053		-----		-----	
6080	D92	158		-0.23	
6085		-----		-----	
6088		-----		-----	
6099		-----		-----	

normality	OK
n	12
outliers	0
mean (n)	159.47
st.dev. (n)	7.031
R(calc.)	19.69
R(D92:16a)	18.00

compare R(ISO2592:2000) = 17.00

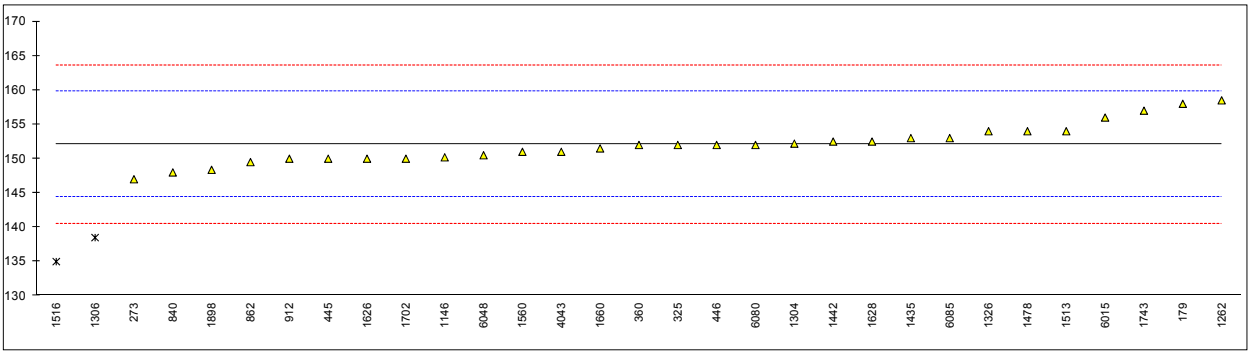

190
180
170
160
150
140
130
1264
1777
1435
360
445
6080
6015
862
325
179
1262
840

