



ENGINEERED LUBRICANTS CO.

LABORATORY FEE SCHEDULE

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Effective August 1, 2016 – July 30, 2017

Elemental Content (Additives, Wear Metals, and Contaminants)

Energy Dispersive X-Ray Fluorescence

XRF	X-Ray Fluorescence – 23 Elements (Listed Below)	ASTM D4294	30ml / 1oz	\$59.60
X20	X-Ray Fluorescence Chlorine (Cl) Only	ASTM D4294	30ml / 1oz	36.60
X19	X-Ray Fluorescence Sulfur (S) Only	ASTM D4294	30ml / 1oz	36.60
X5	X-Ray Fluorescence Sulfur (S) & Chlorine (Cl) Only (Energy Dispersive)	ASTM D4294	30ml / 1oz	54.40
XAQ	X-Ray Fluorescence – Aqueous Only (Al, Fe, K, Ca, Mg, P, Cl, S, & Na)	ASTM D4294	30ml / 1oz	59.60

X-ray analysis is matrix sensitive. The Limit of Quantitation (LOQ) for each element is based on aqueous or oil standards. Samples that are a different matrix may only be considered relative or semi-quantitative. Samples that have high levels of one or more elements may effect the LOQ of other elements.

Aluminum (Al)*	Antimony (Sb)	Barium (Ba)	Cadmium (Cd)	Calcium (Ca)
Chlorine (Cl)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)
Lead (Pb)	Magnesium (Mg)*	Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)
Phosphorus (P)	Potassium (K)	Silicon (Si)	Sulfur (S)	Tin (Sn)
Titanium (Ti)	Vanadium (V)	Zinc (Zn)		

*Results semi-quantitative

ICP (Inductively Coupled Plasma)

1	ICP – Oils – 23 Elements (Listed Below)	ASTM D5185	5ml / 0.17oz	28.55
3	ICP – Sodium (Na) – Oils	ASTM D5185	5ml / 0.17oz	28.55
9	ICP – Arsenic (As) – Oils (<i>send out to another lab for testing</i>)	EPA 6010B	5ml / 0.17oz	28.55
6	ICP – Aqueous – 22 Elements (Listed Below)	ASTM D5185	5ml / 0.17oz	28.55
8	ICP – Beryllium (Be) – Aqueous	ASTM D5185	5ml / 0.17oz	28.55
111	Hardness (ICP as CaCO ₂)		5ml / 0.17oz	28.55

Aluminum (Al)	Antimony (Sb)	Barium (Ba)	Boron (B)	Cadmium (Cd)
Calcium (Ca)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)
Lead (Pb)	Magnesium (Mg)	Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)
Phosphorus (P)	Silicon (Si)	Silver (Ag)*	Sodium (Na)**	Sulfur (S)
Tin (Sn)*	Titanium (Ti)	Vanadium (V)	Zinc (Zn)	

* Oils and Greases Only

**Aqueous Only

Scanning Electron Microscope (SEM)

[See attached information sheet. Please call for more information and pricing.](#)

Viscosity Determination

Automatic Method

Clean, Light Colored Oils with Viscosities of 45-2800 SSU @ 100°F (6-600 cSt @ 40°C) or 32-450 SSU @ 210°F (1-100 cSt 100°C)

33A	Viscosity, SSU &/or cSt @ 40°C & predicted SSU @ 100°F (VI=95)	ASTM D445	40ml / 1.33oz	15.45
34A	Viscosity, SSU &/or cSt @ 100°C	ASTM D445	40ml / 1.33oz	15.45
36A	Viscosity Index (includes 33A+34A)	ASTM D2270	80ml / 2.66oz	30.70

Manual Method

Dirty, Dark Colored Oils or Oils with Viscosities Outside the Range of the Automatic Method

33B	Viscosity, SSU or cSt @ 100°F or 40°C	ASTM D445	20ml / 0.66oz	30.70
34B	Viscosity, SSU or cSt @ 210°F or 100°C	ASTM D445	20ml / 0.66oz	30.70
36B	Viscosity Index (includes 33B+34B)	ASTM D2270	40ml / 1.33oz	64.85
37	Viscosity Calculated for Non-Standard Temperatures, Includes VI	ASTM D2270	40ml / 1.33oz	68.40

Miscellaneous Viscosities

107	Brookfield Viscosity @ Room Temp.	D2196	300ml / 10oz	97.50
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*Some ASTM test methods may be slightly modified.

