Results of Proficiency Test
Liquefied Propane
October 2016

Organised by: Institute for Interlaboratory Studies
Spijkenisse, the Netherlands

Author: dr. R.G. Visser
Correctors: ing. A.S. Noordman – de Neef & ing. C.M. Nijssen-Wester
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1 INTRODUCTION

Since 2009, the Institute for Interlaboratory Studies organizes a proficiency test for the analysis of Liquefied Propane (composition only) every year. It was decided to continue this interlaboratory study during the annual program 2016/2017.
Because iis has limited gas-handling facilities in place to prepare gas samples, a co-operation with EffecTech (Uttoxeter, United Kingdom) was set up. This company is fully equipped and has experience in the preparation of gas mixtures for PT purposes. EffecTech maintains an ISO/IEC 17043 accreditation for the preparation of PT samples in homogeneous and stable batches and an ISO/IEC 17025 accreditation for the calibration and assignment of reference values for these samples.
In the 2016 proficiency test 48 laboratories in 29 different countries did register for participation. See appendix 2 for the number of participants per country. In this report the results of the 2016 proficiency test on Liquefied Propane 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).
To optimise the costs for the participants, it was decided to prepare one Liquefied Propane mixture. The mixture was divided over a batch of 56 cylinders. The cylinder size is a cost-effective one-litre cylinder with dip tube device. Each cylinder, filled with approx 200 grams of liquefied propane mixture, was uniquely numbered. The limited cylinder size is chosen to optimise sample stability, cylinder costs, transport and handling costs. The preparation and testing of the sample cylinders was subcontracted to an ISO/IEX17025 accredited laboratory.
Participants were requested to report rounded and unrounded test results. The unrounded test results were preferably used for statistical evaluation.

2.1 QUALITY SYSTEM

The Institute for Interlaboratory Studies in Spijkenisse, the Netherlands, has implemented a quality system based on ISO/IEC 17043:2010. 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 a regular basis by sending out questionnaires. EffecTech is an accredited provider of proficiency testing schemes under the requirements of ISO/IEC17043:2010 by UKAS (no. 4719).

2.2 PROTOCOL

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' of April 2014 (iis-protocol, version 3.3). This protocol is electronically available through the iis web site 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

In this proficiency test only one sample was used. One batch of 56 one litre cylinders with artificial Liquefied Propane mixture was prepared and tested for homogeneity by EffecTech (Uttoxeter, United Kingdom) in conformance with ISO Guide 35: 2006 and ISO/IEC17043:2010 (job 16/0854) starting September 1, 2016. Each cylinder was uniquely numbered. Every cylinder in the batch was analysed using 5 replicate measurements. The within bottle and between bottle variations were then assessed in accordance with ISO Guide 35:2006 (Annex A.1). This procedure showed that the between bottle variations were all small compared to the uncertainties on the reference values on each component. Hence, a single reference value could be safely assigned to the entire batch of samples.

The repeatability values (r) were calculated per component by multiplication of the respective standard deviation by 2.8. Subsequently, the calculated repeatabilities were compared with 0.3 times the reproducibility of the reference method in agreement with the procedure of ISO 13528, Annex B2 in the next table:

Component	r(observed) in %mol/mol	0.3 X R(D2163:14e1) in %mol/mol
Ethane	0.004	0.053
Propane	0.068	1.244
Propylene	0.007	0.061
Iso-Butane	0.027	0.072
n-Butane	0.024	0.065
1-Butene	0.002	0.020
iso-Butylene	0.002	0.020
n-Pentane	0.006	0.023

Table 1: homogeneity test results of samples #16225

Each calculated repeatability is equal or less than 0.3 times the corresponding reproducibility of the reference method ASTM D2163:14e1. Therefore, homogeneity of the subsamples #16225 was assumed.

To each of the participating laboratories one 1L cylinder was sent on October 5, 2016.

2.5 STABILITY OF THE SAMPLES

EffecTech (Uttoxeter, United Kingdom) declares that the prepared gas cylinders have a shelf life of at least 6 months. This is sufficient for the proficiency testing purposes.

2.6 ANALYSES

The participants were asked to determine the composition of the gas mixture of sample #16225: Ethane, Propane, Propene, n-Butane, iso-Butane, 1-Butene, iso-Butene, n-Pentane and to calculate several physical parameters from the composition: Molar Mass, Relative Density at 60F, Absolute and Relative Vapour pressure at 100F, Absolute and Relative Vapour pressure at 40°C and MON.

To get comparable test results a detailed report form, on which the units were prescribed as well as the required reference test method 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. A SDS was added to the samples.

3 RESULTS

During five weeks after sample dispatch the results of the individual laboratories were gathered via the data entry portal www.kmpd.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 reanalysis). Additional or corrected test results are used for data analysis and original test results are placed under 'Remarks' in the test 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

Statistical calculations were performed as described 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 results. 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. Not all data sets proved to have a normal distribution, in which cases the statistical evaluation of the results should be used with due care.

According to ISO 5725 the original test results per determination were submitted to Dixon’s, Grubbs’ and/or 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 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. 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 one 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 for reference.

3.3 Z-SCORES

To evaluate the performance of the participating laboratories the z-scores were calculated. In order to be able to have an objective evaluation of the performance of each participant, it was decided to evaluate this performance against the literature requirements, e.g. ASTM reproducibilities. Therefore the z-scores were calculated using a target standard deviation. This target standard deviation was calculated from the literature reproducibility (R) 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:

$z_{(target)}$ = (test 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 several problems were encountered with sample transport. Due to these problems three cylinders did reach the laboratory near or after the final reporting date. Therefore these three laboratories were unable to test the cylinder and to report results before the deadline of reporting. Another two laboratories did not report any test results due to several other reasons. Not all laboratories did report all test results requested.

In total 43 participating laboratories reported 472 numerical test results. Observed were 34 outlying test results, which is 7.2% of all numerical results. In proficiency studies outlier percentages of 3% - 7.5% are quite normal.

4.1 EVALUATION PER TEST/COMPONENT

In this section the results are discussed per component and per test. The test methods, which were used by the various laboratories, are 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. 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.

Most test results reported by laboratories 347, 1026, 1776 and 6018 were deviating and many of the eight test results appeared to be statistical outliers. As the calculated physical test results are dependent on the composition, it was decided to reject all of the calculated test results of these four laboratories from the statistical evaluations.

Ethane: The determination of this component was not problematic. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers, is in good agreement with the requirements of ASTM D2163:14e1 and also with the reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

Propane: The determination of this component was not problematic. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D2163:14e1 and also with the reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

Propene: The determination of this component was not problematic. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D2163:14e1 and also with the reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

iso-Butane: The determination of this component may be problematic, depending on the test method used by the laboratory. Four statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D2163:14e1. However, the calculated reproducibility is in good agreement with the less strict reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

n-Butane: The determination of this component may be problematic, depending on the test method used by the laboratory. Four statistical outliers were

observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D2163:14e1. However, the calculated reproducibility is in good agreement with the less strict reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

1-Butene: The determination of this component was not problematic. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D2163:14e1 and also with the reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

Iso-Butene: The determination of this component was not problematic. Four statistical outliers were observed. However, the calculated reproducibility after rejection of the statistical outliers is in good agreement with the requirements of ASTM D2163:14e1 and also with the reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

n-Pentane: The determination of this component may be problematic, depending on the test method used by the laboratory. Four statistical outliers were observed. The calculated reproducibility after rejection of the statistical outliers is not in agreement with the requirements of ASTM D2163:14e1. However, the calculated reproducibility is in good agreement with the less strict reproducibility requirements of EN27941:93 (identical to IP405 and ISO7941).

Molar Mass: This calculated parameter may not be problematic. The results vary over a range from 44.64 – 45.988 g/mol. No statistical outliers were present, but four test results were excluded. The calculated reproducibility after rejection of the four suspect test results is in agreement with the observed reproducibility in the previous PT iis15S03P (0.135 vs. 0.122).

Rel. Density at 60F: This calculated parameter may be problematic. The results vary over a range from 0.5097 – 1.585. No statistical outliers were present, but two test results may contain a calculation error. The calculated reproducibility after rejection of the suspect test results is large in comparison with the calculated reproducibility of iis15S03P (0.00229 vs. 0.00070).

Abs. VP at 100F: As the reported results calculated via ASTM D2598 and ISO8973 are not identical, it was decided to calculate the absolute vapour pressure for each laboratory according to both test methods by using all reported components concentrations. When the result of the calculation method of ASTM D2598 is compared with the result of the calculation method of ISO8973, it is noticed that the difference in the means is significant,

while the difference in the reproducibilities is not significant. See also the discussion in 5. The calculated reproducibilities after rejection of the four suspect test results are larger than the reproducibilities observed in the previous PT iis15S03P (0.962 vs 0.749 for ISO8973 and 1.007 vs 0.798 for D2598).

