Sheet No.
GT200-PE023E Oil

# Determination of base number in gasoline engine oil (Hydrochloric acid titration)



*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

Base number in gasoline engine oil is determined with titration by hydrochloric acid in 2-propanol titrant after dissolving new or used oil into titration solvent contains toluene, 2-propanol, chloroform and small amount of water. The titration result is used as reference of deterioration state of antirust agent in the oils for example.

| | |
|---|---|
| Titration Type | : Non-aqueous Neutralization, Titration mode: INF, Detection: mV |
| ♦Reference | : **ASTM D4739-11** Standard Test Method for Base Number Determination by Potentiometric Hydrochloric Acid Titration |

## Apparatus

| | |
|---|---|
| Automatic titrator | : GT-200 |
| Electrodes | : Reference Electrode sleeve type, Glass electrode |
| Reference electrode solution | : 3mol/L, Lithium chloride in ethanol |
| Buret size | : 5ml |

## Reagents

[ Titrant ]
■0.1mol/L- hydrochloric acid in 2-propanol for testing neutralization number in oil
[ Prepared reagents ]
■Titration solvent : mixed 1L of toluene, 1L of 2-propanol, 1L of chloroform and 10ml of pure water
■3mol/L of Lithium chloride in ethanol : Dissolve 12.7g of lithium chloride, special grade reagent, into ethanol, special grade reagent, and dilute the solution to 100ml by the ethanol.
■pH3 Buffer solution

## Analytical Procedure

[ Blank measurement ]
(1) Add 75ml of the titration solvent into a 100ml beaker by a measuring cylinder.
(2) Titrate with 0.1mol/L .hydrochloric acid in 2-propanol titrant

[ Sample measurement ]
(1) Add proper size of sample depends on the estimated base number into a 200ml beaker. Sample size is calculated by the formula mentioned in the method. 1g in this sample.
(2) Add 75ml of the titration solvent into the above mentioned beaker by a measuring cylinder.
(3) Titrate with 0.1mol/L . hydrochloric acid in 2-propanol titrant

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[ Calculation ]

**Weak base number ( mgKOH/g ) = ( A1- BL ) × M × E × f × FW / S × R**

(Used prefixed formula on GT-200)

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

## Other Requirements

■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 5ml Buret, set the volume by “Setting” on the Automatic Buret’s software.
■Before measurement, record potential while immersing the electrodes into pH3 buffer solution. Weak base number is determined by titrant consumption until an inflection point detected in the range, from the recorded potential to the potential +100mV.
■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

## Measurement Results

| | Sample size(g) | Titrant (ml) | Results(mg KOH/g) |
|---|---|---|---|
| 1 | 1.0067 | 1.1834 | 6.28 |
| 2 | 1.0365 | 1.2183 | 6.28 |
| 3 | 1.0505 | 1.2302 | 6.26 |

| | |
|---|---|
| N | 3 |
| Average | 6.28 |
| SD | 0.010 |
| RSD(%) | 0.16 |

Base number (weak base number) in gasoline engine oil (0W-20) is measured by GT-200.
Average of three measurements is around 6.28mgKOH / g. The results are repeatable, RSD%=0.16%.

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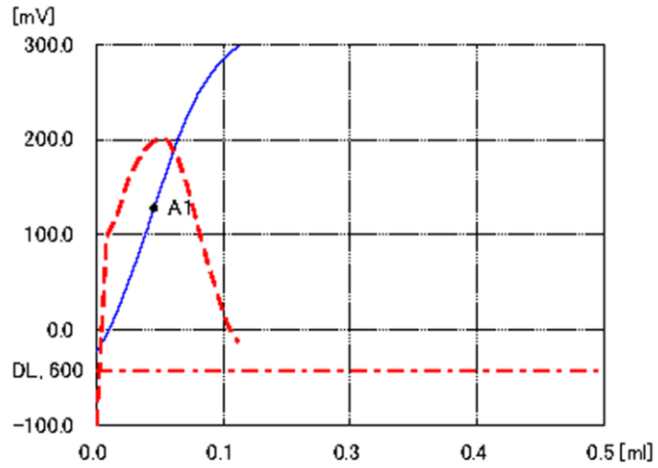
# Determination of base number in gasoline engine oil (Hydrochloric acid titration)