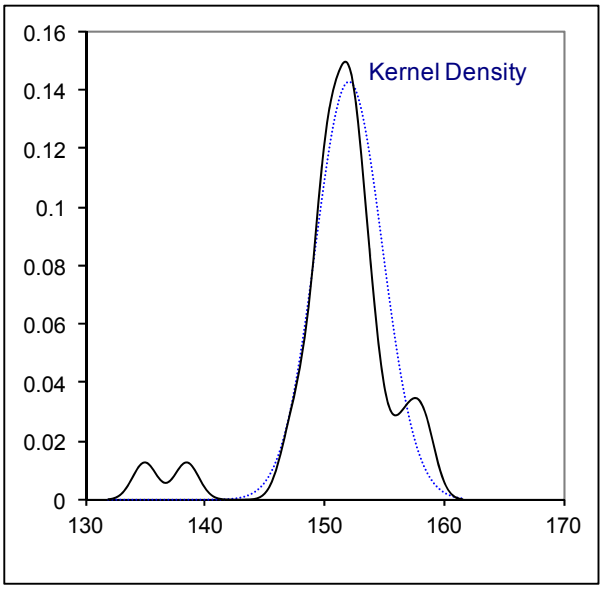

Kernel Density
0.06
0.05
0.04
0.03
0.02
0.01
0
130
150
170
190

Determination of Flash Point PMcc on sample #16250; results in °C

lab	method	value	mark	z(targ)	remarks
179	D93-A	158.0		1.54	
237		-----		-----	
273	D93	147		-1.31	
325	D93-A	152		-0.02	
360	ISO2719-A	152.0		-0.02	
445	ISO2719-A	150.0		-0.53	
446	D93-A	152		-0.02	
614		-----		-----	
840	ISO2719-A	148.0		-1.05	
862	D93-A	149.5		-0.66	
912	D93-A	150		-0.53	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146	In house	150.2		-0.48	
1156		-----		-----	
1161		-----		-----	
1262	ISO2719-A	158.5		1.67	
1264		-----		-----	
1304	INH-115	152.2		0.04	
1306	D7094	138.5	C,R(0.01)	-3.52	first reported as an Open Cup method
1326	D93-A	154.0		0.50	
1435	D93-A	153		0.24	
1440		-----		-----	
1442	ISO2719-A	152.5		0.11	
1444		-----		-----	
1461		-----		-----	
1478	ISO2719-A	154.0		0.50	
1513	ISO2719-A	154.0		0.50	
1516	D93-A	135	R(0.01)	-4.42	
1560	ISO2719	151		-0.28	
1568		-----		-----	
1626	D93-A	150		-0.53	
1628	ISO2719-A	152.5		0.11	
1660	D93-A	151.5		-0.15	
1687		-----		-----	
1702	ISO2719-B	150		-0.53	
1719		-----		-----	
1743	ISO2719-A	157.0		1.28	
1747		-----		-----	
1760		-----		-----	
1777		-----		-----	
1890		-----		-----	
1898	ISO2719-C	148.375		-0.96	
1947		-----		-----	
1955		-----		-----	
2122		-----		-----	
4043	ISO15267	151		-0.28	
6015	D7236	156.0		1.02	
6048	D93-A	150.5		-0.40	
6053		-----		-----	
6080	D93-A	152		-0.02	
6085	D93-A	153		0.24	
6088		-----		-----	
6099		-----		-----	

	normality	OK	
	n	29	
	outliers	2	
	mean (n)	152.06	
	st.dev. (n)	2.789	
	R(calc.)	7.81	
	R(ISO2719:16-A)	10.80	R(ISO2719:16-A) = R(D93:16a-A) = R(IP34:03-A)

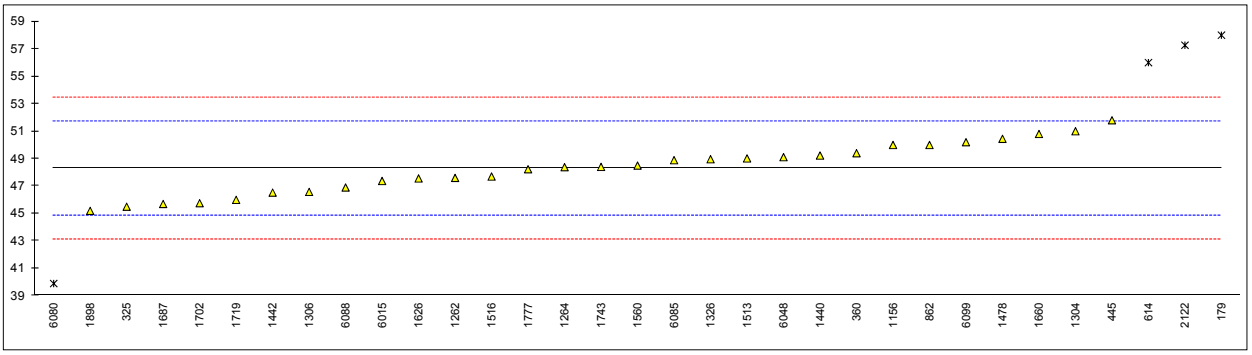

170
165
160
155
150
145
140
135
130
1516
1306
273
840
1898
862
912
445
1626
1702
1146
6048
1560
4043
1660
360
325
446
6080
1304
1442
1628
1435
6085
1326
1478
1513
6015
1743
179
1282