Rel. VP at 100F: As the reported results calculated via ASTM D2598 and ISO8973 are not identical, it was decided to calculate the relative vapour pressure for each laboratory according to both test methods by using all reported components concentrations. When the result of the calculation method of ASTM D2598 is compared with the result of the calculation method of ISO8973, it is noticed that the difference in the means is significant, while the difference in the precisions is not significant. See also the discussion in 4.3. The calculated reproducibilities after rejection of the four suspect test results are larger than the reproducibilities observed in the previous PT iis15S03P (0.962 vs 0.749 for ISO8973 and 1.007 vs 0.798 for D2598).

Abs. VP at 40°C: This determination may be problematic for a number of laboratories. The range of the reported test results is large: from 1241 - 1324 kPa. Two calculation errors were observed. After rejection of the suspect data one statistical outlier was observed. The quality of the test results did not improve since the previous PT iis15S03P as the reproducibility of the results is comparable (5.83 vs 4.67).

Rel. VP at 40°C: This determination may be problematic for a number of laboratories. The range of the reported test results is large: from 1140 – 1223 kPa. Two calculation errors were observed. After rejection of the suspect data one statistical outlier was observed. The quality of the test results did not improve since the previous PT iis15S03P as the dispersion of the results is comparable (6.64 vs 4.66).

MON: As the reported results calculated via ASTM D2598 and EN589 are not identical, it was decided to calculate MON for each laboratory according to both test methods by using all reported components concentrations. When the result of the calculation method of ASTM D2598 is compared with the result of the calculation method of EN589, it is noticed that the difference in the means is significant and the difference in the precisions is also significant. See also the discussion in 4.3.

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 D2163:14e1 and EN27941/ISO7941/IP405) are compared in the next table.

Parameter	unit	n	cons. value	2.8 * sd	R(D2163:14e1) in **%mol**	R(EN27941) liq.-inj. in **%mol**
Ethane	%mol/mol	38	0.364	0.076	0.167	0.300
Propane	%mol/mol	38	92.52	0.79	4.14	1.02
Propene	%mol/mol	36	0.588	0.072	0.201	0.214
iso-Butane	%mol/mol	38	2.65	0.29	0.24	0.39
n-Butane	%mol/mol	38	2.84	0.41	0.22	0.39
1-Butene	%mol/mol	36	0.203	0.029	0.067	0.160
Iso-Butene	%mol/mol	37	0.198	0.040	0.066	0.160
n-Pentane	%mol/mol	38	0.628	0.104	0.077	0.312
Molar Mass	g/mol	18	45.04	0.14	n.a.	n.a.
Rel. Density at 60F		22	0.5120	0.0023	n.a.	n.a.
Abs. VP at 100F-ISO, see §4.4	psi	16	184.4	1.0	n.a.	n.a.
Abs. VP at 100F-ASTM, see §4.4	psi	16	180.4	1.0	n.a.	n.a.
Rel. VP at 100F-ISO, see §4.4	psi	19	169.7	1.0	n.a.	n.a.
Rel. VP at 100F-ASTM, see §4.4	psi	19	165.7	1.0	n.a.	n.a.
Abs. VP at 40°C	kPa	14	1307.6	5.8	n.a.	n.a.
Rel. VP at 40°C	kPa	15	1206.2	6.6	n.a.	n.a.
MON – EN589, see §4.4		13	95.08	0.04	n.a.	n.a.
MON – D2598, see §4.4		13	96.47	0.07	n.a.	n.a.

Table 2: Performance of the group in comparison with the target reproducibilities

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

4.3 COMPARISON OF THE PROFICIENCY TEST OF OCTOBER 2016 WITH PREVIOUS PTS

	Oct. 2016	Oct. 2015	Oct. 2014	Oct. 2013	Oct. 2012
Number of reporting labs	43	41	44	35	27
Number of test results reported	472	468	395	367	267
Statistical outliers	34	24	27	26	19
Percentage outliers	7.2%	5.1%	6.8%	7.1%	7.1%

Table 3: 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 requirements of ASTM D2163. For 2012 – 2013 against D2163:96 and for 2014 – 2016 against D2163:14e1. The conclusions are given the following table:

Component	Oct. 2016	Oct. 2015	Oct. 2014	Oct. 2013	Oct. 2012
Ethane	++	++	-	--	--
Propane	++	++	+/-	+/-	+
Propene	++	+	+/-	-	+
iso-Butane	-	+	+/-	-	+/-
n-Butane	-	-	-	--	-
1-Butene	++	++	--	--	-
Iso-Butene	+	++	--	--	--
n-Pentane	-	-	--	--	--

Table 4: comparison determinations against the requirements of ASTM D2163

The following performance categories were used in the above table:

++: 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

5 DISCUSSION

Because several of the reproducibility requirements of ASTM D2163 differ significantly from the reproducibility requirements of EN27941 (for liquid injection), the outcome of the evaluation will be strongly dependent on the target test method selected for the evaluation.

The consensus values as determined in this PT are compared with the average values from the homogeneity testing by EffecTech, United Kingdom in the following table.

Parameter	Average values by EffecTech in %mol/mol	Consensus values from participants results in %mol/mol	Absolute differences in %mol/mol	calc. z-score
Ethane	0.402	0.364	-0.038	+0.63
Propane	92.678	92.519	-0.159	+0.11
Propene	0.597	0.588	-0.009	+0.13
iso-Butane	2.564	2.646	0.082	-0.94
n-Butane	2.761	2.843	0.082	-1.05
1-Butene	0.200	0.203	0.003	-0.13
Iso-Butene	0.198	0.198	0.000	+0.00
n-Pentane	0.599	0.628	0.029	-1.04

Table 5: comparison of consensus values with values determined by EffecTech

From this comparison it is clear that all consensus values as determined in this PT are in line with the values as determined by EffecTech during the preparation of the cylinders.

In principle no additional variation should be introduced when applying a calculation on the reported component concentrations. However, in practice a significant additional uncertainty is added in most cases. See the differences between the values from the test results as reported by the participating laboratories (each using its own calculation procedure) and the values as calculated by iis using one calculation procedure for each set of laboratory test results.

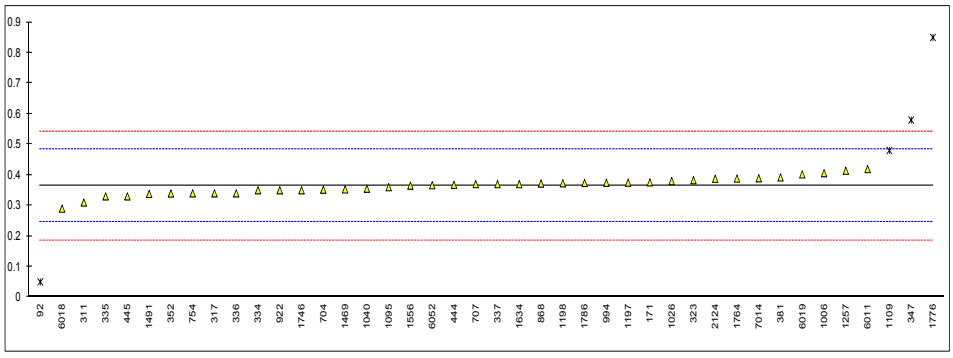
For the calculation of the Molar Mass, Relative Density, Vapour Pressure and Motor Octane Number several standardized test methods are available, e.g. ASTM D2421 for the interconversion of the units to gas-volume, liquid-volume or mass basis. Also different test methods for the calculation of the Vapour Pressure do exist. In ISO 8973 (identical to IP432) the Vapour Pressure is calculated from the mole fraction per component and a Vapour Pressure factor of that component (given for all components). In ASTM D2598 the Vapour Pressure is calculated from the liquid volume percentage per component and a Vapour Pressure factor of that component (given for only several components). Also the selection of the tables to be used for the calculations may cause additional uncertainty. This has been at least observed for Vapour pressure at 100F and Motor Octane Number.

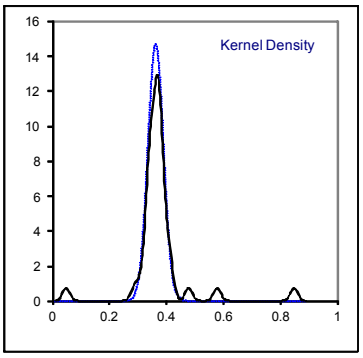
In ASTM D2598 the Gage pressure (identical to the Relative VP) is calculated from the liquid volume percentage per component and a VP factor of that component. Regretfully in the 2002 (2007) version of D2598 no factors are given for n-butene, 1-butene and n-pentane. However, in the 2012 version, factors are mentioned for these and other components.
As one would expect to find identical values from both calculation methods, it is remarkable to see that the results from the ASTM D2598 calculation are significantly lower than the results from the ISO8973/IP432 calculation. The observed difference is caused by a difference in the VP factor of Ethane. ASTM (Subcommittee D02.H) commented (see also Appendix 3, literature: 20):
"*The vapor pressure of ethane in D2598 was revised a few times prior to 2002. The current value, 611 psi, has remained the same for the last ten years. The revision of ethane was done because components in LPG blends do not necessarily behave as ideal gases. In particular, properties of ethane and ethylene appear to differ from ideality. Factors for these two components have been modified from 'ideal gas' values to make the calculated vapor pressure results more closely approximate actual measured vapor pressures of LPG blends. (i.e. D1267). Chapter 2 of Fuels and Lubricants Handbook (George Totten, © 2003), states that calculated vapor pressure were found to be biased high relative to experimental vapor pressure measured by D1267 for high ethane samples in earlier versions of D2598*".

