Sheet No.
GT200-PE022E Oil

Determination of acid number in diesel engine oil

*This application sheet is provided as reference, and does not assure the measurement results. Please consider analysis environment, external factors and sample nature for optimal conditions before the measurement.

Outline

Acid number in diesel engine oil is determined with titration by potassium hydroxide in 2-propanol titrant after dissolving new or used oil into titration solvent contains toluene, 2-propanol and small amount of water. The titration result is used as reference of oxidation and deterioration state of the oils for example.

Titration Type	: Non-aqueous Neutralization, Titration mode: INF, Detection: pH/mV
♦Reference	: **ASTM D664-07** Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration

Apparatus

Automatic titrator	: GT-200
Electrodes	: Reference Electrode sleeve type, Glass electrode
Reference electrode solution	: 3mol/L, Lithium chloride in ethanol
Buret size	: 10ml

Reagents

[Titration solvent]
■0.1mol/L- Potassium hydroxide in 2-propanol for testing neutralization number in oil

[Prepared reagents]
■Titration solvent : mixed 500ml of toluene, 495ml of 2-propanol and 5ml of pure water
■3mol/L of Lithium chloride in ethanol : Dissolve 12.7g of lithium chloride, special grade reagent, in ethanol, special grade reagent, and dilute the solution to 100ml by the ethanol.

Analytical Procedure

[Blank measurement]
(1) Add 125ml of the titration solvent into a 200ml beaker by a measuring cylinder.
(2) Titrate with 0.1mol/L . potassium hydroxide in 2-propanol titrant

[Sample measurement]
(1) Add proper size of sample decided by the method depending on the acid number of the sample into a 200ml beaker. 5g +/-0.5g in this sample.
(2) Add 125ml of the titration solvent into the above mentioned 200ml beaker by a measuring cylinder.
(3) Titrate with 0.1mol/L . potassium hydroxide in 2-propanol titrant

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[Calculation]

Acid number (mgKOH/g) = (A1 – BL) × M × E × f × FW / S × R
(Used prefixed formula on GT-200)

A1 : Titration volume of 0.1mol/L- potassium hydroxide in 2-propanol titrant for sample measurement (ml)
BL : Titration volume of 0.1mol/L- potassium hydroxide in 2-propanol titrant for blank measurement (ml)
M : Molarity of 0.1mol/L- potassium hydroxide in 2-propanol titrant (0.1)
E : Equivalent number of 0.1mol/L- potassium hydroxide in 2-propanol titrant (1)
F : Factor of 0.1mol/L- potassium hydroxide in 2-propanol titrant
FW : Formula weight of potassium hydroxide (56.1)
S : Sample size(g)
R : Dilution rate (1)

Other Requirements

- When measuring samples with pH detection, calibrate the apparatus by three standards, pH 7, 4 and 11 before measurement. Select "Sleeve type liquid: 3.3M KCL (GTRS10B)" and "Three point calibration (Input pH)" on the "pH Calibration" of GT-200.
- For using 10ml Buret, set the volume by "Setting" on the Automatic Buret's software.
- After a measurement, wash the electrodes by the titration solvent and immerse them in pure water for 5min. as conditioning.
- Confirm reagent labels and safety data sheets for safety
- Wear protective equipment (eye protector, gloves and others.) when handling reagents.

Measurement Results

Detection : mV

	Sample size(g)	Titrant (ml)	Results(mg KOH/g)
1	5.0300	2.7613	2.93
2	5.0490	2.7581	2.91
3	5.0464	2.7849	2.95

N	3
Average	2.93
SD	0.016
RSD(%)	0.54

Detection : pH

	Sample size(g)	Titrant (ml)	Results(mg KOH/g)
1	5.0175	2.5524	2.91
2	5.0230	2.5016	2.88
3	5.0049	2.6902	2.89

N	3
Average	2.90
SD	0.017
RSD(%)	0.58

Acid number in diesel engine oil (10W-30) is measured by GT-200.
Average of three measurements is around 2.9mgKOH / g. The results are repeatable on both mV and pH detections.

