



EWI Lab Services MECHANICAL TESTING



1250 Arthur E. Adams Drive, Columbus, OH 43221 / 614.688.5000

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EWI Lab Services provides machining and testing services on an array of materials - metals, plastics, composites,

Tensile Testing - up to 220,000 pounds capacity

| Code | Name | Reference | Description | Rate |
|-------------------------------|--|---------------------|--|-------|
| MACHINING INCLUDED | | | | |
| 25 | Tensile Test (with machining) Yield, Ult, Elongation & ROA | ASTM E8 AWS B4.0 | Tensile Test - 0.2% Offset Yield, Ultimate, Elongation, and Reduction of Area Information provided | \$132 |
| 64 | Tensile Test (with machining) Elevated Temperature - to 1,000 °F * | ASTM E21 | Elevated Temperature Tensile Test - Yield (est.), Ultimate, Elongation, and Reduction of Area Information provided | \$181 |
| MACHINING NOT INCLUDED | | | | |
| 6 | Tensile Test (without machining) - Ultimate Load with strength (psi) | ASTM E8 AWS B4.0 | Tensile Test - No Yield, Ultimate Strength based on cross sectional area | \$36 |
| 8 | Tensile Test (without machining) - Ultimate Load Only | ASTM E8 AWS B4.0 | Tensile test - Ultimate Load with displacement at Ultimate Load | \$30 |
| 62 | Tensile Test (without machining) - Yield, Ult, Elongation & ROA | ASTM E8 AWS B4.0 | Tensile Test - 0.2% Offset Yield, Ultimate, Elongation, and Reduction of Area Information provided | \$85 |
| 65 | Tensile Test (without machining) - Elevated Temperature to 1,000 °F * | ASTM E21 | Elevated Temperature Tensile Test - Yield (est.), Ultimate, Elongation, and Reduction of Area Information provided | \$125 |
| 33 | Stress/Strain Curve | ASTM E8 AWS B4.0 | Additional charge for a computer generated plot of Stress / Strain curve from Tensile Test | \$51 |

Bend Testing - up to 2" wide specimens, plunger or wrap around

| Code | Name | Reference | Description | Rate |
|------|--|------------------------------------|---|------|
| 20 | Bend Test (with machining) - Guided or Semi-Guided | ASTM E190 ASTM E290 AWS B4.0 | Face, Root & Side bend for samples up to 3/4" thick | \$89 |
| 59 | Bend Test (without machining) - Guided or Semi-Guided | ASTM E190 ASTM E290 AWS B4.0 | Face, Root & Side bend for samples up to 3/4" thick | \$47 |

Charpy Impact Testing - 0-300 ft-lbs capacity

| Code | Name | Reference | Description | Rate |
|------|--|----------------------|--|-------|
| 22 | Charpy Impact Test (with machining) - Base, Weld or HAZ | ASTM E23 AWS B4.0 | Charpy Impact Test - Reports impact energy, Shear Area (carbon steel only) and Lateral Expansion | \$70 |
| 60 | Charpy Impact Test (without machining) - Base, Weld or HAZ | ASTM E23 AWS B4.0 | Charpy Impact Test - Reports impact energy, Shear Area (carbon steel only) and Lateral Expansion | \$34 |
| 120 | Drop Weight Test (with machining) to Determine Nil-Ductility | ASTM E23 AWS B4.0 | Drop Weight Test used to determine nil-ductility | \$195 |
| 3 | Drop Weight Test (without machining) to Determine Nil-Ductility | ASTM E23 AWS B4.0 | Drop Weight Test used to determine nil-ductility | \$145 |

Machining - Full service machine shop

| Code | Name | Reference | Description | Rate |
|------|----------------------|-----------|--|---------|
| 52 | Machining (hourly) * | N/A | Hourly machining may be applied to samples that are harder than RC 35, thicker than 3/4", or require complex machining operations. | \$75/hr |

* Not included in scope of A2LA accreditation

For additional information or a quote please contact Rich Minshall (Lead Technician) or Brad Nagy (Mgr. Weld and Test Labs) at labservices@ewi.org or 614.688.5000



