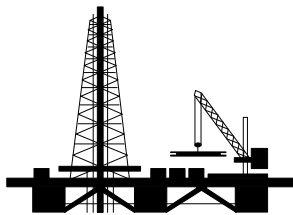




# CRUDE OIL ASSAY

Draugen



STATOIL

PRODUCT TECHNOLOGY  
AND  
CUSTOMER SERVICE

Crude Oil and Products  
Section

DATE: 21.01.03

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## 1. SAMPLE DATA

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SAMPLE:	Crude oil
DESCRIPTION:	Draugen
DATE OF SAMPLING:	07.11.02
SAMPLE VOLUME:	60 litres
SAMPLE PACKAGE:	Jerrycans
LABORATORY:	This assay was prepared by Statoil PTC

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## 2. DISTILLATION CONDITIONS

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The following conditions according to ASTM are used:

### TRUE BOILING POINT DISTILLATION

#### EQUIPMENT:

The distillation up to 375°C is performed according to D-2892/90, and from 375°C according to D-5236/92 (Vacuum Potstill Method)

#### CONDITIONS:

The cutpoints are as follows:

Atmospheric distillation:	C5 - 205°C AET
100 Torr:	205 - 240°C AET
10 Torr:	240 - 320°C AET
5 Torr:	320 - 375°C AET
From 1 to 0.1 Torr:	375 - 565°C AET

The atmospheric cutting points are corrected to 760 mmHg.

#### VOLUME:

Volume expansion or contraction are normalized among fractions boiling below 150°C in proportion to their yields. (Usually the "Loss" is negative due to volume expansion)

#### HOLD UP:

Hold up at 375°C AET is distributed as follows: 50% on the first fraction of the Pot Still (375°C-420°C) and 50% in accordance with the mass-ratios of the fractions from 420°C AET.

#### LOSS:

Loss up to 375°C AET is distributed with 2/3 in the gas-fraction and 1/3 in the first liquid-fraction.

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### 3. ANALYTICAL RESULTS

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PROJECT: CRUDE OIL ASSAY  
REF.NO: 801-011

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Table 1 SAMPLE: 801-011 Draugen Crude oil  
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Analysis of the whole crude: Light ends - see tables 8a-8e

Density at 15°C	kg/l	0.8253
Specific gravity at 60/60°F		0.8256
API gravity at 60/60°F	°API	39.9

Sulphur	mass %	0.147
Total Acid Number (TAN)	mg KOH/g	0.09

Reid Vapor Pressure (RVP)	kPa	62.3
Pour point	°C	-15

Kin. viscosity at 20°C	mm <sup>2</sup> /s (cSt)	4.02
Kin. viscosity at 40°C	mm <sup>2</sup> /s (cSt)	2.49

Nitrogen	mg/kg	540
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Hydrogen sulphide	mass %	* ND
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Vanadium (V)	mg/kg	1.1
Nickel (Ni)	mg/kg	0.9
Sodium (Na)	mg/kg	61

