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Prices effective January 1, 2006, subject to change without prior notice.

All prices are in U.S. dollars.

Expedited services may be subject to additional charges, call for price.

Certain test methods requiring special accreditation, approvals or methods may be subject to additional service charges.

All reports are submitted as the confidential property of our clients. Authorization for publication of our reports, conclusions or extracts from or regarding them, is pending our written approval as a mutual protection to clients, the public, and ourselves. METL's liability shall in no case exceed the amount shown on the invoice.

Minimum charge for any service is \$40.00

Chemical Analysis

Spectrographic Analysis (OES)^{1,2}

| <u>Alloy Base</u> | <u>Price Each</u> |
|--|-------------------|
| Aluminum | 40.00 |
| Cobalt | 60.00 |
| Copper | 60.00 |
| Nickel (Trace Elements Additional) | 60.00 |
| Alloy Steels, Stainless Steels, and Tool Steels | 50.00 |
| Iron Base Superalloys | 60.00 |
| Titanium | 60.00 |
| Titanium (Plus Gases and Yttrium) | 195.00 |
| Single Element Analysis | 30.00 |
| Identification Charge For Unknown Alloy | 15.00 |
| Sample Preparation Charge for Subsize, Melt or Chemical Strip | 17.00 |

Inductively Coupled Plasma Analysis (ICP)

| <u>Sample Type</u> | <u>Price Each³</u> |
|-----------------------|---------------------------------|
| Braze Alloy Powders | 100.00 |
| Metal Alloys: | 100.00 |
| Magnesium, Zinc | |
| Solder Alloys (Pb-Sn) | 90.00 |
| Single Element | 35.00 Setup + 25.00 /Element |

Gas Analysis⁴

| <u>Element</u> | <u>Price Each</u> |
|----------------|-------------------|
| Hydrogen | 55.00 |
| Nitrogen | 45.00 |
| Oxygen | 45.00 |

Combustion Analysis⁵

| <u>Element</u> | <u>Price Each</u> |
|----------------|-------------------|
| Carbon | 45.00 |
| Sulfur | 45.00 |

In-lab chemistry services (instrumentation & technician) 90.00 Hr.

Additional chemical laboratory services available call for price

¹ Solid samples submitted for spectrographic analysis should be approximately one inch across, flat and homogenous. Smaller or larger samples or unidentified alloys may be analyzed at extra cost for sample preparation, sectioning, or identification. Additional charge for identification is \$15.00 per sample where alloys submitted for analysis are unknown. The price for spectrographic analysis of steels, stainless steels, and tool steels includes C, S, and P. The price shown for spectrographic analysis of titanium alloys does not include yttrium, hydrogen, nitrogen, or oxygen. (see gas analysis)

² Lead, tin, (solders), zinc, some nickel and copper alloys, and some single elements are analyzed by other methods as may be required due to sample condition, size, composition, specification or accuracy requirements. Cast irons are analyzed by wet analysis. Drillings, chips, or filings submitted for analysis should be clean and dry. The minimum charge for ICP analysis is \$50.00 per sample.

³ Includes Sample Dissolution

⁴ Extra cost may be incurred for sectioning and sample preparation of materials submitted for gas analysis, due to sample size or condition.

⁵ Samples submitted for carbon and/or sulphur analysis must be clean, oil and dirt free, chips, scrapings, powder, or drillings.

Sample Preparation

Sectioning

| | |
|--------------------------------------|---------------------------|
| Abrasive Cutoff | 60.00 /Hour |
| EDM | 35.00 Setup + 60.00 /Hour |
| EDM 1/2 Inch Diameter Slug | 15.00 /Inch |
| Friction Cutting | 60.00 /Hour |
| Oxide Scale Removal (Where Required) | 60.00 /Hour |
| Sawing | |
| Aluminum and Fe Alloys <40 hrc | 60.00 /Hour |
| Nickel, Cobalt, Titanium and | |
| Fe Alloys >40 hrc | 70.00 /Hour |
| Minimum Charge For Sectioning | 0.2 Hr. Min. |
| Miscellaneous Machining Charges | 60.00/hour |

