



# PERRY JOHNSON LABORATORY ACCREDITATION, INC.

## Certificate of Accreditation

*Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:*

***Colorado Metallurgical Services***  
10605 East 25<sup>th</sup> Avenue, Aurora, CO 80010

*(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:*

**ISO/IEC 17025:2017**

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

***Chemical Testing, Mechanical, Metallographic Examination of Metal Alloys, Weld Qualification and Failure Analysis, and Non-Destructive (UT, MT, & PT)***  
*(As detailed in the supplement)*

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen  
President

Perry Johnson Laboratory  
Accreditation, Inc. (PJLA)  
755 W. Big Beaver, Suite 1325  
Troy, Michigan 48084

*Initial Accreditation Date:*

September 3, 2013

*Issue Date:*

November 24, 2021

*Expiration Date:*

December 31, 2023

*Accreditation No.:*

72916

*Certificate No.:*

L21-731

*The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: [www.pjllabs.com](http://www.pjllabs.com)*



# Certificate of Accreditation: Supplement

## Colorado Metallurgical Services

10605 East 25<sup>th</sup> Avenue, Aurora, CO 80010  
 Contact Name: Ruth Hughes Phone: 720-749-2071

Accreditation is granted to the facility to perform the following testing

FIELD OF TEST	ITEMS, MATERIALS OR PRODUCTS TESTED	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED	RANGE (WHERE APPROPRIATE) AND DETECTION LIMIT
Chemical <sup>F</sup>	Aluminum and Aluminum Alloys	Optical Emission Spectrometry (OES)	ASTM E1251	Beryllium: 0.005 %
	Cast Iron			Chromium: 0.001 %
Copper: 0.002 %				
Iron: 0.001 %				
Lead: 0.001 %				
Magnesium: 0.001 5 %				
Manganese: 0.003 %				
Nickel: 0.001 %				
Silicon: 0.001 %				
Tin: 0.004 %				
Titanium: 0.003 %				
Vanadium: 0.003 %				
Zinc: 0.005 %				
Zirconium: 0.004 %				
Aluminum: Remainder				
Cast Iron			ASTM E1999	Aluminum: 0.003 %
				Boron: 0.000 1 %
				Carbon: 0.002 %
				Chromium: 0.003 %
				Cobalt: 0.004 %
				Copper: 0.001 %
				Lead: 0.002 %
				Magnesium: 0.005 %
				Manganese: 0.001 5 %
				Molybdenum: 0.001 %
				Nickel: 0.01 %
				Phosphorus: 0.003 %
				Silicon: 0.002 %
				Sulfur: 0.001 %
Titanium: 0.003 %				
Tin: 0.005 %				
Tungsten: 0.003 %				
Vanadium: 0.001 %				
Iron: Remainder				



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Chemical <sup>F</sup>	Copper and Copper Alloys	Optical Emission Spectrometry (OES)	Laboratory In house Method	Aluminum: 0.001 %
				Beryllium: 0.001 %
				Carbon: 0.001 %
				Cobalt: 0.001 %
				Iron: 0.001 %
				Lead: 0.003 %
				Manganese: 0.003 %
				Nickel: 0.002 %
				Phosphorus: 0.001 %
				Silicon: 0.001 %
				Sulfur: 0.000 8 %
				Tin: 0.002 %
				Zinc: 0.001 %
				Copper: Remainder
	Carbon Steel and Low Alloy Steel		ASTM A751 ASTM E415	Aluminum: 0.003 %
				Boron: 0.000 1 %
				Carbon: 0.002 %
				Chromium: 0.003 %
				Cobalt: 0.004 %
				Columbium: 0.005 %
				Copper: 0.001 %
				Lead: 0.003 %
				Manganese: 0.001 5 %
				Molybdenum: 0.001 %
				Nickel: 0.01 %
				Phosphorus: 0.003 %
				Selenium: 0.001 %
				Silicon: 0.002 %
				Sulfur: 0.001 %
				Tin: 0.002 %
				Titanium: 0.003 %
				Tungsten: 0.005 %
				Vanadium: 0.001 %
				Zirconium: 0.004 %
				Iron: Remainder