APPENDIX 1

Determination of Ethane on sample #16225; results in %mol/mol

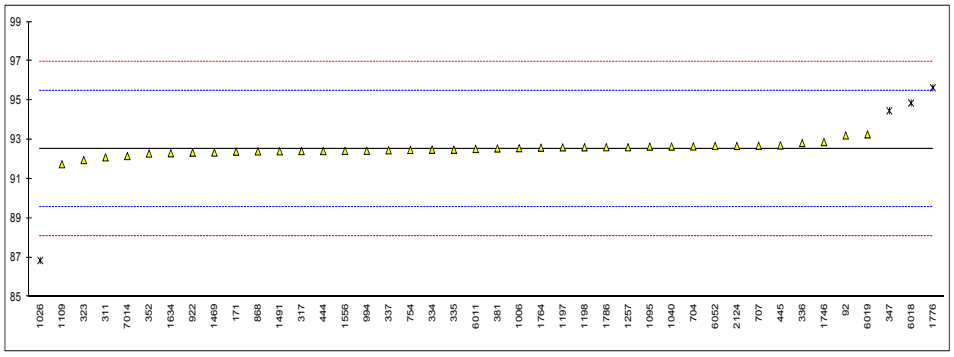
lab	method	value	mark	z(targ)	remarks
92	D2163	0.050	R(0.01)	-5.27	
150		-----		-----	
171	D2163	0.3760		0.20	
311	D2163	0.31		-0.91	
317	D2163	0.34		-0.41	
323	D2163	0.383		0.31	
334	D2163	0.35		-0.24	
335	D2163	0.33		-0.57	
336	D2163	0.34		-0.41	
337	D2163	0.37		0.10	
347	D2163	0.580	R(0.01)	3.62	
352	EN27941	0.3395		-0.42	
381	ISO7941	0.392		0.46	
444	D2163	0.368		0.06	
445	D2163	0.33		-0.57	
511		-----		-----	
562		-----		-----	
704	D2163	0.352		-0.21	
707	D2163	0.370		0.10	
754	D2163	0.340		-0.41	
868	D2163	0.372		0.13	
912		-----		-----	
922	D2163	0.35	C	-0.24	first reported 0.41
994	D2163	0.3746		0.17	
1006	D2163	0.406		0.70	
1011		-----		-----	
1026	D2163	0.38		0.26	
1040	INH-001	0.355		-0.16	
1095	ISO7941	0.36		-0.07	
1109	IP405	0.48	R(0.01)	1.94	
1197	D2163	0.375		0.18	
1198	D2163	0.373		0.15	
1200		-----		-----	
1257	D2163	0.4140		0.83	
1469	D2163	0.352788		-0.19	
1491		0.338		-0.44	
1556	EN27941	0.365		0.01	
1634	ISO7941	0.37		0.10	
1746	D2163	0.35		-0.24	
1764	D2163	0.3884		0.40	
1776	EN27941	0.85	R(0.01)	8.14	
1786	D2163	0.374		0.16	
2124	D2163	0.3880		0.40	
6011	D2163	0.4192		0.92	
6018	EN27941	0.290		-1.25	
6019	EN27941	0.402		0.63	
6052	D2163	0.36645		0.04	
7014	D2163	0.3893		0.42	
	normality	OK			
	n	38			
	outliers	4			
	mean (n)	0.3643			
	st.dev. (n)	0.02720			
	R(calc.)	0.0762			
	R(D2163:14e1)	0.1670			Compare R(EN27941:93(liq)) = 0.2995

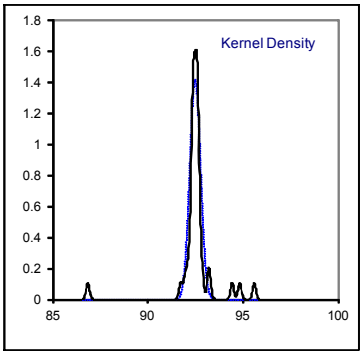




Determination of Propane on sample #16225; results in %mol/mol

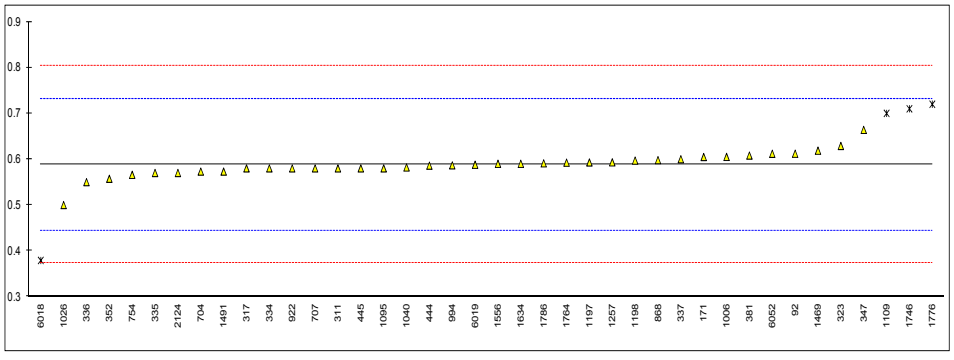
lab	method	value	mark	z(targ)	remarks
92	D2163	93.217		0.47	
150		-----		-----	
171	D2163	92.3891		-0.09	
311	D2163	92.10		-0.28	
317	D2163	92.42		-0.07	
323	D2163	91.964		-0.38	
334	D2163	92.49		-0.02	
335	D2163	92.49		-0.02	
336	D2163	92.83		0.21	
337	D2163	92.46		-0.04	
347	D2163	94.470	R(0.01)	1.32	
352	EN27941	92.2967		-0.15	
381	ISO7941	92.553		0.02	
444	D2163	92.420		-0.07	
445	D2163	92.71		0.13	
511		-----		-----	
562		-----		-----	
704	D2163	92.656		0.09	
707	D2163	92.690		0.12	
754	D2163	92.474		-0.03	
868	D2163	92.404		-0.08	
912		-----		-----	
922	D2163	92.34	C	-0.12	first reported 91.69
994	D2163	92.4366		-0.06	
1006	D2163	92.570		0.03	
1011		-----		-----	
1026	D2163	86.85	R(0.01)	-3.83	
1040	INH-001	92.652		0.09	
1095	ISO7941	92.65		0.09	
1109	IP405	91.75		-0.52	
1197	D2163	92.610		0.06	
1198	D2163	92.612		0.06	
1200		-----		-----	
1257	D2163	92.6166		0.07	
1469	D2163	92.344059		-0.12	
1491		92.411		-0.07	
1556	EN27941	92.435		-0.06	
1634	ISO7941	92.31		-0.14	
1746	D2163	92.88		0.24	
1764	D2163	92.594		0.05	
1776	EN27941	95.64	R(0.01)	2.11	
1786	D2163	92.616		0.07	
2124	D2163	92.6828		0.11	
6011	D2163	92.5253		0.00	
6018	EN27941	94.867	R(0.01)	1.59	
6019	EN27941	93.270		0.51	
6052	D2163	92.681		0.11	
7014	D2163	92.1676		-0.24	
	normality	not OK			
	n	38			
	outliers	4			
	mean (n)	92.5189			
	st.dev. (n)	0.28153			
	R(calc.)	0.7883			
	R(D2163:14e1)	4.1427			Compare R(EN27941:93(liq)) = 1.0210