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Particle Counting

Light Extinction (Hiac)

H1	Hiac Automatic Particle Count (CM Code, Oils)		30ml / 1oz	\$27.20
HS	Hiac Automatic Particle Count (CM Code, Prefiltered Oils)		30ml / 1oz	35.00
H4	Hiac Automatic Particle Count (NAS & ISO Code [4406-99] , Oils)		30ml / 1oz	27.20
HA	Hiac Automatic Particle Count (ISO Code [4406-99] , Oils)		30ml / 1oz	27.20
H7	Hiac Automatic Particle Count (NAS Ranges & ISO Code [4406-99] , Oils)		30ml/ 1oz	27.20
HX	Hiac Automatic Particle Count (NAS Code, Prefiltered Oils)		30ml / 1oz	35.00
HU	Hiac Automatic Particle Count (NAS Code, Prefiltered, Undiluted Oils)		400ml / 13.3oz	35.00
HM	Hiac Automatic Particle Count (SAE Code, Oils)		30ml / 1oz	32.05
HG	Hiac Automatic Particle Count (CM & ISO Code [4406-99] – Water Glycols)		30ml / 1oz	32.05
HT	Hiac Automatic Particle Count (SAE AS4059, Oils)	SAE AS4059	30ml / 1oz	27.20
HD	Hiac Automatic Particle Count	ASTM D7919	100ml/3.33oz	35.00

Analysis by Optical Microscope

R5	Particle Counting/Analysis by Optical Microscope	ISO 16232/ 4406/ 4407**	Sample size varies	Varies*
RP7	Particle Counting/Analysis by Optical Microscope – Premade Filters	ISO 16232/ 4406/ 4407**		97.50

*Call for pricing & information **Other options available

Scanning Electron Microscope (SEM)

See attached information sheet. Please call for more information and pricing.

Ferrography

Direct Readings (DR)

J	Direct Read (DR) Ferrography, Oils		10ml / 0.33oz	35.00
M	Direct Read (DR) Ferrography, Water Glycols		10ml / 0.33oz	35.00

Ferrographic Analysis

L	Ferrographic Analysis, Oils		10ml / 0.33oz	93.10
P	Ferrographic Analysis, Water Glycols		10ml / 0.33oz	93.10
N	Ferrographic Analysis, Greases		10ml / 0.33oz	100.40

Gravimetric Test

(Determines the weight of particulate matter larger than the filter pore size)

C	Gravimetric (0.45 µm Millipore filter), mg/liter, Oils	ASTM D4898	60ml / 2oz	36.40
C8	Gravimetric (0.8 µm Millipore filter), mg/liter, Oils	ASTM D4898	60ml / 2oz	36.40
B	Gravimetric (3.0 µm Millipore filter), mg/liter, Oils	ASTM D4898	60ml / 2oz	36.40
D	Gravimetric (8.0 µm Millipore filter), mg/liter, Oils	ASTM D4898	60ml / 2oz	36.40
G	Gravimetric (5.0 µm Durapore filter), mg/liter, Aqueous	ASTM D4898	60ml / 2oz	36.40
A	Gravimetric (0.45 µm Durapore filter), mg/liter, Aqueous	ASTM D4898	60ml / 2oz	36.40
GS	Gravimetric (Specified Filter Pore Size), mg/liter (Check for available sizes)	ASTM D4898	60ml / 2oz	36.40