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Chemical <sup>F</sup>	Metal	Combustion – LECO	ASTM E1019	Carbon: 0.001 % to 4.5 % Nitrogen: 0.000 5 % to 0.5 % Oxygen: 0.000 5 % to 0.1 % Sulfur: 0.002 % to 0.6 %
	Nickel and Nickel Alloys	Optical Emission Spectrometry (OES)	ASTM E3047 Laboratory In house Method	Aluminum: 0.029 % Boron: 0.000 2 % Carbon: 0.002 % Chromium: 0.001 % Cobalt: 0.014 % Columbium: 0.001 % Copper: 0.004 % Iron: 0.076 % Manganese: 0.018 % Molybdenum: 0.001 % Phosphorus: 0.001 % Silicon: 0.000 6 % Sulfur: 0.001 % Titanium: 0.005 % Tungsten: 0.001 % Vanadium: 0.001 % Zirconium: 0.001 % Nickel: Remainder
Chemical <sup>FO</sup>	Quantitative Analysis of Metallic Products or Metal Alloys	Element Range is Magnesium to Uranium	ASTM E1621	Depending Upon the Element Analyzed in this Element Range D.L.: 0.01 % to 0.1 %
Chemical <sup>F</sup>	Stainless Steel	Optical Emission Spectrometry (OES)	ASTM A751 ASTM E1086	Aluminum: 0.003 %
				Boron: 0.000 1 %
				Carbon: 0.002 %
				Chromium: 0.003 %
				Cobalt: 0.004 %
				Columbium: 0.005 %
				Copper: 0.001 %
				Manganese: 0.001 5 %
				Molybdenum: 0.001 %
				Nickel: 0.01 %
				Phosphorus: 0.003 %
Selenium: 0.001 %				



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Chemical <sup>F</sup>	Stainless Steel	Optical Emission Spectrometry (OES)	ASTM A751 ASTM E1086	Silicon: 0.002 %
				Sulfur: 0.001 %
				Tin: 0.002 %
				Titanium: 0.003 %
				Tungsten: 0.005 %
				Vanadium: 0.001 %
				Zirconium: 0.004 %
				Iron: Remainder
	Titanium	ASTM E2626	Aluminum: 0.002 %	
			Carbon: 0.001 %	
			Iron: 0.001 5 %	
			Manganese: 0.001 5 %	
			Molybdenum: 0.003 %	
			Nickel: 0.005 %	
			Silicon: 0.001 %	
			Tin: 0.001 %	
			Vanadium: 0.003 %	
			Zirconium: 0.001 %	
	Titanium: Remainder			
	Tool Steel	ASTM A751 ASTM E1086	Aluminum: 0.001 %	
			Carbon: 0.002 %	
			Chromium: 0.01 %	
			Cobalt: 0.007 %	
			Copper: 0.001 %	
			Magnesium: 0.005 %	
			Manganese: 0.001 5 %	
			Molybdenum: 0.001 %	
Nickel: 0.01 %				
Phosphorus: 0.003 %				
Silicon: 0.01 %				
Sulfur: 0.001 %				
Tin: 0.005 %				
Titanium: 0.002 %				
Tungsten: 0.01 %				
Vanadium: 0.05 %				
Iron: Remainder				



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Mechanical <sup>F</sup>	All Metals	Brinell Hardness	ASTM E10 SAE J417	500 kgf 3 000 kgf
		Charpy, V-notch Impact Testing	ASTM E23 ASTM A370	Up to 139.5 J (Up to 102.9 lbf•ft)
		Microhardness- Knoop	ASTM E384 ASTM B578	10 g, 25 g, 50 g, 100 g, 200 g, 300 g, 500 g
		Microhardness- Vickers	ASTM E384	5 kg 10 kg
		Rockwell Hardness	ASTM E18	Scale: A, B, C, D, E, F
		Rockwell Hardness - Superficial	ASTM E18	Scale: 15 N, 30 N, 45 N 15 T, 30 T, 45 T
		Room Temperature - Tensile & Bolt Test	ASTM E8 ASTM A370 ASTM B557 ASTM F606 SAE J416 SAE J429 SAE J1216	4 N to 711 680 N (1 lbf to 160 000 lbf)
		Wet Tape Adhesion Testing	MIL-DTL-5541 ASTM D3359 FED-STD-141 6301.3	Qualitative Visual
	Cast Stainless Steel, Duplex Stainless Steels	Ferrite Content Testing	ASTM A799	0.5 % to 83.2 %
	Metal	Bend Testing	ASTM E190 ASTM E290 ASTM A370	1.27 mm to 304.8 mm (0.05 in to 12 in) OD Ram
		Hydrogen Embrittlement Relief	ASTM F519	200 Hr Up to 44 482 N (10 000 lbf)
		Jominy Testing	ASTM A255	Oven to 1 288 °C (2 350 °F)
		Post Weld Stress Relief	AWS D1.1 ASME Section VIII	
		Proof Load	ASTM A370 ASTM F606 SAE J429 SAE J995 SAE J1216	4 N to 711 680 N (1 lbf to 160 000 lbf)
		Wedge Tension	ASTM A370 ASTM F606 SAE J429 SAE J1216	