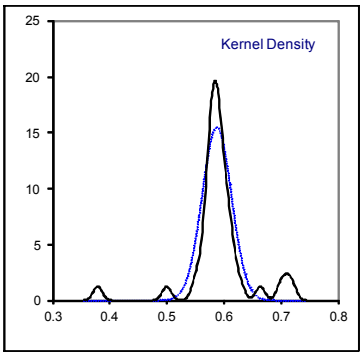




Determination of Propene on sample #16225; results in %mol/mol

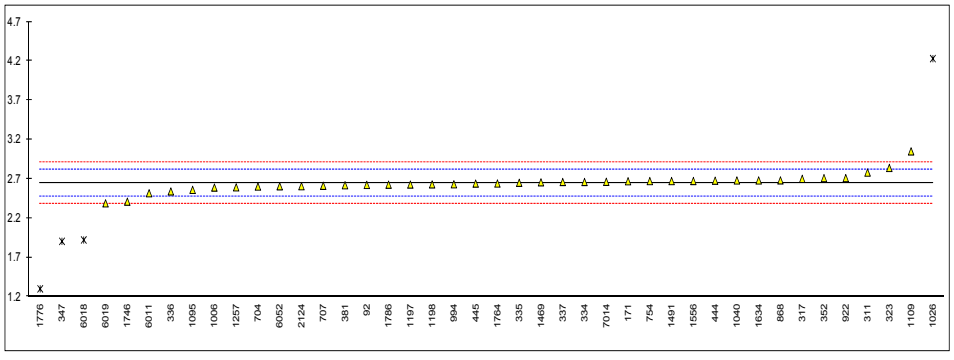
lab	method	value	mark	z(targ)	remarks
92	D2163	0.612		0.34	
150		-----		-----	
171	D2163	0.6048		0.24	
311	D2163	0.58		-0.11	
317	D2163	0.58		-0.11	
323	D2163	0.629		0.58	
334	D2163	0.58		-0.11	
335	D2163	0.57		-0.25	
336	D2163	0.55		-0.53	
337	D2163	0.60		0.17	
347	D2163	0.664		1.06	
352	EN27941	0.5573		-0.43	
381	ISO7941	0.608		0.28	
444	D2163	0.586		-0.02	
445	D2163	0.58		-0.11	
511		-----		-----	
562		-----		-----	
704	D2163	0.573		-0.21	
707	D2163	0.580		-0.11	
754	D2163	0.566		-0.30	
868	D2163	0.598		0.14	
912		-----		-----	
922	D2163	0.58	C	-0.11	first reported 0.66
994	D2163	0.5867		-0.02	
1006	D2163	0.605		0.24	
1011		-----		-----	
1026	D2163	0.50		-1.22	
1040	INH-001	0.582		-0.08	
1095	ISO7941	0.58		-0.11	
1109	IP405	0.70	R(0.01)	1.57	
1197	D2163	0.593		0.07	
1198	D2163	0.597		0.13	
1200		-----		-----	
1257	D2163	0.5932		0.08	
1469	D2163	0.618669		0.43	
1491		0.573		-0.21	
1556	EN27941	0.590		0.03	
1634	ISO7941	0.59		0.03	
1746	D2163	0.71	R(0.01)	1.71	
1764	D2163	0.5925		0.07	
1776	EN27941	0.72	R(0.01)	1.84	
1786	D2163	0.591		0.04	
2124	D2163	0.5700		-0.25	
6011		-----		-----	
6018	EN27941	0.379	R(0.01)	-2.91	
6019	EN27941	0.588		0.00	
6052	D2163	0.6119		0.34	
7014		-----		-----	
	normality	not OK			
	n	36			
	outliers	4			
	mean (n)	0.5878			
	st.dev. (n)	0.02571			
	R(calc.)	0.0720			
	R(D2163:14e1)	0.2007			Compare R(EN27941:93(liq)) = 0.2140

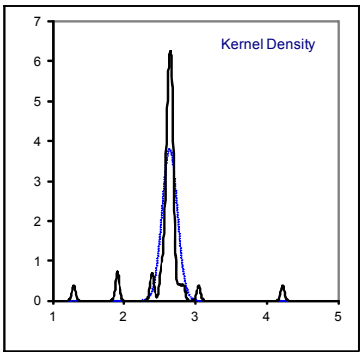




Determination of iso-Butane on sample #16225; results in %mol/mol

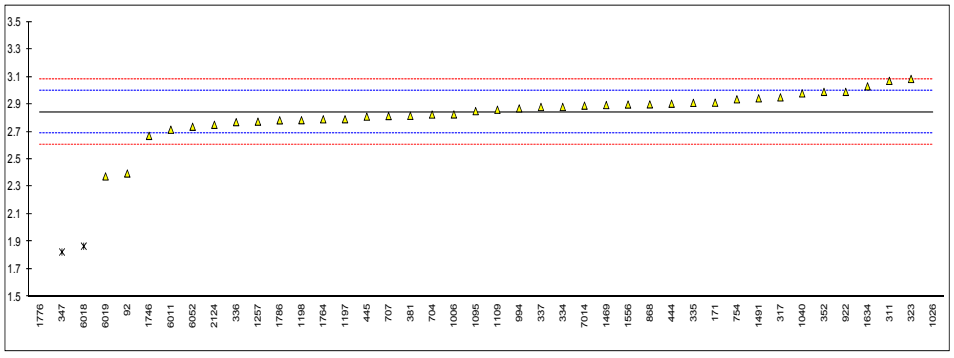
lab	method	value	mark	z(targ)	remarks
92	D2163	2.623		-0.26	
150		-----		-----	
171	D2163	2.6697		0.27	
311	D2163	2.78		1.54	
317	D2163	2.70		0.62	
323	D2163	2.839		2.22	
334	D2163	2.66		0.16	
335	D2163	2.65		0.05	
336	D2163	2.54		-1.22	
337	D2163	2.66		0.16	
347	D2163	1.905	R(0.01)	-8.52	
352	EN27941	2.7097		0.73	
381	ISO7941	2.619		-0.31	
444	D2163	2.677		0.36	
445	D2163	2.64		-0.07	
511		-----		-----	
562		-----		-----	
704	D2163	2.602		-0.50	
707	D2163	2.612		-0.39	
754	D2163	2.672		0.30	
868	D2163	2.681		0.40	
912		-----		-----	
922	D2163	2.71	C	0.74	first reported 2.94
994	D2163	2.6312		-0.17	
1006	D2163	2.589		-0.65	
1011		-----		-----	
1026	D2163	4.23	R(0.01)	18.22	
1040	INH-001	2.680		0.39	
1095	ISO7941	2.56		-0.99	
1109	IP405	3.05		4.65	
1197	D2163	2.628		-0.21	
1198	D2163	2.630		-0.18	
1200		-----		-----	
1257	D2163	2.5918		-0.62	
1469	D2163	2.656037		0.12	
1491		2.672		0.30	
1556	EN27941	2.673		0.31	
1634	ISO7941	2.68		0.39	
1746	D2163	2.41		-2.71	
1764	D2163	2.6409		-0.06	
1776	EN27941	1.30	R(0.01)	-15.48	
1786	D2163	2.626		-0.23	
2124	D2163	2.6064		-0.45	
6011	D2163	2.517		-1.48	
6018	EN27941	1.922	R(0.01)	-8.32	
6019	EN27941	2.388		-2.96	
6052	D2163	2.60555		-0.46	
7014	D2163	2.6630		0.20	
	normality	not OK			
	n	38			
	outliers	4			
	mean (n)	2.6458			
	st.dev. (n)	0.10526			
	R(calc.)	0.2947			
	R(D2163:14e1)	0.2435			Compare R(EN27941:93(liq)) = 0.3873

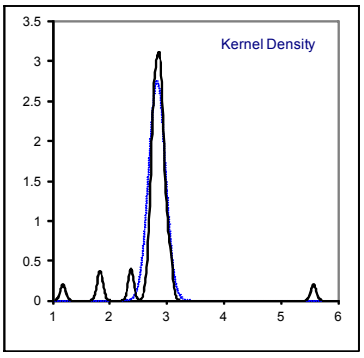




Determination of n-Butane on sample #16225; results in %mol/mol

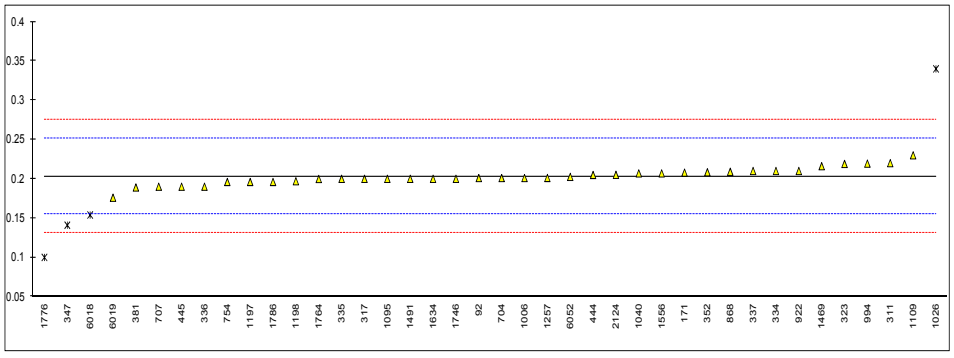
lab	method	value	mark	z(targ)	remarks
92	D2163	2.396		-5.69	
150		-----		-----	
171	D2163	2.9115		0.87	
311	D2163	3.07		2.88	
317	D2163	2.95		1.36	
323	D2163	3.084		3.06	
334	D2163	2.88		0.47	
335	D2163	2.91		0.85	
336	D2163	2.77		-0.93	
337	D2163	2.88		0.47	
347	D2163	1.825	R(0.01)	-12.95	
352	EN27941	2.9899		1.86	
381	ISO7941	2.816		-0.35	
444	D2163	2.904		0.77	
445	D2163	2.81		-0.42	
511		-----		-----	
562		-----		-----	
704	D2163	2.825		-0.23	
707	D2163	2.814		-0.37	
754	D2163	2.936		1.18	
868	D2163	2.899		0.71	
912		-----		-----	
922	D2163	2.99	C	1.87	first reported 3.20
994	D2163	2.8701		0.34	
1006	D2163	2.826		-0.22	
1011		-----		-----	
1026	D2163	5.58	R(0.01)	34.80	
1040	INH-001	2.979		1.73	
1095	ISO7941	2.85		0.09	
1109	IP405	2.86		0.21	
1197	D2163	2.791		-0.66	
1198	D2163	2.784		-0.75	
1200		-----		-----	
1257	D2163	2.7735		-0.89	
1469	D2163	2.893893		0.64	
1491		2.943		1.27	
1556	EN27941	2.898		0.70	
1634	ISO7941	3.03		2.37	
1746	D2163	2.67		-2.20	
1764	D2163	2.7903		-0.67	
1776	EN27941	1.20	R(0.01)	-20.89	
1786	D2163	2.783		-0.77	
2124	D2163	2.7504		-1.18	
6011	D2163	2.7149		-1.63	
6018	EN27941	1.867	R(0.01)	-12.41	
6019	EN27941	2.375		-5.95	
6052	D2163	2.7361		-1.36	
7014	D2163	2.8897		0.59	
	normality	not OK			
	n	38			
	outliers	4			
	mean (n)	2.8432			
	st.dev. (n)	0.14474			
	R(calc.)	0.4053			
	R(D2163:14e1)	0.2202			Compare R(EN27941:93(liq)) = 0.3873