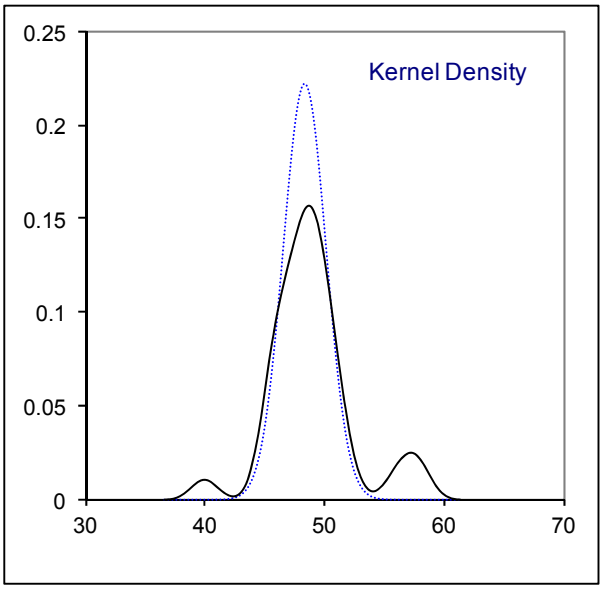

Kernel Density
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
130
140
150
160
170

Determination of Interfacial Surface Tension on sample #16250; results in mN/m

lab	method	value	mark	z(targ)	remarks
179	D971	58	C,R(0.01)	5.62	first reported: 57
237		-----		-----	
273		-----		-----	
325	In house	45.5		-1.62	
360	D971	49.4		0.64	
445	D971	51.8		2.03	
446		-----		-----	
614	D971	56	R(0.01)	4.46	
840		-----		-----	
862	ISO6295	50		0.98	
912		-----		-----	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146		-----		-----	
1156	D971	50.0		0.98	
1161		-----		-----	
1262	D971	47.6		-0.41	
1264	D971	48.38		0.04	
1304	INH-123	51.0		1.56	
1306	D971	46.58		-1.00	
1326	D971	48.96		0.38	
1435		-----		-----	
1440	D971	49.23		0.54	
1442	EN14210	46.530		-1.03	
1444		-----		-----	
1461		-----		-----	
1478	D971	50.45		1.24	
1513	D971	49.02		0.42	
1516	D971	47.7		-0.35	
1560	D971	48.5		0.11	
1568		-----		-----	
1626	ISO6295	47.56		-0.43	
1628		-----		-----	
1660	D971	50.8		1.45	
1687	D971	45.7		-1.51	
1702	D971	45.759	C	-1.47	first reported: 42.354
1719	D2285	46		-1.33	
1743	D971	48.4		0.06	
1747		-----		-----	
1760		-----		-----	
1777	D971	48.23		-0.04	
1890		-----		-----	
1898	D971	45.2		-1.80	
1947		-----		-----	
1955		-----		-----	
2122	EN14210	57.27	R(0.01)	5.20	
4043		-----		-----	
6015	D971	47.375		-0.54	
6048	D971	49.11		0.47	
6053		-----		-----	
6080	D971	39.9	R(0.01)	-4.87	
6085	D971	48.89		0.34	
6088	ISO6295	46.9		-0.81	
6099	EN14210	50.2		1.10	

normality	OK
n	29
outliers	4
mean (n)	48.303
st.dev. (n)	1.7944
R(calc.)	5.024
R(D971:12)	4.830