EWI Lab Services
DYNAMIC MECHANICAL TESTING



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Fatigue Crack Growth - up to 45 Hz

| Code | Name | Reference | Description | Rate |
|-------------------------------|---|-----------|---|---------|
| MACHINING INCLUDED | | | | |
| 27 | Fatigue Crack Growth Rate (with machining) - Greater Than 10 ⁻⁶ mm/cycle * | ASTM E647 | FCGR - Determines steady state fatigue crack growth from near threshold to controlled instability | \$810 |
| 28 | Fatigue Crack Growth Rate (with machining) - Down to 10 ⁻⁷ mm/cycle * | ASTM E647 | FCGR - Determines steady state fatigue crack growth from near threshold to controlled instability with more time spent evaluating near threshold growth | \$1,440 |
| MACHINING NOT INCLUDED | | | | |
| 66 | Fatigue Crack Growth (without machining) - Greater Than 10 ⁻⁶ mm/cycle - Ready to Test * | ASTM E647 | FCGR - Determines steady state fatigue crack growth from near threshold to controlled instability | \$570 |
| 67 | Fatigue Crack Growth Rate (without machining) - Down to 10 ⁻⁷ mm/cycle - Ready to Test * | ASTM E647 | FCGR - Determines steady state fatigue crack growth from near threshold to controlled instability with more time spent evaluating near threshold growth | \$1,200 |

Crack Tip Opening Displacement (SENB)

| Code | Name | Reference | Description | Rate |
|-------------------------------|---|------------------------|--|-------|
| MACHINING INCLUDED | | | | |
| 29 | CTOD Base Metal (with machining) Cross Section up to 1" x 2" 68 °F to -100 °F | BSI 7448 | CTOD Base Material - Pre-cracking, testing, measurement, fracture face photograph and standard test report | \$540 |
| 100 | CTOD Base Metal (with machining) Cross Section up to 1.5" x 3" 68 °F to -100 °F | BSI 7448 | CTOD Base Material - Pre-cracking, testing, measurement, fracture face photograph and standard test report | \$600 |
| 101 | CTOD Base Metal (with machining) Cross Section up to 3" x 3" 68 °F to -100 °F | BSI 7448 | CTOD Base Material - Pre-cracking, testing, measurement, fracture face photograph and standard test report | \$800 |
| 102 | CTOD Base Metal (with machining) Cross Section up to 4" x 4" 68 °F to -100 °F | BSI 7448 | CTOD Base Material - Pre-cracking, testing, measurement, fracture face photograph and standard test report | \$890 |
| 30 | CTOD Weld/HAZ | BSI 7448 | Additional charge for Weld/HAZ CTOD testing | \$150 |
| MACHINING NOT INCLUDED | | | | |
| 68 | CTOD Base Ready to Test - 68 F(20 C) to -100 F(-75 C) | ASTM E1290 or BSI 7448 | CTOD Base Material - Machining NOT Included - Various loading configurations of a pre-cracked samples to determine material resistance to crack growth under static conditions | \$360 |
| 69 | CTOD Weld/HAZ Ready to Test - 68 F(20 C) to -100 F(-75 C) | ASTM E1290 or BSI 7448 | CTOD Weld/ HAZ - Machining NOT Included - Various loading configurations of a pre-cracked sample to determine material resistance to crack growth under static conditions | \$510 |
| 34 | CTOD Other Temperatures Up to 752 °F Down to -320 °F | BSI 7448 | Additional Charge for CTOD at high or low temperatures | \$160 |

Standard Fatigue - Up to 220,000 pounds tension/compression

| Code | Name | Reference | Description | Rate |
|------|---|-----------|--|-------|
| 81 | Fatigue Load or Displacement Controlled - Standard Geometry (without machining) | ASTM E466 | Fatigue Test - Constant Amplitude axial force controlled fatigue test of standard geometry samples | \$410 |

Witness - 3rd party auditor or witness

| Code | Name | Reference | Description | Rate |
|------|------------------|-----------|---|-----------|
| 106 | Witness charge * | N/A | Hosting of 3rd party witness or auditor as required by customer. Lunch and private on-site office with phone and wireless internet connection is included | \$300/day |

Machining - Full service machine shop

| Code | Name | Reference | Description | Rate |
|------|----------------------|-----------|--|---------|
| 52 | Machining (hourly) * | N/A | Hourly machining may be applied to samples that are harder than RC 35 or require complex machining operations. | \$75/hr |

* Not included in scope of A2LA accreditation

For additional information or a quote please contact Fabian Orth (Senior Engineer) or Paul Zelenak (Applications Engineer) at labservices@ewi.org or 614.688.5000



EWI Lab Services METALLURGICAL TESTING

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EWI Lab Services has experience with some of the most challenging metallurgical applications. From thin foils to