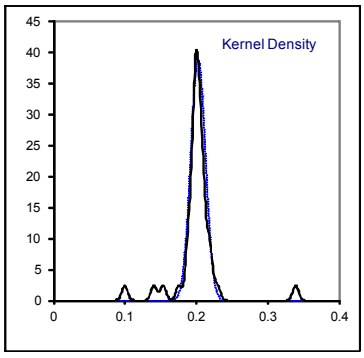




Determination of 1-Butene on sample #16225; results in %mol/mol

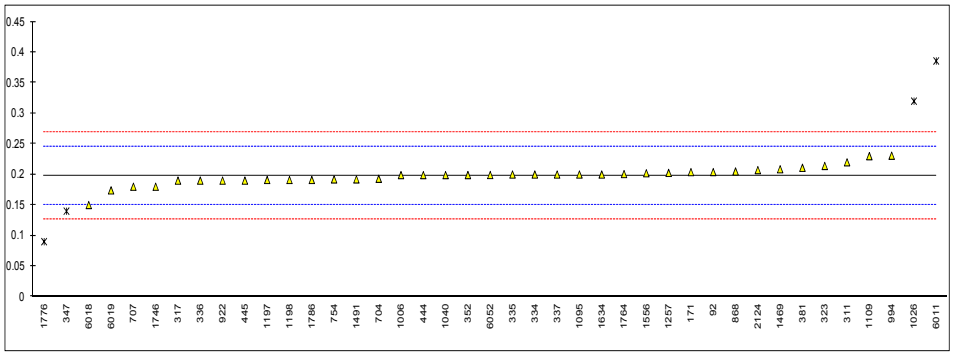
lab	method	value	mark	z(targ)	remarks
92	D2163	0.201		-0.09	
150		-----		-----	
171	D2163	0.2079		0.20	
311	D2163	0.22		0.71	
317	D2163	0.20		-0.13	
323	D2163	0.219		0.66	
334	D2163	0.21		0.29	
335	D2163	0.20		-0.13	
336	D2163	0.19		-0.54	
337	D2163	0.21		0.29	
347	D2163	0.141	R(0.01)	-2.59	
352	EN27941	0.2084		0.22	
381	ISO7941	0.189		-0.59	
444	D2163	0.205		0.08	
445	D2163	0.19		-0.54	
511		-----		-----	
562		-----		-----	
704	D2163	0.201		-0.09	
707	D2163	0.190		-0.54	
754	D2163	0.196		-0.29	
868	D2163	0.209		0.25	
912		-----		-----	
922	D2163	0.21	C	0.29	first reported 0.23
994	D2163	0.2194		0.68	
1006	D2163	0.201		-0.09	
1011		-----		-----	
1026	D2163	0.34	R(0.01)	5.71	
1040	INH-001	0.207		0.16	
1095	ISO7941	0.20		-0.13	
1109	IP405	0.23		1.12	
1197	D2163	0.196		-0.29	
1198	D2163	0.197		-0.25	
1200		-----		-----	
1257	D2163	0.2011		-0.08	
1469	D2163	0.216103		0.54	
1491		0.200		-0.13	
1556	EN27941	0.207		0.16	
1634	ISO7941	0.20		-0.13	
1746	D2163	0.20		-0.13	
1764	D2163	0.1998		-0.14	
1776	EN27941	0.1	R(0.01)	-4.30	
1786	D2163	0.196		-0.29	
2124	D2163	0.2051		0.08	
6011		-----		-----	
6018	EN27941	0.154	R(0.01)	-2.05	
6019	EN27941	0.176		-1.13	
6052	D2163	0.2025		-0.02	
7014		-----		-----	
	normality	suspect			
	n	36			
	outliers	4			
	mean (n)	0.2031			
	st.dev. (n)	0.01026			
	R(calc.)	0.0287			
	R(D2163:14e1)	0.0672			Compare R(EN27941:93(liq)) = 0.1605

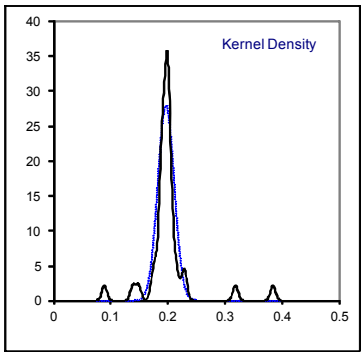




Determination of iso-Butene on sample #16225; results in %mol/mol

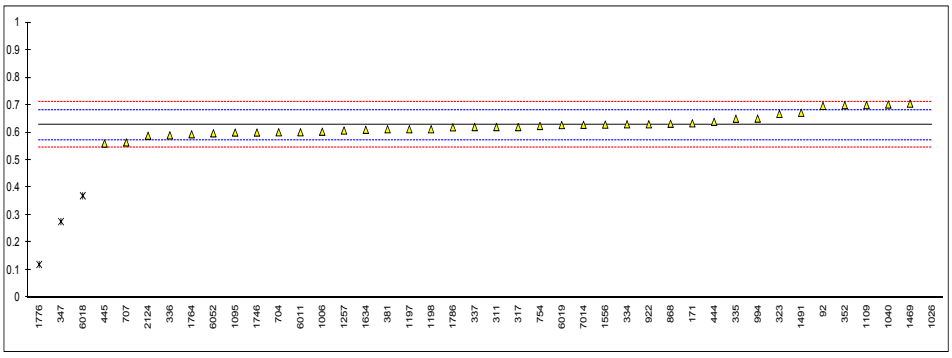
lab	method	value	mark	z(targ)	remarks
92	D2163	0.204		0.25	
150		-----		-----	
171	D2163	0.2039		0.25	
311	D2163	0.22		0.92	
317	D2163	0.19		-0.34	
323	D2163	0.214		0.67	
334	D2163	0.20		0.08	
335	D2163	0.20		0.08	
336	D2163	0.19		-0.34	
337	D2163	0.20		0.08	
347	D2163	0.140	R(0.05)	-2.45	
352	EN27941	0.1991		0.04	
381	ISO7941	0.211		0.54	
444	D2163	0.199		0.04	
445	D2163	0.19		-0.34	
511		-----		-----	
562		-----		-----	
704	D2163	0.193		-0.21	
707	D2163	0.180		-0.76	
754	D2163	0.192		-0.26	
868	D2163	0.205		0.29	
912		-----		-----	
922	D2163	0.19	C	-0.34	first reported 0.22
994	D2163	0.2308		1.38	
1006	D2163	0.199		0.04	
1011		-----		-----	
1026	D2163	0.32	R(0.01)	5.14	
1040	INH-001	0.199		0.04	
1095	ISO7941	0.20		0.08	
1109	IP405	0.23		1.35	
1197	D2163	0.191		-0.30	
1198	D2163	0.191		-0.30	
1200		-----		-----	
1257	D2163	0.2026		0.19	
1469	D2163	0.208609		0.44	
1491		0.192		-0.26	
1556	EN27941	0.202		0.17	
1634	ISO7941	0.20		0.08	
1746	D2163	0.18		-0.76	
1764	D2163	0.2007		0.11	
1776	EN27941	0.09	R(0.01)	-4.56	
1786	D2163	0.191		-0.30	
2124	D2163	0.2072		0.38	
6011	D2163	0.3858	R(0.01)	7.92	
6018	EN27941	0.150		-2.03	
6019	EN27941	0.174		-1.02	
6052	D2163	0.19915		0.05	
7014		-----		-----	
	normality	not OK			
	n	37			
	outliers	4			
	mean (n)	0.1981			
	st.dev. (n)	0.01436			
	R(calc.)	0.0402			
	R(D2163:14e1)	0.0664			Compare R(EN27941:93(liq)) = 0.1605

