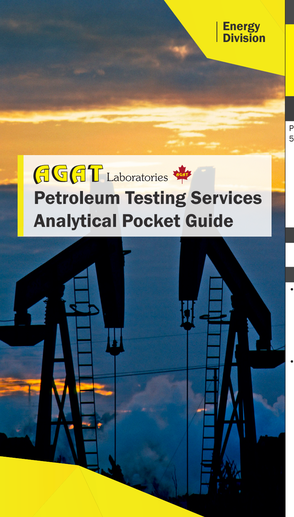

Energy Division

AGAT Laboratories

Petroleum Testing Services Analytical Pocket Guide

Gas Analysis

Natural Gas to C7+ Analysis by Gas Chromatography	Extended Gas to C15+ Analysis by Gas Chromatography	Determination of Trace H2S/Mercaptans in Gas by Sulfur Chemiluminescence Detector	Determination of Trace H2S/Mercaptans in Liquefied Petroleum Gases (LPG) Sulfur Chemiluminescence Detector
SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS
Pressurized gas in a 500 cc cylinder.	Pressurized gas in a 500 cc cylinder.	The sample must be taken in a Tedlar bag or as a pressurized gas in a 500 cc cylinder with an inert lining. The sample holding time is 48 hours and must be kept away from heat and UV radiation (sun light).	The sample must be taken as a pressurized liquid in a 500 cc stainless steel cylinder with an inert lining. The sample holding time is 7 days.
Testing Method	Testing Method	Testing Method	Testing Method
GPA 2261	GPA 2286	ASTM D5504	UOP 791
Deliverables	Deliverables	Deliverables	Deliverables
• GC analysis includes mole fraction values of Helium, Hydrogen, Nitrogen, Carbon Dioxide, Hydrogen Sulphide, and C1-C7+. • Calculated values include calculated gross heating value, relative density, critical temperature and pressure, molecular mass, and vapour pressure of C5+.	• GC analysis includes mole fraction values of Helium, Hydrogen, Nitrogen, Carbon Dioxide, Hydrogen Sulphide, and C1-C15+. Additional characterization of other compounds as well. • Full list available upon request. Calculated values include calculated gross heating value, relative density, critical temperature and pressure, molecular mass, and vapour pressure of C5+.	• This analysis is used for the trace level (<1 ppm) quantification of hydrogen sulfide and other mercaptans in gas samples. • Full list of compounds is available upon request.	• This analysis is used for the trace level (<1 ppm) quantification of hydrogen sulfide and other mercaptans in LPG / NGL samples. • Full list of compounds is available upon request.

Standard Water Analysis

Determination of Density/Specific Gravity	Determination of Conductivity and Resistivity	Determination of Salinity	Determination of pH and Alkalinity by Automatic Titration	Determination of Metals by Inductively Coupled Plasma	Determination of Anions by Ion Chromatography	Determination of Sulphide by Iodometric Titration	Determination of Total Dissolved Solids
SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS
A minimum of 50 mL of sample is required for this analysis.	A minimum of 20 mL of sample is required.	Density and chloride must be known.	A minimum of 30 mL of sample is required.	A minimum of 20 mL of sample is required for this analysis.	A minimum of 5 mL of sample is required for this analysis.	A minimum of 20 mL of sample in a tightly sealed container is required.	10 mL of sample is required for this analysis
Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method
ASTM D1429 or ASTM D7777	APHA 2510B	N/A	APHA 4500 / APHA 2320B	EPA 200.7	APHA 4110B	APHA 4500-S	APHA 2540C
Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables
• This analysis determines the density of the water by use of a hydrometer or handheld density meter. The specific gravity of the sample is listed on the final report.	• This analysis measures the resistivity of the water by use of a conductivity meter. Results are given in OHMm.	• The salinity of a sample is derived from a calculation utilizing the chloride concentration as well as the density of the sample.	• This analysis is used to determine values for both pH and Alkalinity using an automated titrator with pH probe.	• Common metals are analyzed in water by ICP-OES. Standard package includes Na, K, Ca, Mg, and Fe. List of cations tested can be expanded upon request.	• Ion Chromatography is used to measure low levels of Chlorides (Cl^-) and Sulfates ($SO4^{-2}$). List of anions tested can be expanded upon request.	• This analysis is a titrimetric determination of dissolved sulfide in water and reported as H2S.	• TDS amount, in mg/L, of solids remaining. In the standard package only a calculated value is given.