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

Measurement : 2014/08/28 14:29
Sample Name :BLANK
Type : Sample Titr
Sample Size : 75 [ml]




C1 : 0.0571 [ml]

A1 : 0.0571 [ml] 128 [mV]

| | | | | | |
|---|---|---|---|---|---|
| P-initial | : -23 | [mV] | | | |
| Start | : 0 | [ml] | -23 | [mV] | |
| End | : 0.14 | [ml] | 298 | [mV] | Measuring Time : 2’48” |

| | | | |
|---|---|---|---|
| File No. | : 15 OIL / Base Number | | |
| Titr File No. | : 41 Base Number / Blank | | |
| Mode | : INF | End1, End1 Width : 150 [mV] ± 500 [mV] | |
| Detect | : mV1 | | |
| BRT No. | : 1 | | |
| Reagent | : 8 | | |
| WTint | : 60 | [sec] | |
| Vup | : 10 | [µl] | |
| Vlow | : 10 | [µl] | |
| dE | : 50 | [mV] | |
| dT | : 12 | [sec] | |
| DL | : 600 | [mV/ml] | |
| DetCnt | : 6 | | |
| Vmax | : 10 | [ml] | |
| Vover | : 0.05 | [ml] | C1 : A1 |

[ml]

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

Buret Injection Speed : 125 [ul/sec]

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# Determination of base number in gasoline engine oil (Hydrochloric acid titration)

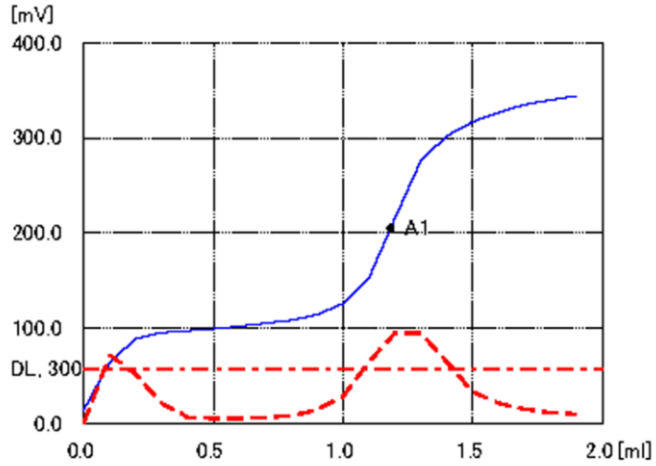


ID No. : 3 GT No.1

User : GT-200

Measurement : 2014/08/28 15:55
Sample Name : Engine Oil

Type : Sample Titr
Sample Size : 1.0067 [g]




C1 : 6.28 [mgKOH/g]

A1 : 1.1834 [ml] 205 [mV]

P-initial : 14 [mV]
Start : 0 [ml] 14 [mV]
End : 1.9 [ml] 344 [mV]

Measuring Time : 28’38”

File No. : 15 OIL / Base Number
Titr File No. : 42 Base Number
Mode : INF
Detect : mV1
BRT No. : 1
Reagent : 8
WTint : 60 [sec]
Vup : 100 [µl]
Vlow : 100 [µl]
dE : 200 [mV]
dT : 90 [sec]
DL : 300 [mV/ml]
DetCnt : 6
Vmax : 50 [ml]
Vover : 0.5 [ml]

End1, End1 Width : 200 [mV] ± 500 [mV]

C1 : (A1-BL)*M*E*f*FW/S*R

[mgKOH/g]

Reag : 0.1M HCl/IPA
F : 1
FW : 56.1

E : 1
BL : 0.0571 [ml]
R : 1

M : 0.1 [Mol/l]

Buret Injection Speed : 125 [ul/sec]