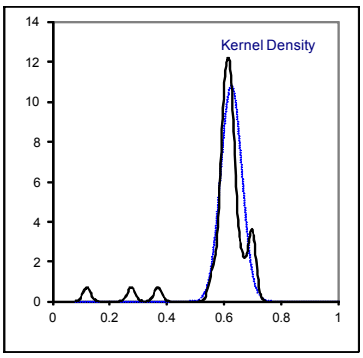




Determination of n-Pentane on sample #16225; results in %mol/mol

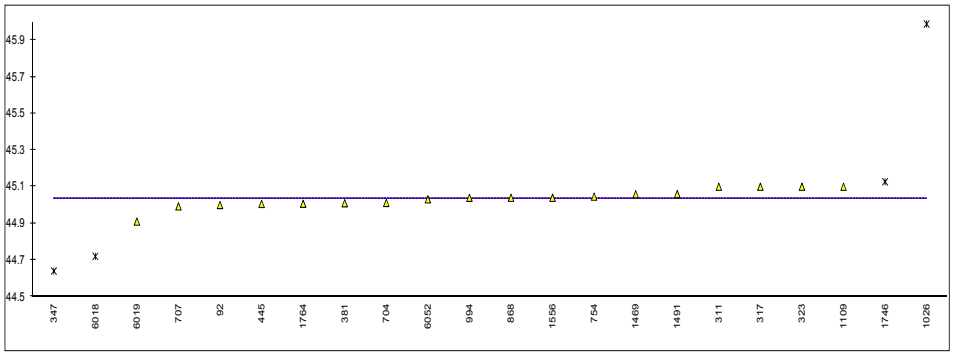
lab	method	value	mark	z(targ)	remarks
92	D2163	0.697		2.52	
150		-----		-----	
171	D2163	0.6336		0.22	
311	D2163	0.62	C	-0.27	first reported 0.72
317	D2163	0.62		-0.27	
323	D2163	0.668		1.47	
334	D2163	0.63		0.09	
335	D2163	0.65		0.81	
336	D2163	0.59		-1.36	
337	D2163	0.62		-0.27	
347	D2163	0.276	R(0.01)	-12.75	
352	EN27941	0.6995		2.61	
381	ISO7941	0.612		-0.56	
444	D2163	0.639		0.41	
445	D2163	0.56		-2.45	
511		-----		-----	
562		-----		-----	
704	D2163	0.601		-0.96	
707	D2163	0.564		-2.31	
754	D2163	0.624		-0.13	
868	D2163	0.632		0.16	
912		-----		-----	
922	D2163	0.63	C	0.09	first reported 0.65
994	D2163	0.6507		0.84	
1006	D2163	0.603		-0.89	
1011		-----		-----	
1026	D2163	1.78	R(0.01)	41.80	
1040	INH-001	0.702		2.70	
1095	ISO7941	0.60		-1.00	
1109	IP405	0.70		2.63	
1197	D2163	0.612		-0.56	
1198	D2163	0.612		-0.56	
1200		-----		-----	
1257	D2163	0.6072		-0.74	
1469	D2163	0.705214		2.82	
1491		0.672		1.61	
1556	EN27941	0.629		0.05	
1634	ISO7941	0.61		-0.64	
1746	D2163	0.60		-1.00	
1764	D2163	0.5937		-1.23	
1776	EN27941	0.12	R(0.01)	-18.41	
1786	D2163	0.619		-0.31	
2124	D2163	0.5884		-1.42	
6011	D2163	0.6010		-0.96	
6018	EN27941	0.370	R(0.01)	-9.34	
6019	EN27941	0.627		-0.02	
6052	D2163	0.5973		-1.10	
7014	D2163	0.6280		0.02	
	normality	OK			
	n	38			
	outliers	4			
	mean (n)	0.6276			
	st.dev. (n)	0.03695			
	R(calc.)	0.1035			
	R(D2163:14e1)	0.0772			Compare R(EN27941:93(liq)) = 0.3120

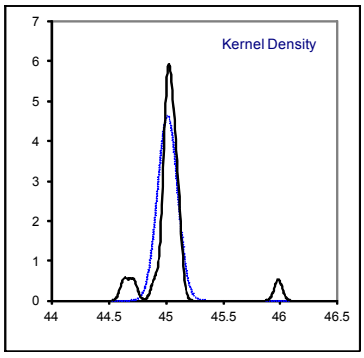




Determination of Molar Mass on sample #16225; results in g/mol

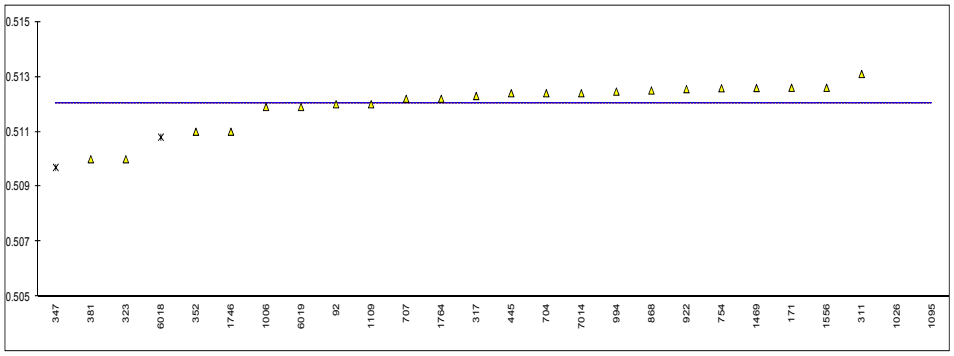
lab	method	value	mark	z(targ)	remarks
92	D2163	45.00		-----	
150		-----		-----	
171		-----		-----	
311	INH-407	45.1		-----	
317	INH-001	45.1		-----	
323	Calc.	45.1		-----	
334		-----		-----	
335		-----		-----	
336		-----		-----	
337		-----		-----	
347	D2598	44.64	ex	-----	excluded, see §4.1
352		-----		-----	
381	ISO8973	45.01		-----	
444		-----		-----	
445	D2163	45.006		-----	
511		-----		-----	
562		-----		-----	
704	D2421	45.0117		-----	
707	D2421	44.9928		-----	
754	D2421	45.046		-----	
868	D2598	45.04		-----	
912		-----		-----	
922		-----		-----	
994	D2163	45.0395		-----	
1006		-----		-----	
1011		-----		-----	
1026		45.988	ex	-----	excluded, see §4.1
1040		-----		-----	
1095		-----		-----	
1109	ISO8973	45.10		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	D2598	45.05891		-----	
1491	ISO8973	45.06		-----	
1556	Calc.	45.04		-----	
1634		-----		-----	
1746	D3588	45.127	ex, E	-----	excluded, iis calculated 44.959
1764	D2598	45.007		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018	ISO8973	44.72	ex	-----	excluded, see §4.1
6019	ISO8973	44.91		-----	
6052	D3588	45.031		-----	
7014		-----		-----	
	normality	suspect			
	n	18			
	outliers	0 + 4 ex			
	mean (n)	45.036			
	st.dev. (n)	0.0483			
	R(calc.)	0.135			
Comp.	R(iis15S03P)	0.122			

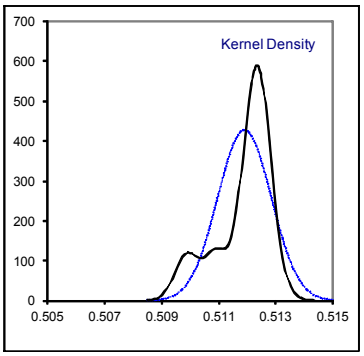




Determination of Relative Density at 60/60F on sample #16225; unitless results

lab	method	value	mark	z(targ)	remarks
92	D2598	0.512		-----	
150		-----		-----	
171	D2598	0.5126		-----	
311	INH-407	0.5131		-----	
317	INH-001	0.5123		-----	
323	D2598	0.510		-----	
334		-----		-----	
335		-----		-----	
336		-----		-----	
337		-----		-----	
347	D2598	0.5097	ex	-----	excluded, see §4.1
352	ISO8973	0.511		-----	
381	D2598	0.510		-----	
444		-----		-----	
445		0.5124		-----	
511		-----		-----	
562		-----		-----	
704	D2598	0.5124		-----	
707	D2598	0.5122		-----	
754	ISO8973	0.51258		-----	
868	D2598	0.5125		-----	
912		-----		-----	
922	D2598	0.51255	C	-----	first reported 0.5129
994	D2598	0.51246		-----	
1006	D2598	0.5119		-----	
1011		-----		-----	
1026		0.5298	ex, C, E	-----	excluded, see §4.1, first reported 529.8, iis calculated 0.5178
1040		-----		-----	
1095	ISO8973	1.585	ex, E	-----	excluded, iis calculated 0.5123
1109	ISO8973	0.5120		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	D2598	0.5125902		-----	
1491		-----		-----	
1556	ISO8973	0.5126		-----	
1634		-----		-----	
1746	D2598	0.511	C	-----	first reported 512
1764	D2598	0.5122		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018	ISO8973	0.5108	ex	-----	excluded, see §4.1
6019	ISO8973	0.5119		-----	
6052		-----		-----	
7014	D2598	0.5124		-----	
	normality	suspect			
	n	22			
	outliers	0 + 4 ex			
	mean (n)	0.51203			
	st.dev. (n)	0.000817			
	R(calc.)	0.00229			
Comp.	R(iis15S03P)	0.00070			