Salt as NaCl	mg/l	201
Wax content	mass %	<5.0

Flash point	°C	<10
Water content	mass %	0.55

\* ND: not detectable



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Table 3	SAMPLE:	801-011	Draugen Crude oil		
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Fraction	°C	150-180	180-240	240-320	320-375
Yield on crude	mass %	5.19	9.89	17.31	10.38
Yield on crude	vol %	5.41	9.90	16.68	9.68
Density at 15°C	kg/l	0.7906	0.8244	0.8566	0.8843
Specific gravity at 60/60°F		0.7909	0.8247	0.8570	0.8848
API gravity at 60/60°F	°API	47.4	40.1	33.6	28.4
Sulphur	mass %	0.040	0.047	0.075	0.185
Mercaptan sulphur	mg/kg	6.1	12.7		
Copper corrosion	1a	1a			
Total Acid Number (TAN)	mg KOH/g	<0.01	0.03	<0.01	0.07
n-Paraffins	mass %	5.5			
i-Paraffins	mass %	30.0			
Naphthenes	mass %	45.6			
Aromatics	mass %	18.8			
n-Paraffins	vol %	6.1			
i-Paraffins	vol %	31.8			
Naphthenes	vol %	45.0			
Aromatics	vol %	17.1			
Aromatics (HPLC)					
Total	mass %	17.4	19.2	25.4	29.6
Mono-Aromatics	mass %	17.4	16.8	16.4	18.4
Di-Aromatics	mass %	<0.1	2.4	8.9	8.4
Polycyclic Aromatics	mass %	<0.1	<0.1	0.1	2.8
Naphtalenes	vol %	0.01	1.58		
Aniline point	°C	48.8	54.5	67.0	75.4
Smoke point	mm	23.5	21.0		
Watson K-factor					11.7
Flash point	°C	35.0			
Freezing point	°C	<-60	<-60		
Cloud point	°C		<-41	-22	7
Cold Filter Plugging Point (CFPP)	°C		<-38	-23	7
Pour point	°C		<-39	-21	6
Cetane number			38.6	49.6	54.9
Cetane index (D-976)		26.8	37.1	46.5	47.2
CCI (D-4737)		31.4	37.3	48.8	56.2
Conradson Carbon Residue (CCR)	mass %				<0.10
Kin. viscosity at 20°C	mm <sup>2</sup> /s (cSt)	1.10	1.95	5.57	20.8
Kin. viscosity at 50°C	mm <sup>2</sup> /s (cSt)	0.78	1.23	2.74	7.14
Kin. viscosity at 100°C	mm <sup>2</sup> /s (cSt)				2.48
Nitrogen	mg/kg	<1	<1	12	135
Basic nitrogen	mass %			0.001	0.006
Refractive index at 67°C					1.472
Distillation D-86 (50%)	°C	158.4	204.8	273.7	336.4

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Fraction	°C	375-420	420-525	525-565
Yield on crude	mass %	6.29	14.21	2.71
Yield on crude	vol %	5.76	12.81	2.37
Density at 15°C	kg/l	0.9011	0.9155	0.9409
Specific gravity at 60/60°F		0.9016	0.9160	0.9415
API gravity at 60/60°F	°API	25.4	23.0	18.8
Sulphur	mass %	0.224	0.283	0.435
Total Acid Number (TAN)	mg KOH/g	0.10	0.15	0.15
Aniline point	°C	85.4	92.2	96.4
Watson K-factor		11.8	11.9	11.9
Pour point	°C	27	39	>45
Conradson Carbon Residue (CCR)	mass %	<0.10	0.14	2.2
Kin. viscosity at 50°C	mm <sup>2</sup> /s (cSt)	20.3	58.6	
Kin. viscosity at 80°C	mm <sup>2</sup> /s (cSt)			70.7
Kin. viscosity at 100°C	mm <sup>2</sup> /s (cSt)	4.95	9.71	31.9
Vanadium (V)	mg/kg	<0.1	<0.1	<0.1
Nickel (Ni)	mg/kg	<0.1	<0.1	0.5
Nitrogen	mg/kg	460	1000	2230
Basic nitrogen	mass %	0.016	0.032	0.061
Refractive index at 67°C		1.480	1.490	1.506

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Table 5		SAMPLE: 801-011 Draugen Crude oil			
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Fraction	°C	375+	525+	565+	
Yield on crude	mass %	29.59	9.09	6.39	
Yield on crude	vol %	26.38	7.81	5.44	
Density at 15°C	kg/l	0.9258	0.9602	0.9687 (1)	
Specific gravity at 60/60°F		0.9263	0.9608	0.9693	
API gravity at 60/60°F	°API	21.3	15.8	14.5	
Sulphur	mass %	0.356	0.557	0.609	
Total Acid Number (TAN)	mg KOH/g	0.18			
Aniline point	°C	91.1	93.7	93.8	
Watson K-factor		11.9	11.9	12.0	
Pour point	°C	42	>45	45	
Conradson Carbon Residue (CCR)	mass %	3.4	11.3	15.1	
Asphaltenes	mass %	<0.50	0.71	1.09	
n-Pentane insolubles	mass %	1.0	3.9	5.3	
Ash	mass %	0.013	0.090	0.144	
Kin. viscosity at 50°C	mm <sup>2</sup> /s (cSt)	133			
Kin. viscosity at 80°C	mm <sup>2</sup> /s (cSt)		694		
Kin. viscosity at 100°C	mm <sup>2</sup> /s (cSt)	16.8	217	681	
Kin. viscosity at 135°C	mm <sup>2</sup> /s (cSt)			118	
Vanadium (V)	mg/kg	3.4	12	16	
Nickel (Ni)	mg/kg	4.0	13	17	
Nitrogen	mg/kg	1850	4030	4780	
Basic nitrogen	mass %	0.050	0.111	0.158	
Penetration at 25°C	0.1mm		225	90	
Refractive index at 67°C		1.502			