Water Content

44	Water by Karl Fischer – Volumetric Method	ASTM E203	20ml / 0.66oz	43.85
44V	Water by Karl Fischer – Coulometric Method (Levels <1000 ppm)	ASTM D6304	20ml / 0.66oz	43.85
44H	Water by Relative Humidity Sensor	ASTM D7546	10ml / 0.33oz	43.85
38	Water & Sediment, Centrifuge Method	ASTM D4007	50ml / 1.69oz	17.80
38F	Water & Sediment in Fuel Oils, Centrifuge Method	ASTM D1796	50ml / 1.69oz	17.80
44R	Water by Refractometer - Aqueous, Synthetic Metalworking Fluids (Levels >40%)		5ml / 0.17oz	8.05

Infrared San

50	FT-IR Fingerprint, Oils		5ml / 0.17oz	39.95
50B	FT-IR Fingerprint, Aqueous		5ml / 0.17oz	39.95
180	Oil Analysis by FTIR (Nitration, Oxidation, Fuel Dilution, Soot, Water) *Must have a sample of new oil to compare	E2412	10ml/0.33oz	40.00
48B	FT-IR Additive Level (EL Products Only)		10ml / 0.33oz	46.95

*Some ASTM test methods may be slightly modified.

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Other Routine Used Oil Tests

60	Color	ASTM D1500	20ml / 0.66oz	\$ 4.25
15	Centrifuge (As Received) – High or low speed		100ml / 3.33oz	17.80
15J	Centrifuging – Trace Sediment in Lubricating Oils	ASTM D2273	100ml / 3.33oz	21.55

Flash and Fire Points

26	Flash & Fire Point – Cleveland Open Cup	ASTM D92	160ml / 5.4oz	60.00
27	Flash Point – Pensky Martens Closed Cup	ASTM D93	160ml / 5.4oz	45.00
81A	Flash - Setaflash (go-no-go) – specify temperature	ASTM D3828A	10ml / 0.33oz	30.00
82A	Flash - Setaflash (go-no-go) – specify temperature	ASTM D3278A	10ml / 0.33oz	30.00
81B	Flash - Setaflash (finite)	ASTM D3828B	40ml / 1.33oz	50.00
82B	Flash - Setaflash (finite)	ASTM D3278B	40ml / 1.33oz	50.00
85	Flash – Setaflash (Ramp Method)	ASTM D7236	40ml / 1.33oz	50.00

Water Glycol Hydraulic Fluids

31	Alkaline Reserve	D1121	20ml / 0.66oz	27.20
HG	Hiac Automatic Particle Count (CM & ISO Code – Water Glycols)		30ml / 1oz	32.05
33G	Viscosity, cSt @ 40°C & predicted SSU @ 100°F(VI=210)	ASTM D445	40ml / 1.33oz	15.45
44	Water by Karl Fischer – Volumetric Method	ASTM E203	20ml / 0.66oz	43.85
22	pH	ASTM E70	30ml / 1oz	20.05
M	Direct Read (DR) Ferrography, Water Glycols		10ml / 0.33oz	35.00
P	Ferrographic Analysis, Water Glycols		10ml / 0.33oz	93.10

Water Extendable Fluids (Aqueous)

Routine Tests

22	pH	ASTM E70	30ml / 1oz	20.05
45, 46	Bacteria & Fungus Counts		50ml / 1.69oz	29.20
69A	Refractometer Reading and Ratio Determination (May require service 69)		10ml / 0.33oz	6.20
52	Acid Split Emulsion Ratio (includes % Tramp Oil, Cuff & Sediment)		100ml / 3.33oz	30.65
87	Centrifuge for Tramp Oil, Cuff & Sediment %'s		100ml / 3.33oz	17.75
110	Ratio Determination by Titration Method		50ml / 1.69oz	27.20
69	Refractometer Chart for Ratio Determination (Water Extendable Fluids)		10ml / 0.33oz	53.90

Miscellaneous Tests

50B	FT-IR Fingerprint, Aqueous		5ml / 0.17oz	39.95
111	Hardness (ICP as CaCO ₂)		5ml / 0.17oz	28.55
97	Cobalt Leach Test (Aqueous), Wt., Mdd, & Co		200ml / 6.66oz	84.40
44R	Water by Refractometer (Levels >40%)		5ml / 0.17oz	8.05
76	Foam Test, Blender		120ml / 4oz	23.40
98	Cast Iron Chip Corrosion (2 Hrs. @ R.T.) (1 Dilution)	ASTM D4627	20ml / 0.66oz	20.80

