

Category *AUTOMATIC TITRATOR COM Series*

Petroleum Products **Total Base Number (TBN)**
by *perchloric acid* titration method

Referenced methods ASTM D2896, JIS K2501, ISO 3771,

Key words; Petroleum products, lubricants, base number, perchloric acid titration

Outline

The total base number (TBN) for petroleum products and lubricants is one of the important indices for evaluating the quality. The TBN is expressed as the milligram (mg) value of potassium hydroxide (KOH) equivalent for the hydrochloric acid or perchloric acid required for neutralizing the total basic components contained in 1g of sample. The components for total base value are organic bases, inorganic bases, amino compounds, weak acid salts (soaps), basic salts of polybasic substances, heavy metal salts, and additives such as antioxidants and cleansers. This section introduces an example in which the total base number measured by perchloric acid method.

Precaution

After repeating several measurements, the response of the glass electrode may deteriorate or the electromotive force may be reduced. Thus, electrodes shall be immersed in water for 5 minutes to activate after each measurement is completed.

Reagents

- Titrant* : 0.1mol/L perchloric acid (in acetic acid)
- Titration solvent* : Chlorobenzene : acetic acid (2 : 1) mixture solution
60mL or 120mL used for 1 measurement
Note) Toluene can also be used instead of chlorobenzene.

Instruments & Electrodes

Recommended automatic titrator **COM-1700S / COM-1600S / COM-300A**

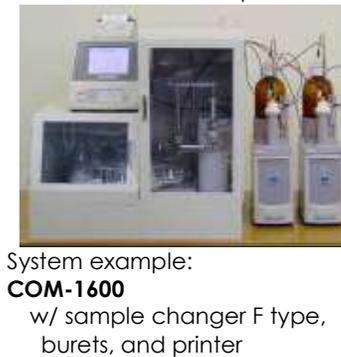
- **GE-101B** Glass electrode
 - **RE-201** Reference electrode
- } standard accessories

(replace the electrolyte with saturated sodium perchlorate in acetic acid)



- Automation system configurations
- 1 x COM-1600 Main unit
 - 1 x S-2000 measurement unit
 - 1 x C-2012F Sample changer
 - 1 x B-2000-20 Buret (for titrant)
 - 1 x B-2000-50 Buret (for solvent)
 - 1 x ST-2000 Titrator stand
 - 1 x Thermal printer PR-2000T2
 - 1 x Printer bracket 2000C

*Sample changer C-2012F has a cabinet w/ fume extractor, useful to reduce strong odor from organic solvents!



Condition parameters (example)

| Master File 1 Condition 1 (for BLANK) | | | | Master File 2 Condition 2 (for TBN measurement) | | | |
|--|----------------------|-----------|-------|--|--------------------------|-----------|-------|
| Method | Auto | | | Method | Auto | | |
| Buret No. | 1 | Mode No. | 16 | Buret No. | 1 | Mode No. | 22 |
| Amp. No. | 1 | Pre Int | 0 sec | Amp No. | 1 | Pre Int | 0 sec |
| Meas Unit | mV | Del K | 0 | Meas Unit | mV | Del K | 5 |
| S-Timer | 10 sec | Del Sens | 0 mV | S-Timer | 10 sec | Del Sens | 0 mV |
| CP mL | 0 mL | Int Time | 3 sec | CP mL | 0 mL | Int Time | 3 sec |
| DP mL | 0 mL | Int Sens | 3 mV | DP mL | 0.5 mL | Int Sens | 3 mV |
| End Sens | 260 | BrT Speed | 2 | End Sens | 260 | BrT Speed | 2 |
| Over mL | 0.2 mL | Pulse | 16 | Over mL | 0.5 mL | Pulse | 40 |
| Max volume | 1 mL | | | Max Volume | 10 mL | | |
| Unit | mL | | | Unit | mg/g | | |
| Size | 0 g | | | Size | --- g | | |
| Blank | 0 mL | | | Blank | BLANK result value | | |
| Factor | Titre of the titrant | | | Factor | Titre of the titrant | | |
| Molarity | 0.1 mol/L | | | Molarity | 0.1 mol/L | | |
| K | 0 | | | K | 56.1 (as KOH) | | |
| L | 0 | | | L | 0 | | |
| Formula | D | | | Formula | (D-B)*K*F*M/S | | |
| | | | | | to be set automatically. | | |

Procedure and result

<Blank titration>

1. Measure out 120mL of titration solvent into a beaker.
2. Titrate with 0.1 mol/L titrant.

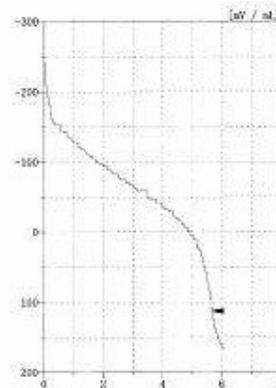
<Sample measurement>

1. Accurately weigh a suitable size of sample into a beaker.
2. Add 120mL of titration solvent to the beaker.
3. Titrate with 0.1mol/L titrant.

<Calculation>

$$BN \text{ [mgKOH/g]} = (D-B) \times 56.1 \times F \times 0.1 / S$$

- where : D= Volume of titrant to end point (mL)
 B= Volume of titrant consumed in blank titration (mL)
 F= Factor of titrant
 S= Sample weight (g)



| | |
|-------------|--------------|
| Initial mV | -240.3 mV |
| End mV | 112.7 mV |
| mL | 5.661 mL |
| ΔE/ΔmL | 280 ΔE/ΔmL |
| Sample size | 0.45680 g |
| *Conc | 69.8168 mg/g |

Information plus1. Method of preparing reference electrode

For this measurement, reference electrode RE-201 is to be changed into the reference electrode for non-aqueous titration.

- Drain out saturated KCl solution in RE-201, and wash well with acetic acid. Then prepare an acetate solution saturated with sodium perchlorate (special class reagent) and inject it into the filling port. Since the electrode potential may not stabilize immediately, it is recommended that it is used after leaving it standing for 1 entire day.

2. The effect of temperature on titer of the titrant

Organic solvent (acetic acid) is used in the titrant of this measurement, and caution is required that its change in volume in concurrence to temperature change (approximately 0.11% change at 1°C) is larger compared to normal titrants with aqueous solution. It is important that measurement is taken at a temperature as constant as possible.

For more information, please feel free to contact:

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