

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017**

**Link Engineering Company**

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**TESTING AND CALIBRATION**

Valid to: **October 21, 2023**

Certificate Number: **ACT-1997**

**TESTING**

**Mechanical**

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Friction Effectiveness/ Performance/Wear	SAE J2522, SAE J2784, SAE J2684, ISO 26867, JASO C406, JASO C407, ATPD-5324-A, ECE R90-02, SAE 2690, ECE R13, ECE R13H, ISO 11157, ECE R139(BAS)	Friction Materials and Components for Hydraulic Brakes	Performance Dynamometer
Noise	SAE J2521, SAE J2636, SAE J294, ATPD-5324-A, USCT, AK Noise	Friction Materials and Components for Hydraulic Brakes	NVH Dynamometer
Wear	JASO C427, SAE J2707, SAE J3006, ATPD-5324-A, USCT	Friction Materials and Components for Hydraulic Brakes	Performance Dynamometer
Structural Performance	JASO C441, JASO C448, SAE J1713, SAE J2928, ECE R90-2, SAE J1404, ATPD-5324-A	Friction Materials and Components for Hydraulic Brakes	Performance Dynamometer

**Mechanical**

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Friction Effectiveness/ Performance/Wear/ Structural	RP 628, TP-121D, SAE J2115, JASO C407, ISO 26865, ISO 26866, ATPD-5324-A	Friction Materials and Components for Air Brakes	Commercial Vehicle Dynamometer
Brake Emissions	CARB 17RD016, WLTP Wear.2018.07.020	Friction Materials and Components for Hydraulic and Air Brakes	Brake Dynamometer with Isokinetic Sampling Tunnel, Multi-stage Low Pressure Impactor, Quartz Crystal Microbalance, Condensation, Particle Counter, Aerodynamic Particle Counter, Electrodynamic Particle Sizer, and PM2.5 & PM10 Gravimetric Sampler
Performance	JIS D 2603, SAE 1603	Hydraulic Brake Systems	Hydraulic Brake Bench Test
Impact	SAE J175, SAE J2530, SAE J3010, ISO 7141, ABNT NBR 6752	Hub-Bearing Assemblies and Wheels	Drop Tester
Cornering Fatigue	SAE J328, SAE J1095, SAE J2530, ISO 3006, ISO 3894, ABNT NBR 6750, ABNT NBR 6752	Hub-Bearing Assemblies and Wheels	Cornering Fatigue Test
Radial Fatigue	SAE J328, SAE J2530, SAE J3010, ISO3006, ISO 3894, ABNT NBR 6750, ABNT NBR 6752	Hub-Bearing Assemblies and Wheels	Radial Fatigue Test
Biaxial Fatigue	SAE J2562	Hub-Bearing Assemblies and Wheels	Biaxial Test
Performance and Durability	SAE J1153	Master Cylinder Assemblies	Caliper Bench/ Dynamometer
Performance	SAE J101	Hydraulic Wheel Cylinders for Automotive Drum Brakes	Caliper Bench/ Dynamometer

**Mechanical**

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Performance	SAE J2316	Wheel Nut Seat System	Mechanical Test
Friction Coefficient and Wear	SAE J661, VESC-V3, NTC 5388	Friction and Composite Materials	Chase Test System
Compressibility	SAE J2468, ISO 6310, JIS D4413, SAE J3907-2 ABNT NBR 9301, ECE R90-02, GMW 15334, NTC 2406, NTC 5390	Friction and Composite Materials	Compressibility, Oven Test System
Flexural Modulus	ASTM D790	Plastics, Friction and Composite Materials	Tensile Machine
Swell and Growth	SAE J160, ABNT NBR 5505, ISO 6310	Friction and Composite Materials	Compressibility, Oven Test System
Internal Shear, Shear Strength	ISO 6311, ISO 6312, ABNT NBR 5537, NTC 5292, SAE J840, ECE R90-02, NTC 2405	Friction and Composite Materials	Shear Test Stand
Specify Gravity/Density/Porosity	SAE J380, ISO 15484	Friction and Composite Materials	Balance
Hardness	ISO 2039, ASTM E18, ISO 6508-1, SAE J2654	Rockwell Hardness of Metallic, Friction and Composite Materials	Rockwell Tester, Compressibility Stand
Hardness	ASTM E10, ISO 6506-1	Brinell Hardness of Metallic and Composite Materials	Compressibility Stand, Brinell Microscope
Hardness	SAE J379	Gogan Hardness of Friction Materials	Compressibility Stand
Servo-Hydraulic	7.4-L3-1652 LINK Durability Cycling Test Procedure 7.4-L3-1656 LINK Static Loading Procedure Customer Specifications	Strength and Durability of End-Products of Non-Standard Size and Shape for Transportation, Automotive, Marine, Military, Medical and Power Sports Products	Linear Hydraulic Actuators (Displacement up to 10 inch, Force up to 55,000 lbs), Rotary Hydraulic Actuators (Torque up to 100,000 inch*lbs, Angle up to 90°)