Machining⁶, Price Each 0.250 inch Round Tensile

| Original Diameter or Diagonal Size in inches | Al, Cu, Mg | L.A.S.&BeCu | L.A.S.&BeCu | Co, Ni, Fe, Ti Superalloys |
|---|------------|-------------------------|----------------------------------|-------------------------------|
| | | <40hrc, PH S/S, C.S. | >40hrc, 300/400 Series S/S | |
| To 1/2 | 17.50 | 22.50 | 27.50 | 37.50 |
| 1/2 To 1 | 22.50 | 32.50 | 37.50 | 47.50 |
| 1 To 1-1/2 | 32.50 | 42.50 | 52.50 | 62.50 |
| Threading Where Required ⁷ , 1/2 - 13 or 7/16 - 14 | 17.50 | 22.50 | 27.50 | 32.50 |

0.500 inch Round Tensile, Price Each

| Original Diameter or Diagonal Size in inches | Al, Cu, Mg | L.A.S.&BeCu | L.A.S.&BeCu | Co, Ni, Fe, Ti Superalloys |
|---|------------|-------------------------|----------------------------------|-------------------------------|
| | | <40hrc, PH S/S, C.S. | >40hrc, 300/400 Series S/S | |
| To 1 | 22.50 | 42.50 | 47.50 | 67.50 |
| 1 To 1-1/2 | 27.50 | 47.50 | 52.50 | 72.50 |

0.500 inch Wide by 2 inch Gage Length Flat Tensile⁸, Price Each

| Sheet or Plate Original Thickness | Al, Cu, Mg | L.A.S.&BeCu | L.A.S.&BeCu | Co, Ni, Fe, Ti Superalloys |
|--------------------------------------|------------|-------------------------|----------------------------------|-------------------------------|
| | | <40hrc, PH S/S, C.S. | >40hrc, 300/400 Series S/S | |
| 0.01 To 0.07 | 17.50 | 27.50 | 32.50 | 42.50 |
| 0.07 To 0.13 | 22.50 | 32.50 | 42.50 | 52.50 |
| 0.13 To 0.38 | 27.50 | 37.50 | 52.50 | 62.50 |
| 0.38 To 0.50 | 32.50 | 42.50 | 62.50 | 82.50 |
| Pinned Flat Add ⁷ : | | | | 42.50 |

Charpy V Notch, per ASTM E-23, Set of Three, Machining Only

| Low Alloy, Carbon Steels | Precipitation Hardening & 400 Series S/S | 300 Series S/S | Ni, Co, Fe Superalloys |
|-----------------------------|--|-------------------|---------------------------|
| 95.00 | 140.00 | 185.00 | 230.00 |

Hydrogen Embrittlement Test Bars

Machined and Inspected per ASTM F-519 25.00 Each

⁶ Machining not listed will be quoted upon request. Prices reflect minimum charges for standard ASTM configuration test specimens. Machining prices do not include extra charges for sectioning, special grinding, polishing, notching, threading, or where difficulty in machining is encountered due to condition, size, or configuration. Pre-machined or cast specimens not conforming to ASTM specifications will be brought into conformance, or noted on test report. All standard test specimens are machined to ASTM e-8.

⁷ Threaded or pinned test specimens are required for stress rupture and elevated temperature tensile tests.

⁸ Prices shown are for flat specimens that are machined from a submitted sample size of 0.750 inch wide by 8 inches long. Prices for subsize or larger specimens will be quoted upon request.