Grease Tests

43	Cone Penetration, Worked 60 Strokes	ASTM D217	1 Pound	61.55
43Q	Cone Penetration ¼ Cone, Unworked	ASTM D1403	¼ Pound	61.55
62	Dropping Point	ASTM D2265	10 Grams	61.55
79	U.S. Steel Pressure Oil Separation from Grease	U.S. Steel Method	1 Pound	207.10
67	ASTM 4-Ball EP Test (Grease)	ASTM D2596	150 Grams	354.10
64	ASTM 4-Ball Wear Test, 20 & 40 kg @ 1200 rpm (53.20 per load)	ASTM D2266	50ml / 1.69oz	106.40
64S	4-Ball Special Test with Graphs and Pictures (Specify parameters)		50ml / 1.69oz	77.70

**Some ASTM test methods may be slightly modified.*

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Quench Oils

55F	Quenchalyzer, °F (*Run @ Room Temp, unless otherwise specified)	ASTM D6200*	1 Gallon	\$223.25
55C	Quenchalyzer, °C (*Run @ Room Temp, unless otherwise specified)	ASTM D6200*	1 Gallon	223.25
55A	Quenchalyzer, °F Agitated (*Run @ Room Temp, unless otherwise specified)	ASTM D6482*	1000ml / 32oz	234.25
55S	Quenchalyzer, °C Agitated (*Run @ Room Temp, unless otherwise specified)	ASTM D6482*	1000ml / 32oz	234.25
59	GM Quenchometer, Ni-Cr Ball <i>*Discontinued & withdrawn in 2008</i>	ASTM D3520*	500ml / 16oz	157.50
59A	GM Quenchometer, Ni Ball <i>*Discontinued & withdrawn in 2008</i>	ASTM D3520*	500ml / 16oz	250.00

Extreme Pressure and Wear Tests

Epsilon Linear Precision Test Machine

State-of-the-art technology. Call for information and pricing.

Can run ASTM methods (Any Falex ASTM methods or any specifications you would like)

Falex Pin and Vee Tests

63	Falex – Automatic	ASTM D3233A	200ml / 6.66oz	137.60
40	Falex – Stepwise	ASTM D3233B	200ml / 6.66oz	137.60
72	Falex Wear Test (Specified Pin Type)		200ml / 6.66oz	169.70
72A	Falex – Thin Film	ASTM D5620A	50ml / 1.69oz	137.60
72S	Falex Wear Properties	ASTM D2670	200ml/1.69oz	137.60

4-Ball Tests

65	ASTM 4-Ball EP Test (Fluids)	ASTM D2783	150ml / 5oz	295.00
67	ASTM 4-Ball EP Test (Grease)	ASTM D2596	150 Grams	354.10
64	ASTM 4-Ball Wear Test, 20 & 40 kg @ 1200 rpm (53.20 per load)	ASTM D4172 / ASTM D2266	50ml / 1.69oz	106.40
64S	4-Ball Special Test with Graphs and Pictures (Specify parameters)		50ml / 1.69oz	77.70

Corrosion Tests

16	Aluminum Corrosion, Oils or Aqueous		50ml / 1.69oz	61.95
98	Cast Iron Chip Corrosion, Aqueous (2 Hrs. @ R.T.) (1 Dilution)	ASTM D4627	20ml / 0.66oz	20.80
25	Copper Corrosion, Aqueous (6 Hrs. @ 80°C)	ASTM D130	40ml / 1.33oz	42.60
24	Copper Corrosion, Oils (3 Hrs. @ 100°C)	ASTM D130	40ml / 1.33oz	42.60
53	Corrosion Test (per 30 Days) (Specify Parameters: Vapor Phase, Sandwich, or Panel Partially Submerged)		200ml / 6.66oz	133.95
77	Galvanic Corrosion Test, Al, Cu, & Fe Metals (6 Hrs. @ 80°C)		40ml / 1.33oz	69.85
51	Humidity Cabinet, Cycling, Specify Test Parameters (per 30 Days)		100ml / 3.33oz	119.70
71	Humidity Cabinet, Static, 120°F or Specified Temperature (per 30 Days)		100ml / 4oz	119.70
97	Cobalt Leach Test (Aqueous), Wt., Mdd, & Co		200ml / 6.66oz	84.40
100	Carbide Corrosion Test (Oils), Wt., Mdd, & Co		50ml / 1.69oz	84.40
66	Turbine Oil Rust Test	ASTM D665A or B	500ml / 16oz	63.40