**Mechanical**

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Tire: Dynamic Performance and Durability	7.2-L2-1649 Moment of Inertia LINK Standard Procedure	Tire: Passenger, Commercial	Moment of Inertia Machine
Full Brake System	ECE-R13, ECE-R13H, ECE-R78, ECE R90, ECE R139(BAS), FMVSS 105, FMVSS 122, FMVSS 135	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Performance	Thermal Capacity, High Speed Fade, AMS Fade Test, Vacuum Boosted, Trailer Tow, Death Valley, Link Brake Balance, New Car Assessment Program, Customer Specified Variations of the Above Listed Tests	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Durability	Detroit City Traffic, Phoenix City Traffic, Detroit Suburban Traffic, Phoenix Suburban Traffic, Huron Detroit Metropolitan Traffic, Customer Specification 7.2-L2-495	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Brake Wear	Los Angeles City Traffic, Detroit City Traffic, Phoenix City Traffic, Detroit Suburban Traffic, Phoenix Suburban Traffic, Huron Detroit Metropolitan Traffic, Customer Specification 7.2-L2-495	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing

**Mechanical**

<b>Specific Tests and/or Properties Measured</b>	<b>Specification, Standard, Method, or Test Technique</b>	<b>Items, Materials or Product Tested</b>	<b>Key Equipment or Technology</b>
Noise	Los Angeles City Traffic, Phoenix City Suburban Traffic, Marquette City Traffic, Customer Specification 7.2-L2-495	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Thermal Failure	Death Valley/Fluid Boil	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Customer Specification	Stopping Distance, Brake Line Pressure, Pedal Force, Pedal Travel, Deceleration, Brake Pad Temperature, Rotor Temperature, Customer Specified Variations of the Above Listed Tests	Friction Materials/ Brake Hardware/ Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Fuel Economy, Coast-down, Fuel Consumption	SAE J1321, SAE J2263	Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
NVH Vehicle Testing, Interior/Exterior Noise Studies, Pass by Noise	SAE J986	Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Thermal HVAC, Cooling Systems, Cold Chamber, Performance, Durability	Customer Specification	Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing
Wheel and Tire, Tire Blow-out, Structural Integrity	FMVSS 110	Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing

**Mechanical**

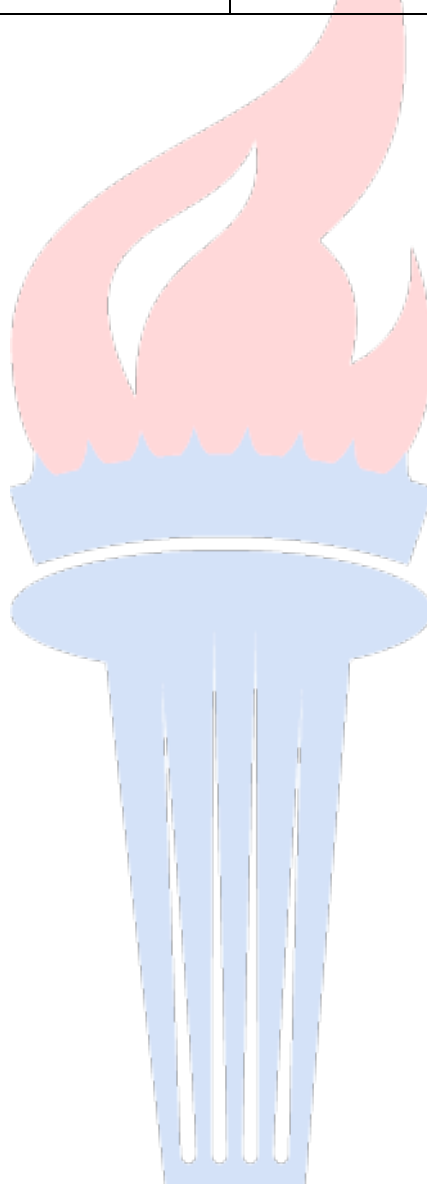
Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Stability Control System	FMVSS 126, ECE R140	Full Vehicle	Vehicle, In-Vehicle Data Acquisition System, Proving Grounds Field Testing

**Chemical**

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Composition	SAE J2975:2011, 2013, SAE J2975:2015, EPA 3051A, 6010C, 3060A, 7196A, EPA/600/R-93/116 ASTM E3061, ASTM D5702	Friction and raw materials, metal alloys, composites materials, paints and coatings	ICP-AES, Microwave, PLM Microscope, UV-Vis Spectrometer
Corrosion	ASTM B117, ISO 9227, MIL-STD-810G Method 509.5, ASTM G85 Annex 1, 2 and 3, ABNT NBR 8094, ASTM D1735 Customer Specifications	Fog (spray) corrosion of metallic and non-metallic materials and composites	Cyclic Corrosion Chamber, Temperature and Humidity Cycling Chambers
Corrosion	GMW14872, SAE J2334, Customer Specifications	Cyclic Corrosion of Metallic and non-metallic materials and composites	Cyclic Corrosion Chamber, Temperature and Humidity Cycling Chambers
Corrosion	ASTM B368, ISO 9227, DIN 50021, Customer Specifications	Accelerated Corrosion: CASS and AASS of Metallic and non-metallic materials and composites	Cyclic Corrosion Chamber, Temperature and Humidity Cycling Chambers
Corrosion	ISO 6314, ASTM D870, ISO 2812-2, Customer Specifications	Resistance to Reagents and Immersion	n.a.