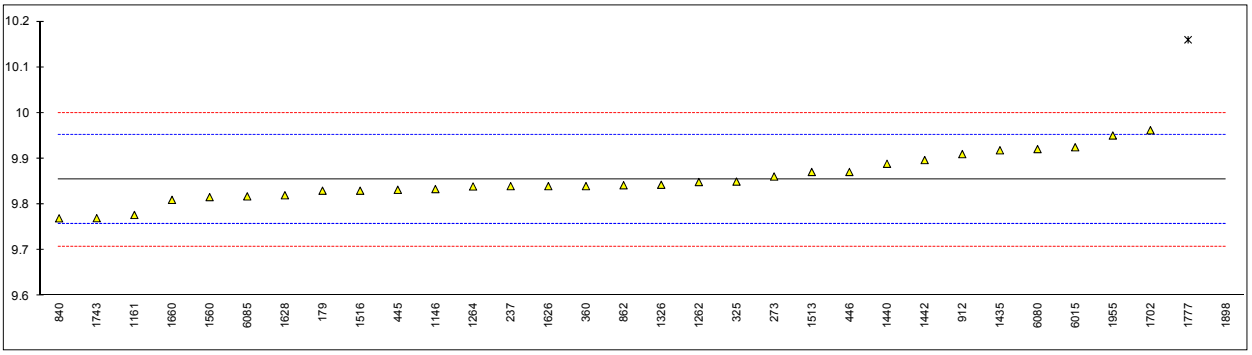

59
57
55
53
51
49
47
45
43
41
39
6080
1898
325
1687
1702
1719
1442
1306
6088
6015
1626
1262
1516
1777
1264
1743
1560
6085
1326
1513
6048
1440
360
1156
862
6099
1478
1660
1304
445
614
2122
179

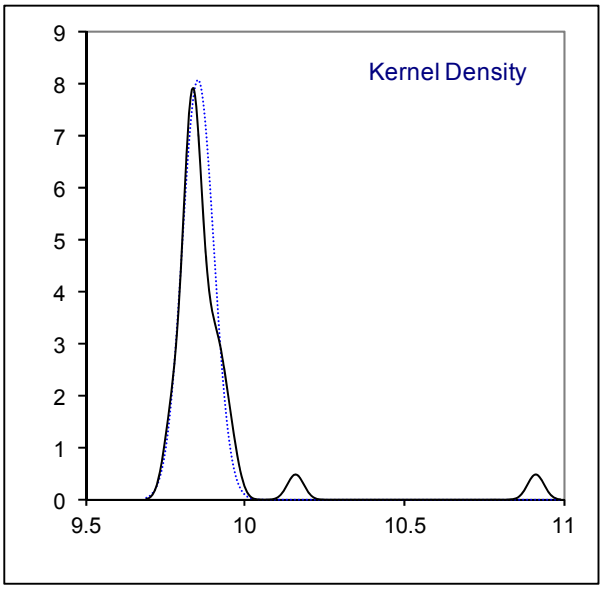

Kernel Density
0.25
0.2
0.15
0.1
0.05
0
30
40
50
60
70

Determination of Kinematic Viscosity at 40°C on sample #16250; results in mm^2/s

lab	method	value	mark	z(targ)	remarks
179	D445	9.83		-0.50	
237	D445	9.840		-0.29	
273	D445	9.861		0.14	
325	D445	9.850		-0.09	
360	ISO3104	9.8401		-0.29	
445	ISO3104	9.832		-0.46	
446	D445	9.871		0.35	
614		-----		-----	
840	ISO3104	9.7696		-1.74	
862	ISO3104	9.842		-0.25	
912	D445	9.91		1.15	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146	ISO3104	9.8336		-0.42	
1156		-----		-----	
1161	ISO3104	9.777		-1.59	
1262	ISO3104	9.849		-0.11	
1264	D7042	9.8393		-0.31	
1304		-----		-----	
1306		-----		-----	
1326	D445	9.843		-0.23	
1435	D7042	9.9184		1.32	
1440	ISO3104	9.88891		0.72	
1442	D7042	9.8970		0.88	
1444		-----		-----	
1461		-----		-----	
1478		-----		-----	
1513	ISO3104	9.87095		0.35	
1516	ISO3104	9.83	C	-0.50	first reported: 9.30
1560	ISO3104	9.816		-0.79	
1568		-----		-----	
1626	D445	9.84		-0.29	
1628	ISO3104	9.820		-0.70	
1660	D7042	9.81		-0.91	
1687		-----		-----	
1702	D7042	9.9622		2.22	
1719		-----		-----	
1743	D7279	9.77		-1.73	
1747		-----		-----	
1760		-----		-----	
1777	D445	10.16	C,R(0.01)	6.30	first reported: 10.054
1890		-----		-----	
1898	ISO3104	10.913	R(0.01)	21.80	
1947		-----		-----	
1955	D7042	9.9507		1.99	
2122		-----		-----	
4043		-----		-----	
6015	D7279	9.925		1.46	
6048		-----		-----	
6053		-----		-----	
6080	D445	9.921		1.38	
6085	D7042	9.8177		-0.75	
6088		-----		-----	
6099		-----		-----	