Mounts & Photographs - same day turnaround available!

| Code | Name | Reference | Description | Rate |
|------|--|-----------|--|-------|
| 41 | 1 1/2" Diameter Carbon Steel Mounts | ASTM E3 | Hot press mounted in clear or black phenolic and polished. Can also be mounted in Conductomet for SEM | \$131 |
| 42 | 1 1/2" Diameter Non-Ferrous Mounts | ASTM E3 | | \$145 |
| 71 | 2" Diameter Carbon Steel Mounts | ASTM E3 | | \$210 |
| 72 | 2" Diameter Non-Ferrous Mounts | ASTM E3 | | \$235 |
| 73 | 1 1/2" Diameter Carbon Steel Mounts (previously mounted) | ASTM E3 | Re-polish and etch previously mounted sample | \$119 |
| 74 | 1 1/2" Diameter Non-Ferrous Mounts (previously mounted) | ASTM E3 | | \$125 |
| 75 | 2" Diameter Carbon Steel Mounts (previously mounted) | ASTM E3 | | \$140 |
| 76 | 2" Diameter Non-Ferrous Mounts (previously mounted) | ASTM E3 | | \$151 |
| 78 | > 2" & < 4" Polished Sections | ASTM E3 | Normally mounted in quick curing compound & hand polished | \$276 |
| 83 | > 4" & < 6" Polished Sections | ASTM E3 | | \$552 |
| 92 | Cold Mounts | ASTM E3 | 24 hour curing epoxy - vacuum or air cured | \$268 |
| 93 | Additional Specimen per Mount Max of 4 per Mount | ASTM E3 | Insertion of additional samples into a single mount - per additional sample - only available in 2 inch or smaller mounts | \$38 |
| 44 | Micro/Shot (max field of view 0.280"x0.370"*) | PAX-it | Digital photography using Pax-it software and camera | \$34 |
| 45 | Macrograph per Photograph * | PAX-it | Digital photography using Pax-it software and camera | \$48 |

Hardness - up to 50kg Vickers, Rockwell A, B and C (does not include specimen prep!)

| Code | Name | Reference | Description | Rate |
|------|--|-----------------------|---|---------------|
| 47 | Microhardness Traverse 10 indents | ASTM E384/E92 | Micro Vickers & Knoop (10g-1kg), Macro Vickers (1-50 kg) | \$137 |
| 96 | Rockwell Macrohardness Average 3 Indents | ASTM E18 ASTM E140 | A, B or C Scales | \$82 |
| 137 | Auto-hardness Test (up to 1000 indents) | ASTM E384 | Vickers (10g – 1kg), 2D matrix or linear traverse, up to 1000 indents | \$750 |
| 139 | Auto-hardness Test (additional hardness indents) | ASTM E384 | Vickers (10g – 1kg), 2D matrix or linear traverse | \$0.50/indent |

Image Analysis

| Code | Name | Reference | Description | Rate |
|------|--|-------------------------|--|-------|
| 48 | Grain Size Measurements | ASTM E112 ASTM E1382 | Physical comparison or computer measurement | \$88 |
| 54 | Ferrite Count-Prep & Magnegage * | AWS A4.2 | Magnetic attraction | \$202 |
| 138 | % Ferrite per E 562-02 | ASTM E562 | Manual point count determination only - sample prep time is additional. Price includes 5 micro photos at 500x | \$257 |
| 58 | Automated Porosity Measurement (up to 3 pores) * | Customer Specified | Price for image analysis software method - other methods available | \$76 |
| 97 | Inclusion Rating | ASTM E45 | Determination of inclusion content of wrought steel | \$174 |
| 107 | Single Linear Measurement * | Customer Specified | Using Pax-It Software package | \$16 |
| 145 | Microstructure Analysis * | ASTM A923 | Metallurgical evaluations following customer or other specifications, including (but not limited to) detecting the presence of intermetallics, deleterious phases, and/or defects in metallurgical samples | \$145 |

SEM with EDS - specimens up to 4.4 pounds

| Code | Name | Reference | Description | Rate |
|------|---------------------------------|--------------------|---|------------|
| 77 | SEM/EDS Analysis (1 hr. min.) * | Customer Specified | Includes mild sample cleaning, stage mounting, technician to operate the Zeiss EVO 60 with EDS and post exam cleanup. | \$277/hour |