**Chemical**

Specific Tests and/or Properties Measured	Specification, Standard, Method, or Test Technique	Items, Materials or Product Tested	Key Equipment or Technology
Corrosion	ISO 2409, ASTM D3599, ABNT NBR 11003, ASTM D610, ASTM D1654	Paint/Coat degree of rusting, migration and adhesion by crosscut, creep-back and tape adhesion	Scribe tool, tape



## CALIBRATION

### Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Volt Sensors and Transducers	(0 to 10) V (0 to 60) V	0.001 V 0.03 V	7.4-L2-1130 DC Voltage Calibration

### Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) <sup>3</sup>	Reference Standard, Method, and/or Equipment
Pressure Sensors	(345 to 27 407) kPa	(0.15 + 0.000 6P) kPa	6.4-L2-208 Calibration of Pressure Transducers using Ashcroft Dead Weight Tester
Pressure Sensor and Transducer Systems	Up to -15 psig Up to 200 psig Up to 3 000 psig Up to 5 000 psig Up to 7 500 psig	0.03 psi vacuum 0.3 psi 4 psi 8 psi 12 psi	7.4-L2-1124 Pressure Hardware Calibration 7.4-L2-1145 Pressure Software Calibration
Force Sensors	(89 to 2 224) N	(1.93 + 0.001 3F) N	6.4-L2-211 Interface Gold Standard 1610AJH Calibration Load Cell
Force Sensor and Transducer Systems	Up to 500 lbf Up to 500 lbf Up to 1 000 lbf Up to 5 000 lbf Up to 30 000 lbf Up to 50 000 lbf	0.8 lbf 0.8 lbf 0.9 lbf 5 lbf 60 lbf 84 lbf	7.4-L2-1129 Force Calibration 7.4-L2-1149 Force Software Calibration
Decelerometers	(-1 to 1) g	(0.000 8 + 0.003 1A) g	6.4-L2-266 DTC Calibration of Decelerometers



Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Torque Sensor and Transducer Systems	Up to 1 000 lbf·in Up to 5 000 lbf·ft Up to 25 000 lbf·ft Up to 75 000 lbf·ft	0.6 lbf·in 8 lbf·ft 30 lbf·ft 180 lbf·ft	7.4-L2-1123 Torque Hardware Calibration 7.4-L2-1144 Torque Software Calibration 7.4-L2-1151 HBM Torque Calibration - Verification
Liquid Volume Sensor	Up to 25 ml	0.1 ml	7.4-L2-1127 Volume Calibration
Air Velocity Sensor and Transducer Systems	(500 to 3 500) fpm	50 fpm	7.4-L2-1131 Air Velocity Calibration

### Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) <sup>2</sup>	Reference Standard, Method, and/or Equipment
Angle	Up to 180 ° Up to 7 °	0.3 ° 0.02 °	7.4-L2-1143 Angle Calibration
Non-Contact Displacement Probes	(0.125 to 25.4) mm	0.002 mm	6.4-L2-227 Calibration of Non-Contact Probes Work Instruction
Distance Sensor and Transducer Systems	Up to 1 in Up to 2 in Up to 6 in Up to 24 in	0.000 06 in 0.000 2 in 0.001 in 0.003 in	7.4-L2-1136 Capacitec Measurement System Calibration 7.4-L2-1148 Length Software Calibration 7.4-L2-1128 Length Calibration
Distance Sensors	(0.254 to 508) mm	(0.06 + 0.003 3L) mm	6.4-L2-92 Calibration of String Potentiometers

**Time and Frequency**

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Rotational Speed Sensors and Transducers Systems	Up to 50 rpm Up to 20 000 rpm	0.1 rpm 3 rpm	7.4-L2-1125 Rotational Speed Calibration and 7.4-L2-1146 Rotational Speed Digital Calibration

**Thermodynamic**

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature Sensor and Transducer Systems	(-40 to 2 400) °F	0.7 °F	7.4-L2-1126 Temperature Hardware Calibration 7.4-L2-1147 Temperature Software Calibration 7.4-L2-1108 Temperature Linearizer Calibration
Relative Humidity Sensor and Transducer Systems	(10 to 95) % RH	5 % RH	7.4-L2-1132 Humidity Calibration

Notes:

1. Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ( $k=2$ ), corresponding to a confidence level of approximately 95%.
2. The term *L* represents Length in units appropriate to the uncertainty statement.
3. The term *A* represents Acceleration\Deceleration in units appropriate to the uncertainty statement.
4. The term *F* represents Force in units appropriate to the uncertainty statement.
5. The term *P* represents Pressure in units appropriate to the uncertainty statement.
6. This scope is part of and must be included with the Certificate of Accreditation No. ACT-1997.



R. Douglas Leonard Jr., VP, PILR SBU