Condensate Analysis

Determination of Hydrocarbon Liquid to C7+	Determination of Hydrocarbon Liquid to C30+	Determination of Natural Gas Liquid Mixtures Applicable to LPGs and NGLs	Determination of Vapor Pressure by Reid Method	Determination of Percent Glycol by GC/TCD	Determination of PIONA Components in Hydrocarbon Liquids	Determination of Light Hydrocarbon by GC/HPLIS
SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS
The sampling requirement is a pressurized 500 cc sampling cylinder containing a minimum of 20 mL of liquid sample. Atmospheric samples may also be tested.	The sampling requirement is a pressurized 500 cc sampling cylinder containing a minimum of 20 mL of liquid sample. Atmospheric samples may also be tested.	The sampling requirement is a pressurized 500 cc sampling cylinder. It is recommended to sample using a medium displacement technique.	The sampling requirement is a 1 L plastic bottle filled only 70 - 80% with sample.	The sampling requirement is a 1 L plastic bottle containing a minimum of 30 mL of sample.	The sampling requirement is a pressurized 500 cc sampling cylinder containing a minimum of 20 mL of liquid sample. Atmospheric samples may also be tested.	Samples should be collected in a 1000 cc floating piston cylinder sampled by ASTM D3700.
Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method
GPA 2186	GPA 2186	GPA 2177	ASTM D323	ASTM E1064	ASTM D6730	ASTM D8003
Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables
• This analysis includes a C7+ Liquid analysis reported in mole, mass, and volume fraction with Measured and calculated Density, Relative Density, API @ 15 °C, Relative Molecular Mass and Gas Equivalency.	• This analysis includes a C30+ Liquid analysis reported in mole, mass, and volume fraction with Measured and calculated Density, Relative Density, API @ 15 °C, Relative Molecular Mass and Gas Equivalency. An additional second page report includes extended compositional analysis.	• This analysis includes a C7+ Liquid analysis with calculated Density, Relative Density, API @ 15 °C, Relative Molecular Mass and Gas Equivalency. If heavy components (C7+) exceed 5% of the sample then an extended analysis to C30+ will be performed to ensure accurate quantification of these fractions.	• Reid Vapor Pressure is used to determine the vapor pressure (kPa) at 37.8 °C (100 °F) of crude oils and petroleum products with initial boiling points above 0 °C.	• Determine the percent of Water, Methanol, Ethylene glycol, Diethylene glycol, Triethylene glycol and Tetraethylene glycol in a water or glycol based sample.	• A GC-FID technique that analyzes for paraffins, isoparaffins, olefins, naphthenes, aromatics and oxygenate compounds up to C14+.	• A GC-FID technique that utilizes a heated pressurized liquid injection system (HPLIS) to measure hydrocarbons from C1 - C24+.

Important Information

General Information

This pocket guide is specific to AGAT Laboratories operations and lists some of the most common analyses provided. Should you have any questions or concerns, please don't hesitate to contact us at one of the phone numbers provided or email us at **info@agatlabs.com** for more assistance.

Sampling Guidelines

Each package listed in this pocket guide contains information regarding the sampling requirements for each test. It is always a good idea, to obtain an additional sample(s) for QA/QC purposes and/or for any additional testing you may want to do in the future.

Depot Locations

AGAT Laboratories has an extensive network of branches and depots located across Canada. These facilities provide our clients with convenient and nearby drop offs allowing quick receipt and turnaround time on analysis. **Please note:** Depots are not AGAT owned facilities, but are familiar with shipping samples to and receiving bottle orders from AGAT branches and laboratories. For further information please to contact our **Head Office in Calgary** at **403.736.2000** or toll-free **1.866.764.7554**.

***Depot details are subject to change. Please visit agatlabs.com for the most up to date information.**

Routine Oil Analysis

Determination of Sediment and Water in Oil (BS&W)	Determination of API and Density of Crude Oils and Gas Condensates by Digital Density Meter	Colour Number	Determination of Dynamic Viscosity and Density, and the Calculation of Kinematic Viscosity by Stabinger Viscometer	Determination of Sulfur Content in Crude Oils and in its Products by Energy-Dispersive X-Ray Fluorescence Spectrometry	Determination of Pour Point of Oil	Distillation of Crude Oil and Petroleum Products
SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS
50 mL of sample is required.	15 mL of clean sample is required.	10 mL of sample is required.	15 mL of clean sample is required.	15 mL of clean sample is required.	50 mL of clean sample is required.	100 mL of clean sample is required.
Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method
ASTM D4007	ASTM D4052 or D5002	ASTM D1500	ASTM D7042	ASTM D4294	ASTM D97/D5853/D7346	ASTM D86
Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables
• BS&W is reported in percent volume fraction. Any free water is also noted in the final report.	• Density is measured (Kg/m^3 @15°C), Reports include API and Specific Gravity calculated using measured density.	• Reported as ASTM code and description.	• Dynamic Viscosity and Density are measured simultaneously and kinematic viscosity is calculated. As part of our routine oil package the viscosity will be performed at 3 temperatures.	• Total Sulfur is measured as weight percent and reported as mass fraction.	• Measured in °C, this test indicates the temperature at which the liquid loses its flow characteristics.	• Reported as recovered volume fraction at designated temperature ranges (°C). Calculated volume fraction of Naphtha Cut, Kerosene and Light Gas Oil Cut are reported.