Oxidation / Thermal Stability Tests

122	Rotating Pressure Vessel Oxidation Test (AKA: RPVOT)	ASTM D2272B	250ml / 8oz	153.30
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Microscopic / Imaging Tests

May require special sample preparation (see service PREP)

R3	Microscopic Scan with Comments & Picture			45.70
R5	Particle Size Distribution (Analysis by Optical Microscope)	ISO 16232/ 4406/ 4407**	Sample size varies	Varies*

**Call for pricing & information **Other options available*

Miscellaneous Tests – Alphabetical Order

AIR	Air Release (<i>send out to another lab for testing</i>)	ASTM D3427	200ml / 6.66oz	\$260.00
90	Aniline Point (Thin Film)	ASTM D611E	30ml / 1oz	65.40
28	Anti-Freeze / Ethylene and Propylene Glycols Only	ASTM D2982A	20ml / 0.66oz	36.15
13	Appearance; Visual Color, Clarity, and Particulate		10ml / 0.33oz	4.20
49	Ash, Percent	ASTM D482	200ml / 6.66oz	40.00
102	Bacteria & Fungus Counts (Oils)		10ml / 0.33oz	29.20
89	Bijur Filtration Test		1 Gallon	171.20
112A	BTUs per Gallon (<i>send out to another lab for testing</i>)	ASTM D240	75ml / 2.5oz	175.00
112	BTUs per Pound (<i>send out to another lab for testing</i>)	ASTM D240	50ml / 1.69oz	175.00
92	Cetane No. of Distillate Fuels (Calc. Only) (Includes Services 29 & 61)	ASTM D976	500ml / 16oz	96.60
95	Cloud Point	ASTM D2500	30ml / 1oz	57.60
23	Compatibility – 4 Weeks @ 105°F		250ml / 8oz	184.40
124	Conductivity		10ml/0.33oz	19.65
70	Conradson Carbon Residue	ASTM D189	30ml / 1oz	62.40
118	Dielectric Breakdown (<i>send out to another lab for testing</i>)	ASTM D877	300ml / 10oz	30.90
61E	Distillation, °C (IBP & DP)	ASTM D1078	500ml / 16oz	84.90
61G	Distillation, °C (IBP & FBP)	ASTM D86	500ml / 16oz	84.90
61D	Distillation, °F (IBP & DP)	ASTM D1078	500ml / 16oz	84.90
61F	Distillation, °F (IBP & FBP)	ASTM D86	500ml / 16oz	84.90
190	Evaporation Loss (NOACK)	ASTM D6375	10ml/0.33oz	200.00
76	Foam Test, Blender		110ml / 3.66oz	23.40
76A	Foam (Sequence I, II, & III)	ASTM D892	380ml / 12.6oz	147.10
76B	Foam (Sequence I Only)	ASTM D892	180ml / 6oz	100.50
69M	Glycol Ratio & Freeze Point (Anti-Freeze)	ASTM D3321	10ml / 0.33 oz	6.20
104	Gas Chromatograph Qualitative Analysis		10ml / 0.33oz	39.95
104H	Gas Chromatograph Qualitative Head Space Analysis		10ml/0.33oz	53.65
Z1	Imaging (Picture)			6.50
96	Pentane Insolubles	ASTM D893A	30ml / 1oz	67.35
57	Pour Point	ASTM D6749	30ml / 1oz	45.45
58	Precipitation Number	ASTM D91	50ml / 1.69oz	67.50
18	Refractive Index (Abbe Refractometer)	ASTM D1218	5ml / 0.17oz	8.10
41	Rubber Swell, Room Temperature or Specified Temperature (per 7 Days)		50ml / 1.69oz	47.70
32	Saponification Number	ASTM D94	25ml / 0.85oz	48.50
73I	Solids – Evaporation Test, Infrared Drying		10ml / 0.33oz	21.20
73	Solids – Evaporation Test, Oven Drying	ASTM D2369	10ml / 0.33oz	33.40
42	Special per Hour (in 10 Min. Increments)			134.70
PREP	Special Sample Preparation			21.35
29	Specific Gravity (includes API Gravity & Pounds/Gallon)	ASTM D4052	20ml / 0.66oz	23.40
49S	Sulfated Ash	ASTM D874	200ml / 6.66oz	51.30
54	Surface Tension (One Phase) *Uncorrected factor reported, unless requested (provide density of fluid or add test 29 (\$23.40) for density testing)	ASTM D1331A*	50ml / 1.69oz	40.00
88	Total Base Number (<i>send out to another lab for testing</i>)	ASTM D2896	30ml / 1oz	77.55
88A	Total Base Number (<i>send out to another lab for testing</i>)	ASTM D4739	30ml / 1oz	32.30
160	Twist Compression (<i>if new method development is needed additional charges may apply</i>)		50ml / 1.69oz	38.65
MPC	Varnish Potential - MPC (Membrane Patch Colorimetry)	ASTM D7843	100ml / 3.33oz	76.00
73V	Volatile Organic Content (Per EPA Test 24)	ASTM D2369	10ml / 0.33oz	35.00
73T	VOC % (includes 29 & 44/44V)	ASTM E1868	30ml / 1oz	215.50
73TD	VOC % (*VOC RUN IN DUPLICATE) (includes 29 & 44/44V)	ASTM E1868	30ml / 1oz	293.20
106	Water Separability of Petroleum Oils & Synthetic Fluids	ASTM D1401	50ml / 1.69oz	105.90