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For additional information or a quote please contact Rich Minshall (Lead Technician) or Brad Nagy (Mgr. Weld and Test Labs) at labservices@ewi.org or 614.688.5000



We Manufacture Innovation

EWI Lab Services WELDING SERVICES

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EWI Lab Services has certified welders and AWS Certified Welding Inspectors (CWI) on staff for procedure and

Welding Services - GMAW, FCAW, GTAW, SAW, SMAW and PAW

| Code | Name | Reference | Description | Rate |
|------|------------------|-----------|--|------------|
| 94 | Welding Services | Various | Welding to various AWS and other specifications - no research or engineering support | \$105/hour |

Procedure Qualification Plate Welding Guidelines

| Code | Name | Reference | Description | Rate |
|------|--|--------------------------|---|----------|
| | 1/2" groove - 1/16" diameter GMAW/FCAW welding | N/A | Welding parameters and wire supplied by customer - does not include base material (see below). These are guidelines for estimation purposes only - please contact us for a quote! | ~\$290 |
| | 3/4" groove - 1/16" diameter GMAW/FCAW welding | N/A | | ~\$395 |
| | 1/2" groove - 1/16" diameter manual GTAW welding | N/A | | ~\$815 |
| | 3/4" groove - 1/16" diameter manual GTAW welding | ASTM E 1032 AWS A5.01 | | ~\$1,160 |
| | 1" groove - 5/32" diameter SAW welding | N/A | | ~\$700 |
| | Robotic or automated welding | N/A | Quoted on request | |

AWS Welding Tests - Kristen Merlo is the 2nd Vice Chair of B4.0!

| Code | Name | Reference | Description | Rate |
|------|--------------------------------|-----------|---------------------------------------|-------|
| 95 | AWS Fillet Weld Test | AWS B4.0 | Fillet weld break test with Machining | \$165 |
| 36 | Nick Break (with machining) | AWS B4.0 | Nick break test | \$51 |
| 70 | Nick Break (without machining) | AWS B4.0 | Nick break test | \$35 |

Diffusible Hydrogen - up to 10 sets per day

| Code | Name | Reference | Description | Rate |
|------|--|-------------|---|-------|
| 13 | Diffusible Hydrogen via Gas Chromatograph Method | AWS A4.3-93 | Includes welding and testing of 4 coupons using the same consumable and weld parameters | \$675 |

Certified Base Metal Pricing *

| Code | Name | Reference | Description | Rate | |
|------|--------------------------------------|---------------|---|------------|-------|
| 160 | A36 1/2" thick groove | ASTM A36 | 12" length, 45 degree included angle w/ backing bar | \$102 | |
| 161 | A36 3/4" thick groove | ASTM A36 | | \$120 | |
| 162 | A36 1" thick groove | ASTM A36 | | \$139 | |
| 163 | HY-80 - 3/4" thick groove | Mil Spec | | \$271 | |
| 164 | A588 Gr. B 3/4" thick groove | ASTM A588 | | \$197 | |
| 165 | A537 Cl. 1 or 2 3/4" thick groove | ASTM A537 | | \$140 | |
| 166 | A387 Gr. 11 3/4" thick groove | ASTM A387 | | \$164 | |
| 167 | A131 Gr. B 3/4" thick groove | ASTM A131 | | \$189 | |
| 168 | A516 Gr. 70 3/4" thick groove | ASTM A516 | | \$126 | |
| 169 | A572 Gr. 50 3/4" thick groove | ASTM A572 | | \$127 | |
| 170 | A204 Gr. B 3/4" thick groove | ASTM A204 | | \$207 | |
| 171 | A387 Gr. 91, Cl. 2 3/4" thick groove | ASTM A387 | | \$354 | |
| 172 | 304 SS, 1/2" thick groove | SAE Grade 304 | | \$214 | |
| 173 | 304 SS, 3/4" thick groove | SAE Grade 304 | | \$269 | |
| 174 | A36 1/2" x 3.5" fillet | ASTM A36 | | 10" length | \$55 |
| 175 | 304SS 3/8" x 3" fillet | SAE Grade 304 | | | \$115 |
| 176 | A36 1/2" x 3" fillet | ASTM A36 | \$45 | | |

Humidity exposure *

| Code | Name | Reference | Description | Rate |
|------|---|--------------------|---|----------|
| 2 | Humidity and Temperature Exposure Testing | Customer Specified | Humidity and temperature controlled chamber | \$25/day |