Mechanical Testing

| <u>Test</u> | <u>Price Each</u> |
|--|---------------------------------|
| Bend | 20.00 |
| Flaring or Flattening (Tubing) | 20.00 |
| Hardness (Brinell or Rockwell): | 15.00 + 5.00 each additional |
| Hydrogen Embrittlement (200 Hour Test) | 20.00 /Bar |
| Impact (Charpy) | 25.00 Setup |
| Ambient | +10.00 Each |
| To -100E F | +15.00 Each |
| In-Lab Services (Technician and Equipment) | 90.00 /Hour (135.00 Min.) |
| Oven Certification: Nine Tensiles Tested per Mil-H-6088 Includes Machining, Test and Metallography | 275.00 |
| Portable Hardness (Outside Lab) | 90.00 /Hour +Travel Expenses |
| Proof Load (To 60,000 lb) | Call for Price |
| Shear (Double or Single) | 20.00 + Fixturing |
| Stress Rupture: | 40.00 Setup |
| To 1200E F | +2.00 /Hour |
| To 1600E F | +3.00 /Hour |
| To 2000E F | +4.00 /Hour |
| Tensile/Proof Load/Wedge: ⁹ | |
| Ambient Temperature (To 60,000 lbf) | 15.00 |
| Ambient Temperature (To 120,000 lbf) | 25.00 |
| Elevated Temperature (To 1200E F) | 50.00 |
| Elevated Temperature (To 1600E F) | 70.00 |
| Elevated Temperature (To 2000E F) | 90.00 |
| Tubing (1.25" Max. O.D., Tested Full Size) | 20.00 |
| Other Mechanical Testing Services Available | Call for Price |

⁹ Tensile tests include yield strength at 0.2% offset, ultimate tensile strength, percent elongation, and percent reduction of area where applicable and/or possible.

Metallurgy

Metallography

| <u>Test</u> | <u>Price Each</u> |
|---|-----------------------------|
| Case Depth (Visual Method) ¹⁰ | 45.00 |
| Case Depth (Microhardness Method) ¹⁰ | 45.00 |
| Failure Analysis | Call for Price |
| Grain Flow | Call For Price |
| Grain Size ¹⁰ | |
| ASTM E-112, Visual Comparison Method | 45.00 |
| ASTM E-112, Intercept Method | 50.00 /Hour |
| Inclusion Rating, Visual Comparison Method ¹⁰ | 45.00 |
| Intergranular Attack, Examination ¹⁰ | 45.00 |
| Macro/Sample Preparation and Examination | 35.00 Minimum |
| Metallurgical Report Includes examination, Data Compilation, Research, Writing, Report Assembly, etc. | 100.00 /Hour |
| Metallurgical Services Outside Lab, Portal to Portal | 100.00 /Hour + Expenses |
| In-Lab Metallographic Services (technician & equipment) | 90.00/Hour |
| Metallurgical Engineering/Consulting Services | Call for Price |
| Metallographic Services Available Not Listed | Call for Price |
| Microhardness Test, Knoop or Vickers ¹⁰ | 35.00 +1.50 /Indentation |
| Microstructural Examination ¹⁰ | 100.00/Hour (40.00 min.) |
| Mount and Sample Preparation | |
| Standard Bakelite Type | 45.00 |
| Castable Resin/Epoxy | 50.00 |
| Plating, Electroless Nickel, Where Required For Mounted Specimen Edge Retention | 30.00 |
| Photography-Digital Image Transfer - CD-Rom | 15.00 |
| Photomicrographs/Photomacrographs | |
| 4x5 | 15.00 |
| 8x10 | 25.00 |
| Extra Prints (4x5) | 5.00 |
| " " (8x10) | 10.00 |
| Plating/Coating Thickness ¹⁰ | 45.00 Minimum |
| Sectioning | 60.00 /Hour |

¹⁰

Requires mounting and sample preparation. May require sectioning and plating.

