KEM **Application Note** №DAA-11001

Petroleum

Density of Low Sulphur Waxy Residue (tar oil)

Density measurement by
Density/Specific Gravity Meter

Standard	JIS K 0061 JIS K 2249 ASTM D1250	ASTM D 4052 ASTM D 5002 ISO 91-1	API Std. 2540

1.Abstract

Measurement of density of crude petroleum and petroleum products is specified in JIS K 2249-1995 Crude petroleum and petroleum products - Determination of density and petroleum measurement tables based on a reference temperature.

Density of crude petroleum and petroleum products is prescribed to express value [density (15℃)] in 15℃ normally. The sample which is hard to measure such as solid at room temperature or high viscosity liquid is measured after lowering viscosity by heating with a method converted to density at room temperature. This application note exemplifies a measurement of specific gravity 60/60°F and specific gravity 15/15℃ with a built-in temperature conversion formula using multiple sample changer (high temperature specification (electric heater type)) and density/specific gravity meter made by Kyoto Electronics (KEM).

This density/specific gravity meter is equipped conversion formula to density, API degree and specific gravity (temperature：60°F・15℃・20℃) of crude petroleum(A)・fuel oil(B)・grease(D) based on prescription of petroleum products.

2.Reference

1) JIS K 0061-2001 Test methods for density and relative density of chemical products
2) JIS K 2249-1995 Crude petroleum and petroleum products - Determination of density and petroleum measurement tables based on a reference temperature
3) ASTM D1250-08 Standard Guide for Use of the Petroleum Measurement Tables
4) ASTM D 4052-09 Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
5) ASTM D 5002-99(2010) Standard Test Method for Density and Relative Density of Crude Oils by Digital Density Analyzer
6) ISO 91-1:1992 Petroleum measurement tables -- Part 1: Tables based on reference temperatures of 15 degrees C and 60 degrees F
7) API Std. 2540

3.Cautions in measurement

1) Use a fresh desiccant (silica gel). If its color is reddish, change it with new one (blue).
2) Before sample measurement, perform factor calibration with dry air and pure water after degas.
3) Watch out for fire due to use flammable solvent.

4.Post-measurement care

Drain out residue inside the cell. Rinse well the measurement cell with solvent, and dry it completely.

5.Test equipment

Main unit : Density/specific gravity meter
Option : Multiple sample changer (high temperature specification (electric heater type))

6.Reagent

Rinse solvent : Toluene (for cleaning) rinse solvent 1
Rinse solvent : Acetone (for drying) rinse solvent 2

7.Measurement procedure

—Calibration—

1) Set the temperature of density meter to 70℃, and leave it until stabilized.
2) Set the temperature of turn table side of multiple sample changer to 80℃ which is 10℃ higher than measurement temperature and tube heating unit to 75℃ which is 5℃ higher than measurement temperature, and leave it until stabilized.
3) Calibrate the meter with dry air and pure water after degas. The water should be used after heated at 100 ℃.

—Measurement—

1) Set sample to sampling bottle and multiple sample changer, and make sampling temperature stable.
2) Start measurement.
(when measurement is started, the series of sampling, measurement, cleaning and drying are automatically operated.)

8.Example of measurement

－Ambient condition－

Room temperature : 25 ℃	Humidity : 54 %	Weather : Fair

-Measurement Parameter-

[Method Parameter]

<Measurement Parameter>

Temperature	:	70.00 ℃
Stability	:	1
Limit Time	:	600 s
Visco. Corr.	:	Off
Sequence	:	Off
Calib.Mate.	:	Air&Water
Sample[mL]	:	0.00

<Contents>

Contents Name	:	Density
Decimal	:	4
Contents Name	:	API(S.G.)A 60F
		API(S.G.)A 15C
Decimal	:	4

<Temperature Comp.>

Temp.Comp.	:	Off

<Sequence>

Sequence File No.	:	Sequence auto
01 Sampling		
02 Meas.		
03 Drain		
04 Rince1		
05 Rince2		
06 Purge		

Sampling Seq.	:	Auto
Samp.Limit	:	0s
O.S.Rate	:	70%
Drain Seq.	:	Auto
Drain Rate	:	100%
Rince-1 Time	:	30s
Rince-2 Time	:	10s
Purge Seq.	:	Auto
Tolerance	:	10

-Calibration Parameter-

[Check&Calib]

One Point Calib.	:	off
Calib. Temp.	:	70.00℃
Stability	:	1
Viscosity	:	Off
Limit Time	:	600s

(Rest of Calibration parameter)

Tolerance	:	0.0002
Sequence	:	On
Sequence Name	:	Sequence 1
Calib. Mate.	:	Air&Water
Check	:	Off

-Sequence-

<Sequence>

Sequence File No.	:	Sequence 1
01 Sampling		
02 Meas.		
03 Drain		
04 Rince2		
05 Purge		

Sampling Seq.	:	Auto
O.S.Rate	:	70%
Samp.Limit	:	20s
Drain Seq.	:	Auto
Drain Rate	:	100%
Rince-1 Time	:	0s
Rince-2 Time	:	10s
Purge Seq.	:	Auto
Tolerance	:	10

-Measurement Result-

*** R e s u l t ***

Sample No. 01-001

Date : 2011/04/12 15:41

Sample ID	:	
Method Name	:	original
Meas.Temp.	:	70.00 ℃
d[g/cm3]	:	1.0577

<Result>

API(S.G.)A 60F

: 1.0897

API(S.G.)A 15C

: 1.0900

Meas.Time : 00:01 : 19

(Printout examples by DA-640)

－Measurement result－

	Frequency	Density (g/cm³)	API(S.G.)A 60F	API(S.G.)A 15C
1	112121	1.0577	1.0897	1.0900
2	112121	1.0577	1.0897	1.0900
3	112122	1.0577	1.0897	1.0900
4	112123	1.0577	1.0897	1.0900
5	112123	1.0577	1.0897	1.0900

Statistics	
Mean	1.0577 g/cm³
Diff (Max-Min)	0.0000 g/cm³
SD	0.0000 g/cm³
RSD	0.00 %

＊ The above data are the results of 5 tests of the same sample.
＊ Red underline shows the data from page 3/4.
＊ The above “API(S.G.)A 60F” shows gravity 60/60°F.
＊ The above ”API(S.G.)A 15C” shows gravity 15/15℃.

9.Summary

Sample measurement this time shows a good repeatability.

Since the following density/specific gravity meters are equipped with density conversion formula corresponding to JIS K2249・ASTM D1250・ASTM D 4052・ASTM D 5002・ISO91・API Std.2540, can be calculated gravity 60/60°F and gravity 15/15℃ of crude petroleum(A)・fuel oil(B)・grease(D) automatically.

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