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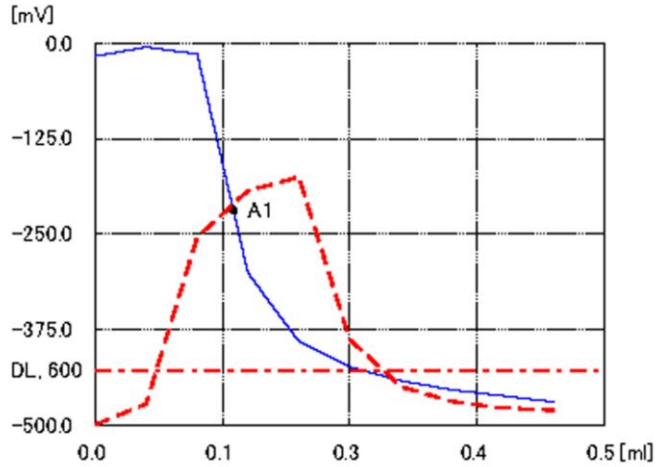
ID No. : 7 GT No.1 User : GT-200

Measurement : 2014/08/21 15:00
Sample Name : BLANK
Type : Sample Titr
Sample Size : 125 [ml]



C1 : 0.1357 [ml]

A1 : 0.1357 [ml] -219 [mV]

P-initial	: -17	[mV]			
Start	: 0	[ml]	-17	[mV]	
End	: 0.45	[ml]	-470	[mV]	Measuring Time : 4’47”

File No.	: 14 OIL / Acid Number		
Titr File No.	: 39 Acid Number / Blank		
Mode	: INF	End1, End1 Width : -500 [mV] ± 1000 [mV]	
Detect	: mV1		
BRT No.	: 1		
Reagent	: 13		
WTint	: 30	[sec]	
Vup	: 100	[µl]	
Vlow	: 50	[µl]	
dE	: 10	[mV]	
dT	: 10	[sec]	
DL	: 600	[mV/ml]	
DetCnt	: 2		
Vmax	: 20	[ml]	
Vover	: 0.2	[ml]	C1 : A1

[ml]

Reag	: 0.1M-KOH/IPA	E	: 1	M	: 0.1 [Mol/l]
F	1				

Buret Injection Speed : 500 [ul/sec]

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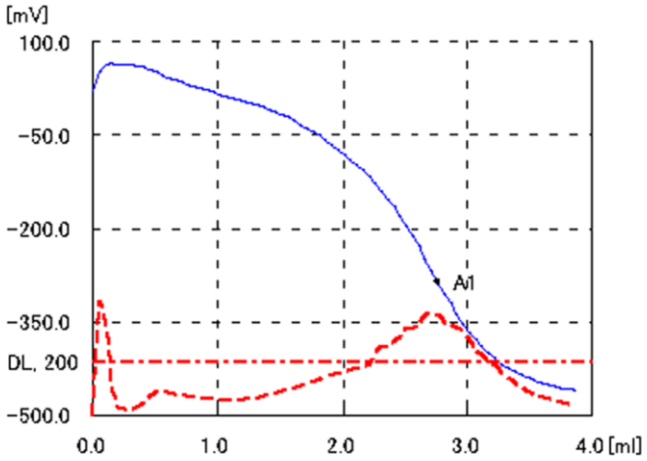
ID No. : 8 GT No.1 User : GT-200

Measurement : 2014/08/21 15:28
Sample Name : Engine Oil
Type : Sample Titr
Sample Size : 5.0300 [g]



C1 : 2.93 [mgKOH/g]

A1 : 2.7613 [ml] -286 [mV]

P-initial	: 19	[mV]			
Start	: 0	[ml]	19	[mV]	
End	: 3.864	[ml]	-460	[mV]	Measuring Time : 13’58”

File No.	: 14 OIL / Acid Number		
Titr File No.	: 6 OIL / Acid Number		
Mode	: INF	End1, End1 Width : -300 [mV] ± 500 [mV]	
Detect	: mV1		
BRT No.	: 1		
Reagent	: 13		
WTint	: 30 [sec]		
Vup	: 100 [µl]		
Vlow	: 50 [µl]		
dE	: 10 [mV]		
dT	: 10 [sec]		
DL	: 200 [mV/ml]		
DetCnt	: 20	C1 : (A1-BL)*M*E*f*FW/S*R	
Vmax	: 20 [ml]		[mgKOH/g]
Vover	: 0.2 [ml]		

Reag	: 0.1M-KOH/IPA	E	: 1	M	: 0.1 [Mol/l]
F	: 1	BL	: 0.1357 [ml]		
FW	: 56.1	R	: 1		

Buret Injection Speed : 500 [ul/sec]