Scanning Electron Microscopy

| <u>Procedure</u> | <u>Price Each</u> |
|---|--------------------------|
| Scanning Electron Microscopy (SEM) Including Energy Dispersive X-Ray Spectroscopy (EDS/EDX), Semi- Quantitative or Qualitative Chemical Analysis, and X-Ray Dot Mapping | 160.00 /Hour |
| Photographs (Digital Images) | |
| 4x5 | 10.00 |
| 8x10 | 20.00 |
| Extra Prints (4x5) | 5.00 |
| Extra Prints (8x10) | 10.00 |
| Sample Preparation, Cellulose Acetate Replication, Gold Deposition, Optical Microscopy, Data Analysis, Consultation, Preparation of Reports, Failure Analysis | 85.00 /Hour |
| Minimum Charge, SEM Services | 80.00 |
| Qualitative Chemical Analysis by EDX (Peak spectrum only) | 55.00 |

Miscellaneous

Salt Spray Corrosion Tests

| <u>Test</u> | <u>Price Each</u> |
|---|-------------------|
| ASTM B-117 (standard panels) | |
| 0 To 168 Hours | 20.00 |
| 169 To 336 Hours | 31.00 |
| Over 336 Hours | P.O.A. |
| non-standard sized components or panels | P.O.A. |
| Minimum Charge | 40.00 |

Non-Metallic Physical Properties

| <u>Test</u> | <u>Price Each</u> |
|--|--|
| Bond Strength of Sprayed Coatings (Epoxy Bond, Cure and Tension Test) | 45.00 single bond 50.00 double bond |
| Coating Weight | 25.00 |
| Density | 35.00 |
| Dimensional Measurements | 75.00 /Hour |
| Shore Hardness (A or D Scale) | 25.00 |
| Solderability per mil-std-202,method 208 | 25.00 set-up 7.50/sample |
| Specific Gravity | 35.00 |
| Visual Examination | 20.00 |

Non-Destructive Penetrant Oils

| <u>Test</u> | <u>Price Each</u> |
|--|-------------------|
| Fluorescent Penetrant Oil (water content, fluorescence, removability, sensitivity) | 60.00 |
| Emulsifier Oil (removability, water content, contamination) | 45.00 |
| Magnetic Inspection Oil (viscosity) | 35.00 |
| Water Base Emulsifier (removability, contamination) | 40.00 |

Weld Certification¹¹
per AMS-STD-1595/AWS D17.1

| <u>Joint Name</u> | <u>Description</u> | <u>Lot Charge Per Material</u> |
|--------------------------------|--|---|
| 0.063 or Less Sheet Groove | Cut, Machine and Bend Test One (1) Longitudinal Weld | 30.00 |
| 0.063 - 0.125 Sheet Groove | Cut, Machine and Bend Test Two (2) Longitudinal Welds | 50.00 |
| T-fillet, To 0.125 Thick | Cut, Polish, and Examine Eight (8) Cross Sections | 90.00 |
| T-fillet .126-.375" thick | Cut, Polish, and Examine Eight (8) Cross Sections | 125.00 |
| Sheet Groove | Radiographic Inspection | 50.00 |
| Tube Groove | " | 70.00 |
| Tube Fillet, to 0.125 Thick | Cut, Polish, and Examine Eight (8) Cross Sections | 125.00 |
| Tube Fillet over .126 thick | Cut, Polish, and Examine Eight (8) Cross Sections | 150.00 |

Plating Solution Analysis
Call for Price

Taber Abrasion Test

| <u>test</u> | <u>Price Each</u> |
|---|--------------------------|
| 10,000 Cycles per MIL-A-8625 F and FED STD I41, Method 6192 | 40.00 |
| Abrasion Test on other Materials and/or per Other Specifications | P.O.A. |

Stress Corrosion Test per ASTM G-34

| <u>Operation</u> | <u>Price Each¹²</u> |
|---------------------------|---------------------------------------|
| Machining C-Ring Specimen | 135.00 |
| 20 Day Exposure | 150.00 |
| 30 Day Exposure | 215.00 |

Conductivity

| <u>Test</u> | <u>Price Each</u> |
|---------------------|--------------------------|
| CONDUCTIVITY (IACS) | 25.00 |

Heat Treating

| <u>Cycle</u> | <u>Price Each</u> |
|---------------------|---------------------------|
| to 2000°F | 30.00 Set-Up 5.00/Hour |

¹¹ Qualification to other specifications may require radiographic inspection, in addition to the tests listed, at additional cost. Some materials must be radiographically inspected only. Refer to the specification for information.

¹² Includes exam and report