

Sheet No.

**GT200-PE024E** Oil

## Determination of base number in diesel engine oil (Hydrochloric acid titration) \_\_\_\_\_ 1/4

\*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 diesel engine oil is determined with titration by hydrochloric acid in 2-propanol titrant after dissolving new or used oil in 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 : Double junction type reference electrode, Glass electrode  
 Reference electrode solution : Inner : 1 mol / L - potassium chloride in water  
 : Outer : 1 mol / L - potassium nitrate in water

### 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, in ethanol, special grade reagent, and dilute the solution to 100m l 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 ]

$$\text{Base number (mgKOH/g)} = (A1 - BL) \times M \times E \times f \times FW / S \times R$$

(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**

	Sample size(g)	Titrant (ml)	Results(mg KOH/g)
1	1.0124	1.4485	7.76
2	1.0177	1.4456	7.71
3	1.0098	1.4329	7.70

N	3
Average	7.72
SD	0.036
RSD(%)	0.47

Base number (weak base number) in diesel engine oil (10W-30) is measured by GT-200.

Average of three measurements is around 7.72mgKOH / g. The results are repeatable, RSD%=0.47%.

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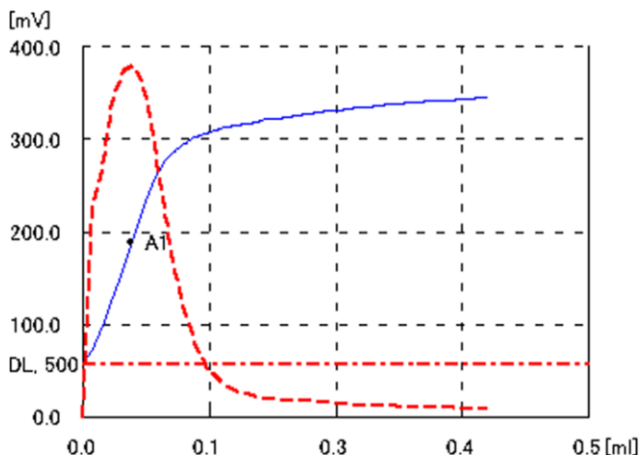
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ID No. : 1 GT No.1

User : GT-200

Measurement : 2014/08/29 14:21  
Sample Name : BLANK

Type : Sample Titr  
Sample Size : 75 [ml]



C1 : 0.0477 [ml]

A1 : 0.0477 [ml] 188 [mV]

P-initial : 57 [mV]  
Start : 0 [ml] 57 [mV]  
End : 0.4 [ml] 345 [mV] Measuring Time : 8' 0"

File No. : 15 OIL / Base Number  
Titr File No. : 41 Base Number / Blank  
Mode : INF End1, End1 Width : -500 [mV] ± 1000 [mV]  
Detect : mV1  
BRT No. : 1  
Reagent : 8  
WTint : 60 [sec]  
Vup : 10 [μl]  
Vlow : 10 [μl]  
dE : 50 [mV]  
dT : 12 [sec]  
DL : 500 [mV/ml]  
DetCnt : 3  
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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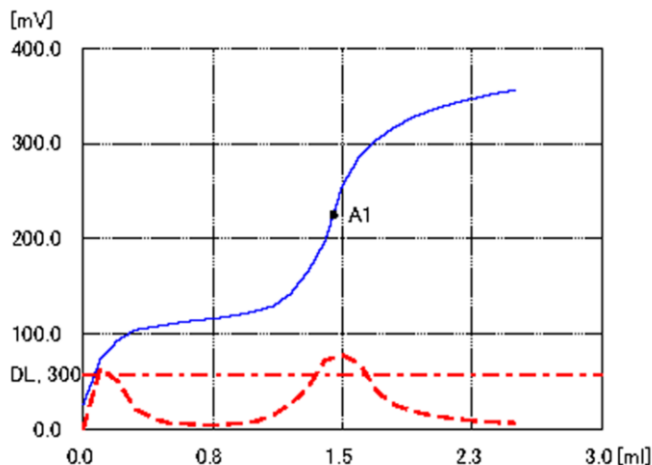
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ID No. : 2 GT No.1

User : GT-200

Measurement : 2014/08/29 15:30  
Sample Name : Diesel oil

Type : Sample Titr  
Sample Size : 1.0124 [g]



C1 : 7.76 [mgKOH/g]

A1 : 1.4485 [ml] 225 [mV]

P-initial : 25 [mV]  
Start : 0 [ml] 25 [mV]  
End : 2.5 [ml] 356 [mV] Measuring Time : 38'50"

File No. : 15 OIL / Base Number  
Titr File No. : 42 Base Number  
Mode : INF End1, End1 Width : 150 [mV] ± 1000 [mV]  
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 : 10 C1 : (A1-BL)\*M\*E\*FW/S\*R  
Vmax : 50 [ml] [mgKOH/g]  
Vover : 0.1 [ml]

Reag : 0.1M HCl/IPA E : 1 M : 0.1 [Mol/l]  
F : 1 BL : 0.0477 [ml]  
FW : 56.1 R : 1

Buret Injection Speed : 125 [ul/sec]