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Mechanical <sup>F</sup>	Steels and Cast Steel, Cold Worked Steel, Stainless and High Temp Resistant Steel, Gray and Ductile Cast Iron, Aluminum Alloys Cast and Wrought, Copper and Copper Alloys	Leeb Hardness Testing	ASTM A956	All Leeb Values are Automatically Converted per ASTM E140 to One of the Following Scales: 19-70 HMMRC; 19-70 HRC; 67-638 HB; 35-950 HV; 60-86 HRA; 29-107 HRB; 69-74 HR15N; 88-96 HR15T; 100-107 HRH (AL Only); 75-106 HRE (AL Only)
Mechanical – Corrosion <sup>F</sup>	Aluminum, Stainless & Nickel Alloys	Chemical Passivation Screening/Salt Spray (Fog)/Copper Sulfate Screening	ASTM A967 ASTM B117	Qualitative Visual Weight Loss (g) 0.001 g to 560 g 0.000 01 g to 159 g
		Corrosion – Bend Test	ASTM A262 Practice E	Qualitative Visual
		Corrosion - Microstructure Exam	ASTM A262 Practice A	
		Corrosion - Visual	ASTM B117 ASTM G38 ASTM G49 ASTM G34 ASTM G110	
		Pitting & Crevice Corrosion Susceptibility, Intergranular Corrosion Susceptibility	ASTM G28 ASTM G48 ASTM A923 ASTM G1 ASTM A262 Practice B, C, F	Weight Loss (g) 0.001 g to 560 g 0.000 01 g to 159 g
Mechanical – Failure Analysis <sup>FO</sup>	Metal	Failure Analysis Investigation	ASM Handbook, Volume 11, Standard Industry Practices	Qualitative Visual
		Fractographic Investigation	ASM Handbook, Volume 12, Standard Industry Practices	



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Mechanical – Metallurgy <sup>F</sup>	Metal	Coating Thickness	ASTM B487	0.002 5 mm (0.000 1 in) Minimum Optical
		Coating Weight	ASTM A90 ASTM A428 MIL-A-8625 TT-C-490F	0.001 g to 560 g
		Grain Flow	ASTM E340	Qualitative Visual
		Grain Size	ASTM E112	
		Inclusions	ASTM E45	
		Macroetch Evaluation	ASTM E381 MIL-STD-867C	
		Macroetching	ASTM E340 ASTM E407	
	Tool Steel	Case Depth	SAE J423 ASTM E384 ASTM E407	0.076 mm (0.003 in) Minimum
		Intergranular Attack and End Grain Pitting	ASTM F2111	(0.000 2 in) at 500 X D.L.: 0.005 1 mm
		Metallographic Evaluation	ASM Handbook Volume 9 Metals Handbook, 8th Ed., Volume 7 Standard Industry Practices ASTM A247 ASTM E883	Optical Metallograph: 20 X to 1 000 X  SEM: 10 X to 10 000 X
		Metallographic Sample Preparation	ASTM E3 ASTM E340 ASTM E1920 ASM Handbook Volume 9	Up to 1 µm Alumina
		Presence of Carburization / Decarburization	ASTM E1077 ASTM E384 ASTM E407 ASTM F2328 SAE J121 SAE J419	D.L.: 0.013 mm (0.000 5 in) Minimum





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Mechanical – SEM <sup>F</sup>	All Solid Materials (Except for Those that Release Gas upon Exposure to Vacuum)	Microscopic Evaluation	ASTM B748 ASTM E766 ASTM E1508	10 X to 10 000 X
Mechanical – Welding Qualification Services <sup>FO</sup>	PQR and WPQ Testing	Visual Inspection Charpy V-Notch All Metal Weld Tensile Properties	API 1104 AWS D1.1, AWS D1.5 ASTM A370	All Welding Processes
		Tensile Test, Bend Tests, Fillet Weld Break Tests, Macro-Etching, Nick Break Tests, Hardness Profiles	ASME IX, API 1104, AWS B2.1, D1.1, D1.2, D1.3, D1.4, D1.5, D1.6, D17.1	
Non-Destructive Ultrasonic Testing <sup>FO</sup>	Weld Flaw Detection /Material Thickness Readings	Flaw Length / Width / Depth / Indication Rating	AWS D1.1 A-scan Longitudinal Wave / A-scan ShearWave	>5/16" to 8" Thickness
Non-Destructive Magnetic Particle Testing <sup>FO</sup>	Weld and Base Material Flaw Detection	Flaw Length / Width	ASTM E709 Wet / Dry / Fluorescent / Yoke	Surface and Slight Subsurface Flaws
Non-Destructive Liquid Penetrant Testing <sup>FO</sup>			ASTM E165 Fluorescent / Visible Dye / Water Washable / Solvent Removed	Surface Flaws Only

1. The presence of a superscript F means that the laboratory performs testing of the indicated parameter at its fixed location. Example: Outside Micrometer<sup>F</sup> would mean that the laboratory performs this testing at its fixed location.
2. The presence of a superscript FO means that the laboratory performs testing of the indicated parameter both at its fixed location and onsite at customer locations. Example: Outside Micrometer<sup>FO</sup> would mean that the laboratory performs this testing at its fixed location and onsite at customer locations.