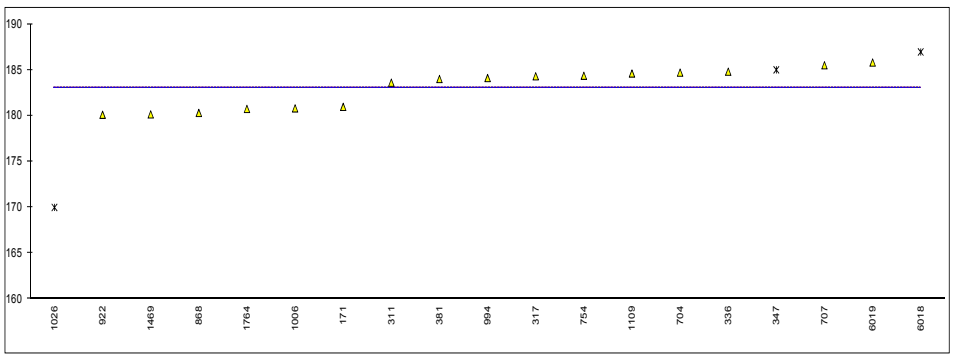


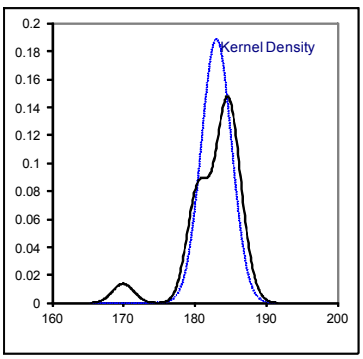
Determination of Absolute Vapour Pressure at 100F on sample #16225; results in psi

lab	method	value	mark	z(targ)	remarks
92		-----		-----	
150		-----		-----	
171	D2598	180.96		-----	
311	ISO8973	183.6		-----	
317	ISO8973	184.3		-----	
323		-----		-----	
334		-----		-----	
335		-----		-----	
336	ISO8973	184.8		-----	
337		-----		-----	
347	D2598	185.0	ex	-----	excluded, see §4.1
352		-----		-----	
381	D2598	184		-----	
444		-----		-----	
445		-----		-----	
511		-----		-----	
562		-----		-----	
704	ISO8973	184.7		-----	
707	ISO8973	185.5		-----	
754	ISO8973	184.36		-----	
868	D2598	180.3		-----	
912		-----		-----	
922	D2598	180.1	C	-----	first reported 179.6
994	D2598	184.11		-----	
1006	D2598	180.8		-----	
1011		-----		-----	
1026		169.99	ex	-----	excluded, see §4.1
1040		-----		-----	
1095		-----		-----	
1109	ISO8973	184.6		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	D2598	180.1394		-----	
1491		-----		-----	
1556		-----		-----	
1634		-----		-----	
1746		-----		-----	
1764	D2598	180.736		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018	ISO8973	186.95	ex	-----	excluded, see §4.1
6019	ISO8973	185.8		-----	
6052		-----		-----	
7014		-----		-----	

Calculated by iis from all reported composition results

		ISO8973 / IP432	ASTM D2598
	normality	OK	OK
	n	34	37
	outliers	2 + 4 ex	1 + 4 ex
	mean (n)	184.369	180.418
	st.dev. (n)	0.3436	0.3597
	R(calc.)	0.962	1.007
Comp.	R(iis15S03P)	0.749	0.798



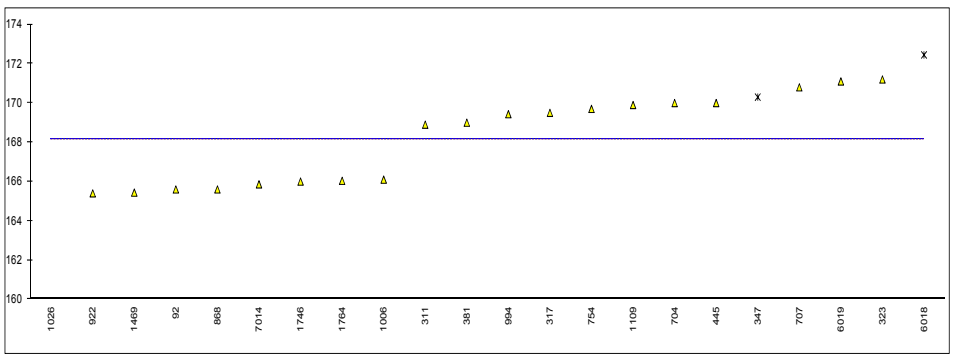


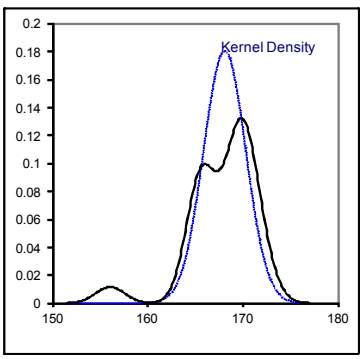
Determination of Relative Vapour Pressure at 100F on sample #16225; results in psi

lab	method	value	mark	z(targ)	remarks
92	D2598	165.6		-----	
150		-----		-----	
171		-----		-----	
311	ISO8973	168.9		-----	
317	ISO8973	169.5		-----	
323	D2598	171.2		-----	
334		-----		-----	
335		-----		-----	
336		-----		-----	
337		-----		-----	
347	D2598	170.3	ex	-----	excluded, see §4.1
352		-----		-----	
381	D2598	169		-----	
444		-----		-----	
445		170		-----	
511		-----		-----	
562		-----		-----	
704	ISO8973	170.0		-----	
707	ISO8973	170.8		-----	
754	ISO8973	169.7		-----	
868	D2598	165.6		-----	
912		-----		-----	
922	D2598	165.4	C	-----	first reported 164.9
994	D2598	169.43		-----	
1006	D2598	166.1		-----	
1011		-----		-----	
1026		156.15	ex	-----	excluded, see §4.1
1040		-----		-----	
1095		-----		-----	
1109	ISO8973	169.9		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	D2598	165.4394		-----	
1491		-----		-----	
1556		-----		-----	
1634		-----		-----	
1746	D2598	166		-----	
1764	D2598	166.040		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018	ISO8973	172.45	ex	-----	excluded, see §4.1
6019	ISO8973	171.1		-----	
6052		-----		-----	
7014	D2598	165.86		-----	

Calculated by iis from all reported composition results

		ISO8973 / IP432	ASTM D2598
	normality	OK	OK
	n	34	37
	outliers	2 + 4 ex	1 + 4 ex
	mean (n)	169.673	165.723
	st.dev. (n)	0.3436	0.3597
	R(calc.)	0.962	1.007
Comp.	R(iis15S03P)	0.749	0.798

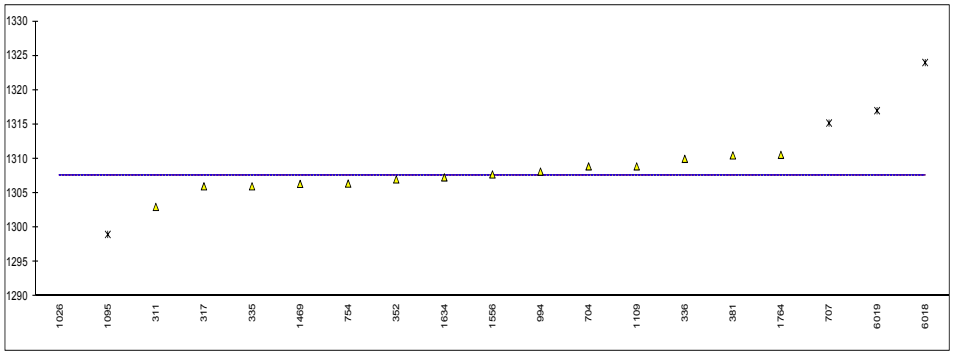


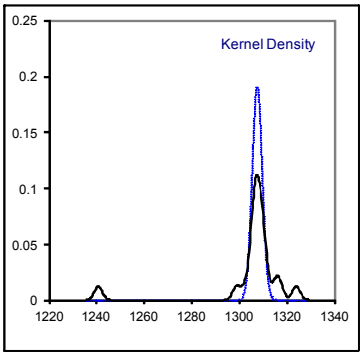


Determination of Absolute Vapour Pressure at 40°C on sample #16225; results in kPa

lab	method	value	mark	z(targ)	remarks
92		-----		-----	
150		-----		-----	
171		-----		-----	
311	ISO8973	1303		-----	
317	ISO8973	1306		-----	
323		-----		-----	
334		-----		-----	
335	ISO8973	1306		-----	
336	ISO8973	1310		-----	
337		-----		-----	
347		-----		-----	
352	ISO8973	1307		-----	
381	ISO8973	1310.5		-----	
444		-----		-----	
445		-----		-----	
511		-----		-----	
562		-----		-----	
704	ISO8973	1308.9		-----	
707	ISO8973	1315.2	E, ex	-----	excluded; iis calculated 1310.4
754	ISO8973	1306.4		-----	
868		-----		-----	
912		-----		-----	
922		-----		-----	
994	ISO8973	1308.14		-----	
1006		-----		-----	
1011		-----		-----	
1026		1241	ex	-----	excluded, see §4.1
1040		-----		-----	
1095	ISO8973	1299	E, ex	-----	excluded; iis calculated 1309
1109	ISO8973	1308.9		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	IP432	1306.3505		-----	
1491		-----		-----	
1556	ISO8973	1307.73		-----	
1634	ISO8973	1307.3		-----	
1746		-----		-----	
1764	ISO8973	1310.575		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018	ISO8973	1324	ex	-----	excluded, see §4.1
6019	ISO8973	1317	G(0.01)	-----	
6052		-----		-----	
7014		-----		-----	