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For additional information or a quote please contact Josh Shoemaker (Principal Technician) or Brad Nagy (Mgr. Weld and Test Labs) at labservices@ewi.org or 614.688.5000



We Manufacture Innovation

EWI Lab Services Chemistry, NDE and Other

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EWI Lab Services has certified welders and AWS Certified Welding Inspectors (CWI) on staff for procedure and consumable qualification testing. We also have commonly used welding processes available including robotic, mechanized and semiautomatic

Chemical Analysis - LECO Glow Discharge system

| Code | Name | Reference | Description | Rate |
|------|---|------------|--|-------|
| 46 | Chemical Analysis (Leco GDS-500) CS, SS, Al, Ni, and Ti alloys | ASTM E415 | Optical Emission Spectroscopy Method using Leco GDS-500. CS, SS, Al, Ni, and Ti alloys (Other methods available for different materials) | \$165 |
| 108 | Carbon Steel - Oxygen/Nitrogen Analysis via Leco * | ASTM E1019 | Oxygen and Nitrogen content of carbon steel using the LECO method | \$106 |

NDE methods - Level 3 RT, Level 2 MT, PT

| Code | Name | Reference | Description | Rate |
|------|--|--------------------------|---|------------------|
| 9 | PQR plate X-ray preparation | ASTM E 1032 AWS A5.01 | Preparation of weld plate for x-ray - assumes standard AWS 12" x 12" x 1" thick plate | \$65 |
| 80 | PQR plate X-ray using film | ASTM E 1032 AWS A5.01 | Film x-ray of steel for standard AWS 12" x 12" x 1" plate. Includes film digitization. | \$225 |
| 17 | Pipe X-ray - 1/2" - 2 1/2" diameter pipe | ASTM E 1032 | 1/2" - 2 1/2" Pipe Welds 3 - Shots (Elliptical) Includes film digitization. | \$550 |
| 18 | Pipe X-ray - 3" - 4" diameter pipe | ASTM E 1032 | 3" - 4" Pipe Welds 6 - Shots (Double Wall) Includes film digitization. | \$675 |
| 19 | Pipe X-ray - 5" - 8" diameter pipe | ASTM E 1032 | 5" - 8" Pipe Welds 6 - Shots (Single Wall) Includes film digitization. | \$775 |
| 26 | Pipe X-ray - 10" - 12" diameter pipe | ASTM E 1032 | 10" - 12" Pipe Welds 6 - 7 Shots (Single Wall) Includes film digitization. | \$875 |
| 84 | X-ray using Computed Radiography * | Customer Specified | Digital computed radiography of steel - price is per shot | \$89 |
| 85 | X-ray film digitization * | Customer Specified | Digital scanning of previously developed films | \$25 |
| 146 | Visual Inspection * | Customer Specified | Visual Inspection performed by AWS CWI - price is per inspection | \$100 |
| | Magnetic Particle Inspection * | Customer Specified | Magnetic Particle Inspection by AWS CWI | Ask for quote |
| | Die Penetrant Inspection * | Customer Specified | Die Penetrant Inspection by AWS CWI | Ask for quote |
| | Ultrasonic Inspection * | Customer Specified | Ultrasonic NDE using traditional or phased array inspection methods. | Ask for quote |

Heat Treatment - up to 1,375F *

| Code | Name | Reference | Description | Rate |
|------|-------------------------------|-----------------------|--|-------|
| 79 | Furnace - PWHT up to 1,375 °F | Customer Specified | Various ovens with largest capacity of 270 lb and 18"x18"x36" | \$189 |
| 86 | Aging/Bake-out up to 210 °F | Customer Specified | Calibrated 210 F continuous oven/ or PID controlled time programmable oven up to 450 °F | \$25 |
| 87 | Aging/Bake-out > 210 °F | Customer Specified | Computer controlled oven up to 450 °F and recordable PID controlled ovens for higher temperatures | \$95 |

Corrosion

| Code | Name | Reference | Description | Rate |
|------|------------------------|----------------------|---|-------|
| 99 | G-48 Corrosion Testing | ASTM G48 Method A | Ferric Chloride solution for 72 hours at RT and 40 °C | \$336 |
| 4 | ASTM A-262 Method E * | ASTM A262 | Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels | \$650 |

Residual Stress

| Code | Name | Reference | Description | Rate |
|------|--------------------------------|-----------|-----------------------------|-------|
| 31 | Residual Stress via Blind Hole | ASTM E837 | Residual stress measurement | \$406 |

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