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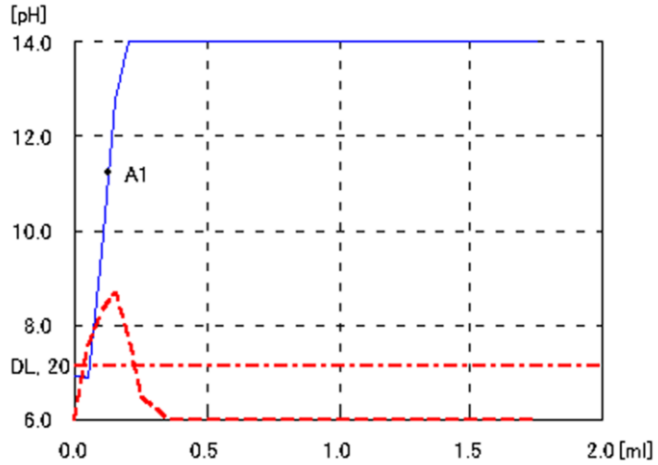
ID No. : 1GT No.1 User : GT-200

Measurement : 2014/08/20 10:10
SampleName : Blank
Type :Sample Titr
SampleSize : 125 [ml]



C1 : 0.1261 [ml]

A1 : 0.1261 [ml] 11.229 [pH]

P-initial :6.939 [pH]
Start :0 [ml] 6.939 [pH]
End :1.75 [ml] 14 [pH] Measuring Time: 6'15"

FileNo. : 14 OIL/ Acid Number
Titr FileNo. : 40 AcidNumber / BlankpH
Mode : INF End1, End1 Width: 11[pH] ± 2 [pH]
Detect : pH
BRT No. : 1
Reagent : 13
WTint : 30 [sec]
Vup : 100 [µl]
Vlow : 50 [µl]
dE : 0.2 [pH]
dT : 10 [sec]
DL : 20 [pH/ml]
DetCnt : 3
Vmax : 20 [ml]
Vover : 0.2 [ml] C1: A1
[ml]

Reag : 0.1M-KOH/IPA E : 1 M : 0.1 [Mol/l]
F : 1

BuretInjectionSpeed: 500 [ul/sec]

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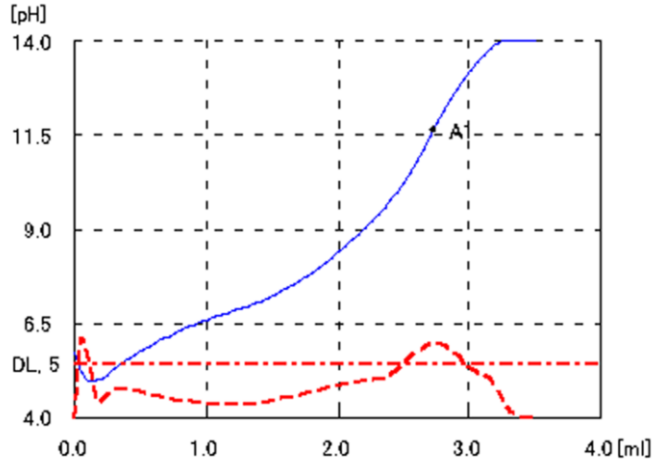
ID No. : 1 GT No.1 User : GT-200

Measurement : 2014/08/21 10:32
Sample Name : Diesel oil
Type : Sample Titr
Sample Size : 5.0175 [g]



C1 : 2.91 [mgKOH/g]

A1 : 2.7324 [ml] 11.646 [pH]

P-initial	: 5.74	[pH]			
Start	: 0	[ml]	5.74	[pH]	
End	: 3.506	[ml]	14	[pH]	Measuring Time : 12’13”

File No.	: 14 OIL / Acid Number		
Titr File No.	: 36 OIL / Acid Number pH		
Mode	: INF	End1, End1 Width : 11 [pH] ± 2 [pH]	
Detect	: pH		
BRT No.	: 1		
Reagent	: 13		
WTint	: 30 [sec]		
Vup	: 100 [µl]		
Vlow	: 50 [µl]		
dE	: 0.2 [pH]		
dT	: 10 [sec]		
DL	: 5 [pH/ml]		
DetCnt	: 10	C1 : (A1-BL)*M*E*f*FW/S*R	
Vmax	: 20 [ml]		[mgKOH/g]
Vover	: 0.2 [ml]		

Reag	: 0.1M-KOH/IPA	E	: 1	M	: 0.1 [Mol/l]
F	: 1	BL	: 0.1261 [ml]		
FW	: 56.1	R	: 1		

Buret Injection Speed : 500 [ul/sec]