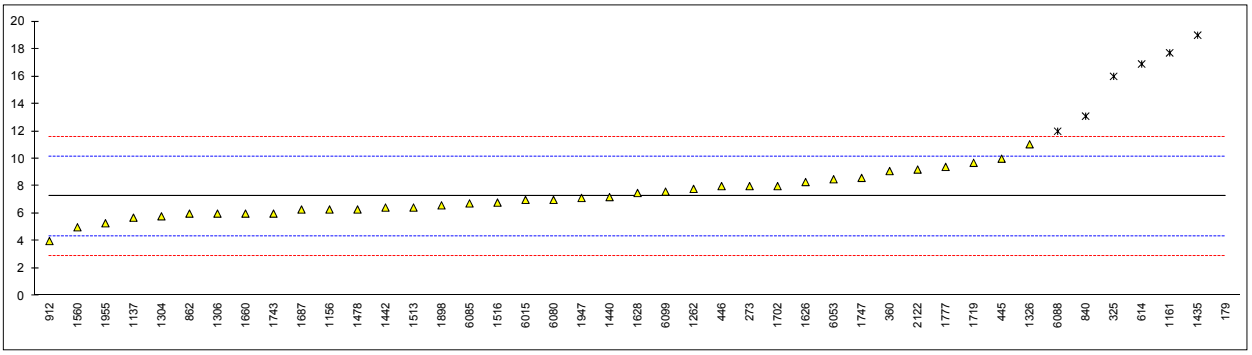
			Only ISO3104/D445:	Only D7042:	Only D7279:
	normality	OK	OK	OK	unknown
	n	30	21	7	2
	outliers	2	2	0	n.a.
	mean (n)	9.854	9.845	9.885	9.845 (average of results)
	st.dev. (n)	0.0494	0.0362	0.0630	0.155 (difference of results)
	R(calc.)	0.138	0.101	0.176	
	R(D445:15a)	0.136	0.136		
comp	R(ISO3104:94)	0.075	0.075		
comp	R(D7042:16e3)			0.222	
comp	R(D7279:16)				0.149

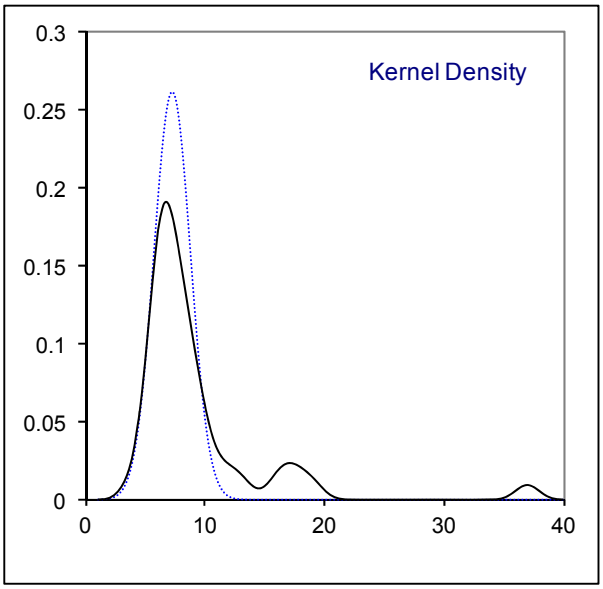

10.2
10.1
10
9.9
9.8
9.7
9.6
840
1743
1161
1660
1560
6085
1628
179
1516
445
1146
1264
237
1626
360
862
1326
1262
325
273
1513
446
1440
1442
912
1435
6080
6015
1955
1702
1777
1898