Please refer to service 42 – Special Rate – if test procedure desired is not a normal EL procedure.

Normal Turn Around is 3-5 Days.

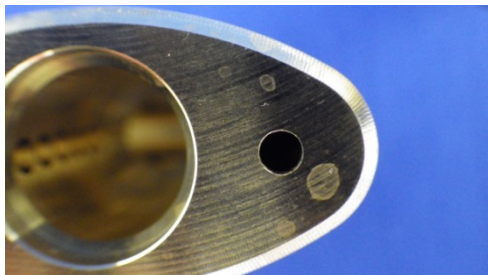
There is an Additional Charge of \$50.00 for 24 Hour Service (1-5 Samples)

ISO 9001: Certified Company

**Some ASTM test methods may be slightly modified.*

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The Power of SEM-EDX and Engineered Lubricants

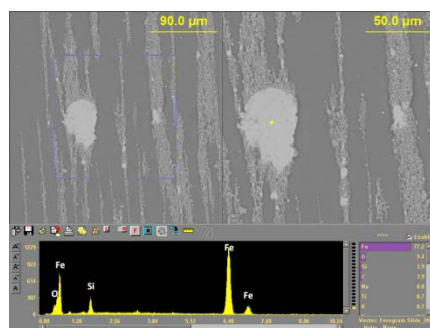
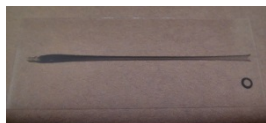


Parts

- Determine alloy
- Confirm quality
- Analyze stains/residues
- Identify leaching
- Characterize wear

Solids

- Detect elements present
- Determine concentrations
- Map elemental content



Analytical Ferrography

- Improve ferrography by providing elemental analysis of individual particles.

AFA (Automated Feature Analysis)

- Detect size and shape of each particle
- Identify elemental content
- Categorize by size, shape, chemistry
- Pinpoint component failure
- Use trending to monitor wear