(1): Calculated density for 525+ and 565+ fractions.











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Table 8d

SAMPLE: 801-011 Draugen Crude oil

## C8 HYDROCARBONS

### ISO PARAFFINS:

2,2,4-Trimethylpentane	<0.01
2,5-Dimethylhexane	0.07
2,4-Dimethylhexane	0.09
3,4-Dimethylhexane	0.01
3,3-Dimethylhexane	0.02
2,3-Dimethylhexane	0.11
(Inc. naphthenic compound)	
2-Methyl-3-ethylpentane	0.02
2-Methylheptane	0.50
4-Methylheptane	0.17
3-Methylheptane	0.90
2,3,4-Trimethylpentane	0.01
Sum C8 i-paraffins	1.91

### NAPHTHENES:

1,1,3-Trimethylcyclopentane	0.15
(Inc. 2,2-Dimethylhexane)	
trans, cis-1,2,4-Trimethylcyclopentane	0.14
trans,cis-1,2,3-Trimethylcyclopentane	0.14
trans-1,4-Dimethylcyclohexane	0.22
1,1-Dimethylcyclohexane	0.08
trans-1-Methyl-3-ethylcyclopentane	0.05
cis-1-Methyl-3-ethylcyclopentane	0.04
trans-1-Methyl-2-ethylcyclopentane	0.11
trans-1,2-Dimethylcyclohexane	0.28
2-Propylcyclopentane	0.02
cis-1,2-Dimethylcyclohexane	0.13
Ethylcyclohexane	0.67
1-Propylcyclopentane	0.19
cis,cis-1,2,4-Trimethylcyclopentane	0.02
1-Methyl-1-ethylcyclopentane	0.02
cis-1,3-Dimethylcyclohexane	<0.01
(Inc. naphthenic compound)	
Sum C8 naphthenes	2.25



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## 4. ANALYTICAL METHODS

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Table 9a

SAMPLE: 801-011 Draugen Crude oil

TEST	UNITS	METHOD
Density at 15°C	kg/l	D-4052/D-5002
Specific gravity at 60/60 °F		-
Total Sulphur	mass %	D-4294
Total Sulphur	mass %	D-5453 for sulphur content less than 0,01%
Hydrogen sulphide	mass %	D-3227
Mercaptan sulphur	mg/kg	D-3227
n-Paraffins	mass %	GC
i-Paraffins	mass %	GC
Naphthenes	mass %	GC
Aromatics	mass %	GC
Benzene	mass %	GC
Aromatics - HPLC	mass %	IP-391/95
Naphthalene	vol %	D-1840
Watson K		UOP 375
Vapor Pressure (DVPE)	kPa	D-5191
Reid Vapor Pressure (RVP)	kPa	D-323
Flash point ( Pensky Martens)	°C	D-93
Freezing point	°C	D-2386
Cloud point	°C	D-2500/D-5772
Pour point	°C	D-5853/D-5950
Could Filter Plugging Point	°C	IP 309
Kin. viscosity at 20°C	mm <sup>2</sup> /s (cSt)	D-445
Kin. viscosity at 50°C	mm <sup>2</sup> /s (cSt)	D-445
Kin. viscosity at 80°C	mm <sup>2</sup> /s (cSt)	D-445
Kin. viscosity at 100°C	mm <sup>2</sup> /s (cSt)	D-445
Kin. viscosity at 135°C	mm <sup>2</sup> /s (cSt)	D-445