Kernel Density
9
8
7
6
5
4
3
2
1
0
9.5
10
10.5
11

Determination of Water on sample #16250; results in mg/kg

lab	method	value	mark	z(targ)	remarks
179	D6304-C	37	C,R(0.01)	20.64	first reported: 2.4
237		-----		-----	
273	EN60814	8		0.52	
325	D6304-C	16	R(0.01)	6.07	
360	EN60814	9.1		1.29	
445	D6304-B	10		1.91	
446	EN60814	8		0.52	
614	IEC60814	16.9	R(0.01)	6.70	
840	IEC60814	13.10	R(0.05)	4.06	
862	D6304-A	6		-0.86	
912	D6304-C	4		-2.25	
962		-----		-----	
963		-----		-----	
1137	ISO12937	5.70		-1.07	
1146		-----		-----	
1156	IEC60814	6.3		-0.66	
1161	ISO12937	17.712	C,R(0.01)	7.26	first reported: 12.217
1262	EN60814	7.8		0.39	
1264		-----		-----	
1304	INH-121	5.8		-1.00	
1306	EN60814	6		-0.86	
1326	D1533	11.05		2.64	
1435	IEC60814	19	R(0.01)	8.15	
1440	EN60814	7.2		-0.03	
1442	IEC60814	6.44		-0.56	
1444		-----		-----	
1461		-----		-----	
1478	EN60814	6.3		-0.66	
1513	IEC60814	6.44		-0.56	
1516	IEC60814	6.8		-0.31	
1560	IEC60814	5		-1.56	
1568		-----		-----	
1626	IEC60814	8.3		0.73	
1628	EN60814	7.5		0.18	
1660	EN60814	6		-0.86	
1687	IEC60814	6.296		-0.66	
1702	IEC60814	8		0.52	
1719	IEC60814	9.7		1.70	
1743	IEC60814	6		-0.86	
1747	IEC60814	8.6		0.94	
1760		-----		-----	
1777	IEC60814	9.4		1.49	
1890		-----		-----	
1898	EN60814	6.6		-0.45	
1947	IEC60814	7.138		-0.07	
1955	IEC60814	5.2927		-1.35	
2122	EN60814	9.21		1.36	
4043		-----		-----	
6015	DIN51777	7.00		-0.17	
6048		-----		-----	
6053	IEC60814	8.5		0.87	
6080	D1533	7		-0.17	
6085	EN60814	6.7427		-0.35	
6088	D1533	12	C,R(0.05)	3.30	first reported; 20
6099	IEC60814	7.6		0.25	
	normality	OK			
	n	36			
	outliers	7			
	mean (n)	7.245			
	st.dev. (n)	1.5289			Compare R(D1533:12) = 14.000
	R(calc.)	4.281			Compare R(D6304:16e1-C) = 55.422, range: 10-25000
	R(EN60814:98)	4.037			Compare R(ISO12937:00) = 18.510, range: 30-10000


20
18
16
14
12
10
8
6
4
2
0
912
1560
1955
1137
1304
862
1306
1660
1743
1687
1156
1478
1442
1513
1898
6085
1516
6015
6080
1947
1440
1628
6099
1262
446
273
1702
1626
6053
1747
360
2122
1777
1719
445
1326
6088
840
325
614
1161
1435
179