Non-Routine Oil Analysis

Determination of Cloud Point of Oil	Determination of Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents	Determination of Vapour Pressure of Crude Oil: Expansion Method	Method for Acid Number of Petroleum Products by Potentiometric Titration	Determination of Organic Chloride Content in Crude Oil	Determination of Total Sulfur in Light Hydrocarbons by Ultraviolet Fluorescence	Determination of Hydrogen Sulfide and Mercaptan Sulfur in Liquid Hydrocarbons by Potentiometric Titration	Determination of Trace H2S/Mercaptans in Oil by Sulfur Chemiluminescence Detector	Determination of Flash Point by Pensky- Martens Closed Cup	Determination of Water Content by Karl Fischer	Simulated Distillation (Boiling Point Distribution of Petroleum Products by High Temperature Gas Chromatography)	Determination of Asphaltene Content in Oil (Pentane/nC5 insoluble)	Determination of Wax Content of Oil	Determination of SARA (Saturates, Aromatics, Resins and Asphaltenes) in Petroleum Products
SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS	SAMPLE REQUIREMENTS
50 mL is required for this analysis.	50 mL of sample is required.	Floating piston cylinder is required, sampled by ASTM D3700	10 mL of sample is required	10 g of naphtha distillate is required (>500 mL of crude). A D86 distillation is performed on the original crude sample to collect the naphtha fraction.	5 ml of sample is required	100 g of sample is required.	The sample may be taken as a pressurized liquid in a 500 cc Teflon or Sulfinert lined stainless steel cylinder or under atmospheric conditions in a plastic bottle. The sample holding time is 7 days.	75 mL of sample is required. The container should not be more than 85% full or less than 50% full.	5 mL of sample is required. If sample is multilayered, the testing will only be performed on the oil fraction.	5 mL of clean sample is required.	5 mL of sample is required.	5 mL of sample is required.	10 g of sample is required.
Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method	Testing Method
ASTM D2500 or D5771	ASTM D611	ASTM D6377	ASTM D664	ASTM D4929B	ASTM D5453	UOP 163	ASTM D5623	ASTM D93	ASTM D4928 or ASTM D6304	ASTM D7169	ASTM D4055	UOP 46-64	ASTM D2007
Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables	Deliverables
• Cloud point is the temperature (°C) at which wax crystals begin to form. The sample must be transparent. For darker samples an alternative method can be run, please contact your client project manager for more information.	• The temperature (°C) at which equal volumes of aniline and the sample are completely miscible.	• This method determines the vapour pressure exerted in vacuum of crude oils at 37.8°C, to the nearest 0.1kPa.	• The TAN of the sample is reported as mg KOH/g, and comprises any constituents considered to have acidic characteristics. These include organic and inorganic acids, esters, phenols, resins or additives.	• Report gives concentration in ppm of organic chloride content in sample. Detection limit of 1 ppm.	• Results of this test method are reported in mg/kg, ranging from 0-8000 mg/kg.	• The lower measurement limit is 0.2 mass-ppm mercaptan (as sulfur) and 1.0 mass-ppm hydrogen sulfide (as sulfur)	• This analysis is used for the trace level (<1 ppm) quantification of hydrogen sulfide and other mercaptans in oil samples. • Full list of compounds is available upon request.	• Flashpoint (°C) of the sample.	• Coulometric titration of hydrocarbon samples to determine trace levels (>10 ppm) of water.	• Report contains a distillation curve plot as well as carbon fraction range distribution from C5-C100. • Light ends are not available from this method but it can be merged with an ASTM D7900 report for a corrected curve that includes a corrected C1-C9 analysis.	• Report gives weight percentage of sample that is insoluble in pentane.	• Report gives weight percentage of sample that is considered to be paraffinic wax.	• A method of characterizing crude oils by measuring the saturates, aromatics, resins, and asphaltenes content.

Petroleum Testing Services Locations

Calgary
3650 21st Street NE
Calgary, Alberta
T2E 6V6
403-299-2000

Red Deer
Unit 12, 7471 Edgar Industrial
Bend Red Deer, Alberta
T4P 3Z5
403-346-6645

Edmonton
8207 Roper Road
Edmonton, Alberta
T6E 6S4
780-395-2525

Fort St.John
10331 Alaska Road
Fort St. John, BC
V1J 1B1
250-785-5500

Fort McMurray
405 Taiga Nova Crescent
Fort McMurray, Alberta
T9K 0T4
780-743-1289

Fort Nelson
5032 51 Avenue
Fort Nelson, BC
V0C 1R0
250-774-6500

Grande Prairie
9625 115th Street
Grande Prairie. Alberta
T8V 8B7
780-402-2050

Estevan
53 Devonian Street
Estevan, Saskatchewan
S4A 2H7
306-636-2347

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Website: www.agatlabs.com