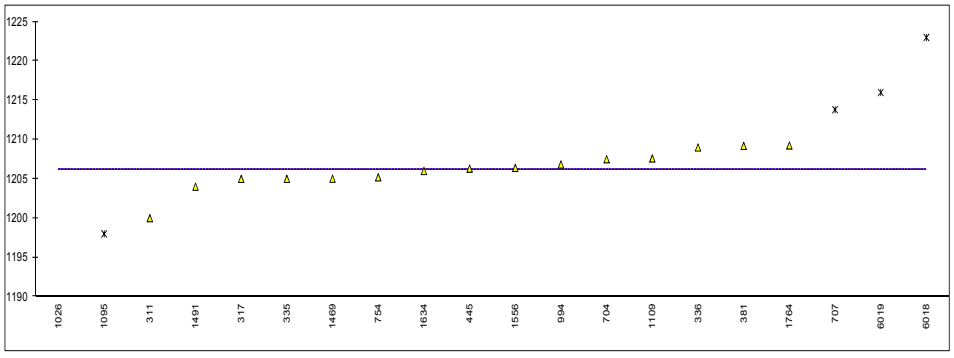
	normality	OK
	n	14
	outliers	1 + 4 ex
	mean (n)	1307.63
	st.dev. (n)	2.083
	R(calc.)	5.83
Comp.	R(iis15S03P)	4.67

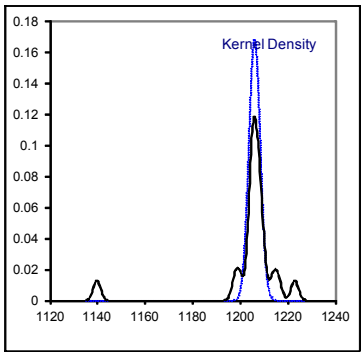




Determination of Relative Vapour Pressure at 40°C on sample #16225; results in kPa

lab	method	value	mark	z(targ)	remarks
92		-----		-----	
150		-----		-----	
171		-----		-----	
311	ISO8973	1200		-----	
317	ISO8973	1205		-----	
323		-----		-----	
334		-----		-----	
335	ISO8973	1205		-----	
336	ISO8973	1209		-----	
337		-----		-----	
347		-----		-----	
352		-----		-----	
381	ISO8973	1209.2		-----	
444		-----		-----	
445		1206.3		-----	
511		-----		-----	
562		-----		-----	
704	ISO8973	1207.5		-----	
707	ISO8973	1213.8	E, ex	-----	excluded; iis calculated 1209.1
754	ISO8973	1205.2		-----	
868		-----		-----	
912		-----		-----	
922		-----		-----	
994	ISO8973	1206.84		-----	
1006		-----		-----	
1011		-----		-----	
1026		1140	ex	-----	excluded, see §4.1
1040		-----		-----	
1095	ISO8973	1198	E, ex	-----	excluded; iis calculated 1208
1109	ISO8973	1207.6		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	IP432	1205.0255		-----	
1491	ISO8973	1204		-----	
1556	ISO8973	1206.40		-----	
1634	ISO8973	1206		-----	
1746		-----		-----	
1764	ISO8973	1209.250		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018	ISO8973	1223	ex	-----	excluded, see §4.1
6019	ISO8973	1216	G(0.05)	-----	
6052		-----		-----	
7014		-----		-----	
	normality	not OK			
	n	15			
	outliers	1 + 4 ex			
	mean (n)	1206.15			
	st.dev. (n)	2.372			
	R(calc.)	6.64			
Comp.	R(iis15S03P)	4.66			



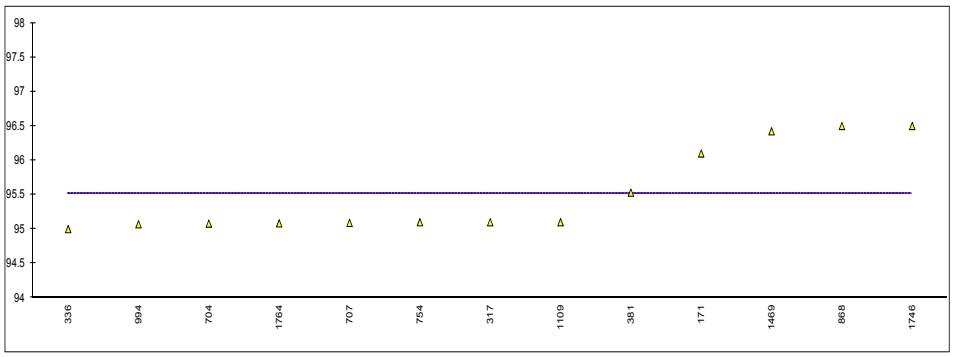


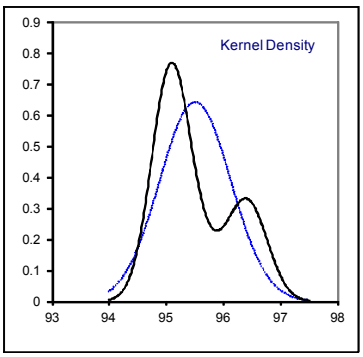
Determination of Motor Octane Number, MON on sample #16225;

lab	method	value	mark	z(targ)	remarks
92		-----		-----	
150		-----		-----	
171	D2598Calc.	96.1		-----	
311		-----		-----	
317	EN589	95.1		-----	
323		-----		-----	
334		-----		-----	
335		-----		-----	
336	EN589	95.0		-----	
337		-----		-----	
347		-----		-----	
352		-----		-----	
381	EN589	95.53		-----	
444		-----		-----	
445		-----		-----	
511		-----		-----	
562		-----		-----	
704	EN589	95.08		-----	
707	EN589	95.09		-----	
754	EN589	95.1		-----	
868	D2598Calc.	96.5		-----	
912		-----		-----	
922		-----		-----	
994	EN589	95.07		-----	
1006		-----		-----	
1011		-----		-----	
1026		-----		-----	
1040		-----		-----	
1095		-----		-----	
1109	EN589	95.1		-----	
1197		-----		-----	
1198		-----		-----	
1200		-----		-----	
1257		-----		-----	
1469	D2598	96.42280		-----	
1491		-----		-----	
1556		-----		-----	
1634		-----		-----	
1746	EN589	96.5		-----	
1764	EN589	95.084		-----	
1776		-----		-----	
1786		-----		-----	
2124		-----		-----	
6011		-----		-----	
6018		-----		-----	
6019		-----		-----	
6052		-----		-----	
7014		-----		-----	

Calculated by iis from all reported composition results

	EN589	ASTM D2598
normality	suspect	OK
n	34	36
outliers	2 + 4 ex	0 + 4 ex
mean (n)	95.078	96.474
st.dev. (n)	0.0126	0.0247
R(calc.)	0.035	0.069
R(target)	n.a.	n.a.





APPENDIX 2

Number of participants per country

2 labs in	AUSTRALIA
1 lab in	AZERBAIJAN
1 lab in	BELGIUM
1 lab in	CANADA
1 lab in	CHILE
1 lab in	CHINA, People's Republic
1 lab in	EGYPT
4 labs in	FRANCE
1 lab in	GERMANY
1 lab in	INDIA
1 lab in	IRAN, Islamic Republic of
1 lab in	ITALY
3 labs in	MALAYSIA
3 labs in	NETHERLANDS
1 lab in	NIGER
1 lab in	PAKISTAN
1 lab in	PERU
7 labs in	PORTUGAL
1 lab in	RUSSIAN FEDERATION
1 lab in	SAUDI ARABIA
1 lab in	SERBIA
1 lab in	SPAIN
2 labs in	SWEDEN
1 lab in	TAIWAN
1 lab in	THAILAND
2 labs in	UKRAINE
2 labs in	UNITED ARAB EMIRATES
2 labs in	UNITED KINGDOM
2 labs in	UNITED STATES OF AMERICA

APPENDIX 3

Abbreviations:

C	= final result after checking of first reported suspect 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 outlier test
R(0.05)	= straggler in Rosner outlier test
E	= probably an error in calculations
W	= test result withdrawn on request of participant
ex	= test result excluded from calculations
n.a.	= not applicable
fr.	= first reported
SDS	= safety data sheet

Literature:

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