Kernel Density
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40

Determination of DBPC Antioxidant additive on sample #16250; results in mg/kg

lab	method	value	mark	z(targ)	remarks
179		-----		-----	
237		-----		-----	
273		-----		-----	
325		-----		-----	
360	IEC60666	<100		-----	
445		-----		-----	
446		-----		-----	
614		-----		-----	
840	IEC60666	0.00		-----	
862		-----		-----	
912	D4768	Not detected		-----	
962		-----		-----	
963		-----		-----	
1137		-----		-----	
1146		-----		-----	
1156	IEC60666	0		-----	
1161		-----		-----	
1262	IEC60666	none		-----	
1264		-----		-----	
1304		-----		-----	
1306		-----		-----	
1326		-----		-----	
1435	IEC60666-B	<LOQ		-----	
1440	IEC60666	0.00		-----	
1442	IEC60666	<0,01		-----	
1444		-----		-----	
1461		-----		-----	
1478	IEC60666	0.00		-----	
1513	IEC60666	< 0,01		-----	
1516	IEC60666	0		-----	
1560	IEC60666	Not detectable		-----	
1568		-----		-----	
1626	IEC60666	0		-----	
1628		-----		-----	
1660	IEC60666	0.000		-----	
1687		-----		-----	
1702	IEC60666	not detected		-----	
1719		-----		-----	
1743		-----		-----	
1747		-----		-----	
1760		-----		-----	
1777	IEC60666	0.001		-----	
1890		-----		-----	
1898		-----		-----	
1947		-----		-----	
1955		-----		-----	
2122		-----		-----	
4043		-----		-----	
6015		-----		-----	
6048		-----		-----	
6053		-----		-----	
6080	IEC60666	4		-----	
6085		-----		-----	
6088		-----		-----	
6099	IEC60666	0.00		-----	
	n	13			
	mean (n)	<100			

APPENDIX 2

Number of participants per country

2 labs in AUSTRALIA
3 labs in BELGIUM
3 labs in BULGARIA
2 labs in CHINA, People's Republic
1 lab in ESTONIA
3 labs in FRANCE
5 labs in GERMANY
1 lab in GREECE
1 lab in INDIA
1 lab in ISRAEL
1 lab in ITALY
1 lab in MALAYSIA
1 lab in MEXICO
1 lab in NETHERLANDS
1 lab in NEW ZEALAND
1 lab in NIGERIA
2 labs in PORTUGAL
2 labs in SAUDI ARABIA
2 labs in SINGAPORE
1 lab in SLOVENIA
2 labs in SOUTH AFRICA
1 lab in SOUTH KOREA
2 labs in SPAIN
1 lab in SWEDEN
1 lab in SWITZERLAND
3 labs in TURKEY
5 labs in UNITED ARAB EMIRATES
3 labs in UNITED KINGDOM
1 lab in UNITED STATES OF AMERICA
1 lab in VIETNAM

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	= probably an error in calculations
U	= test result probably reported in a different unit
W	= test result withdrawn on request participant
ex	= test result excluded from statistical evaluation
n.a.	= not applicable
n.e.	= not evaluated
n.d.	= not detected
fr.	= first reported
SDS	= Safety Data Sheet
B&C	= Bright & Clear

Literature:

1 iis Interlaboratory Studies, Protocol for the Organisation, Statistics and Evaluation, April 2014
2 prNEN 12766-2:2000
3 ASTM E178:02
4 ASTM E1301:03
5 ISO 5725:86
6 ISO 5725, parts 1-6, 1994
7 M. Thompson and R. Wood, J. AOAC Int, 76, 926, (1993)
8 W.J. Youden and E.H. Steiner, Statistical Manual of the AOAC, (1975)
9 IP 367:84
10 DIN 38402 T41/42
11 P.L. Davies, Fr. Z. Anal. Chem, 331, 513, (1988)
12 J.N. Miller, Analyst, 118, 455, (1993)
13 Analytical Methods Committee Technical Brief, No 4, January 2001
14 P.J. Lowthian and M. Thompson, the Royal Society of Chemistry, Analyst, 127, 1359-1364 (2002)
15 Bernard Rosner, Percentage Points for a Generalized ESD Many-Outlier Procedure, *Technometrics*, 25(2), 165-172, (1983)