

LAMIFIL



LAMIFIL TEST LAB

Accredited test solutions for overhead conductors,
catenary and specialty wires

ADDRESSING YOUR CHALLENGES



INNOVATION AND QUALITY, ONE STEP FURTHER

Technology, society and business are changing at an unknown pace. In order to meet the changing needs and expectations, our customers in various business domains need to be increasingly adaptive and innovative.

At Lamifil we have always taken your challenges as a starting point to take innovation one step further. Our ISO 17025 accredited on-site laboratory not only ensures the quality of our products. It allows our customers to pursue innovation, to lower costs and to improve the efficiency of their projects.

“ *Our commitment to excellence is to create value for our clients. Discover how our lab can help improve your business.* ”



Certificatenr.
494-TEST



TESTING AS A CORNERSTONE FOR RELIABILITY

Most grid operators and wire manufacturers do not have adequate facilities, in-depth knowledge or practical experience to perform the wide range of required, accredited or often tailored cable, conductor, fitting or wire tests. Outsourcing these tests to a full-service trusted partner is an economical and effective solution that provides peace of mind.

POWER AND RAILWAY GRIDS

Overhead conductors and catenary wires are the cornerstone of power and railway grids. Assuring their quality, specifications and strict adherence to standards are important challenges for railway or power grid operators, contractors or engineering firms alike. The reliability, performance and future-proof design of grids depends on it.

First and foremost, accredited and independent testing is indispensable for conductor, cable or alloy development and innovation, ensuring compliance with all necessary type testing and customer requirements. Swift and thorough testing is key in case of incidents and maintenance as well. Finding the root of the problem quickly avoids unnecessary delays and costs.

COPPER AND ALUMINIUM MANUFACTURING

Copper and aluminium wire products are used for thousands of different applications in industries such as consumer products, construction, automotive and aviation. In order to guarantee and improve quality and continuity of production processes, manufacturers need to be able to rely on a specialised partner for expert advice, dependable testing services and joint development to help them to improve or develop products.

ONE-STOP ACCREDITED LAB

Lamifil's leading accredited in-house lab offers mechanical and electrical test solutions for aluminium and copper (alloy) conductors, contact wires, fittings and specialty wires. Grid operators, contractors, engineering firms, research facilities and manufacturers around the world turn to us as their one-stop partner for unbiased, tailored and cost-effective testing services.

CONFIDENT OUTSOURCING

Customers can rely on our one-stop test lab for full outsourcing of their cable and conductor testing. Next to a dedicated and highly experienced staff, it offers its own state-of-the-art infrastructure and has all material available on site. Trusted for its knowledge and testing skills, our lab has proven field experience and extensive global references.

COMPLIANCE TO STANDARDS

Because our lab is fully accredited, our customers can rest assured that all test results comply to international standards. We offer a solution-oriented approach as an independent aluminium and copper expert.

CONVENIENT SERVICES

Our lab addresses customer needs in the most flexible way, offering a broad range of mechanical, electrical and chemical tests, possibilities for customisation, cost-efficient and speedy services and training.

“ Thanks to its accreditation, field experience and state of the art testing environment, our lab offers a flexible, dependable and complete testing service. ”

OUR LAB'S KEY FEATURES

ACCREDITATION

Our ISO 17025-accredited on-site lab is specifically equipped and recognised for all industry tests and international quality standards and can be sourced independently of production by Lamifil.

Product and test standards we adhere to include EN 50182, EN 50540, EN IEC 62420, EN IEC 62219, IEC 61089, EN ISO 6892-1 and ISO 7800, 7801 and 7802, amongst others. Obviously, we can perform tests according to customer-specific standards.

STATE OF THE ART TESTING ENVIRONMENT

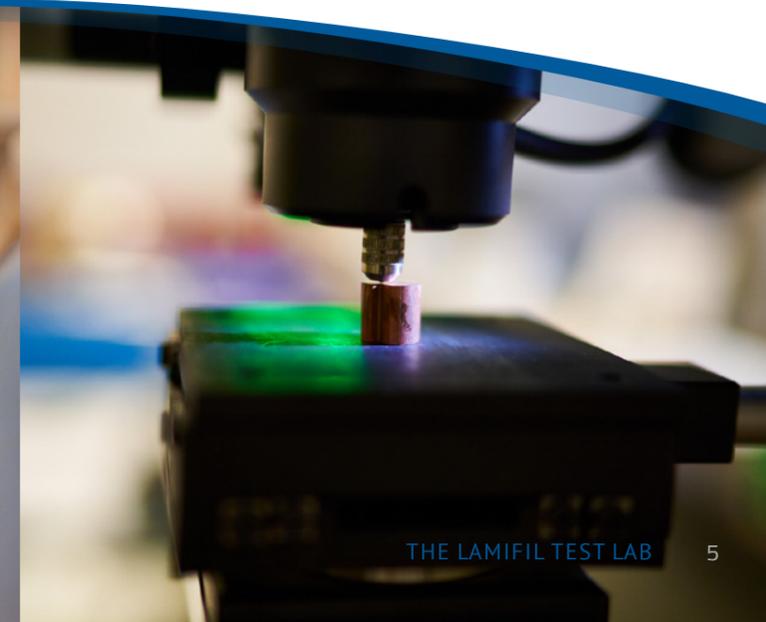
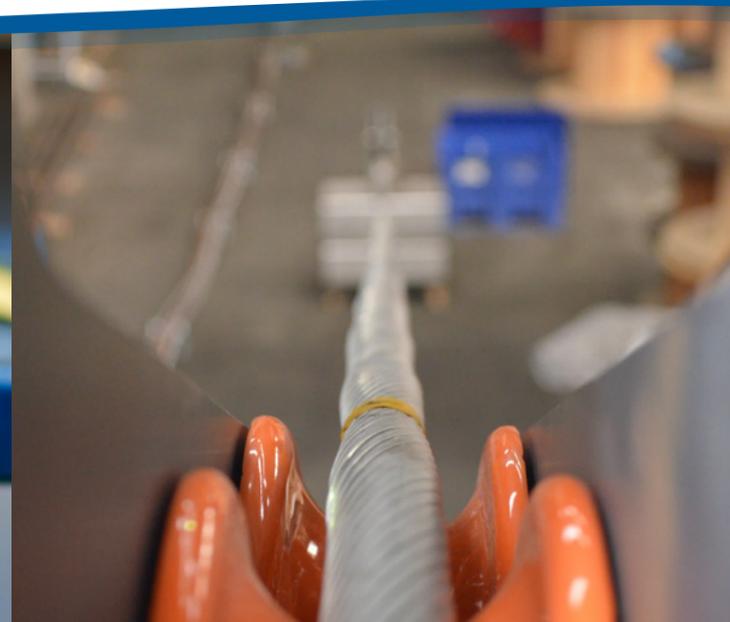
Our lab features a unique and fully rigged testing environment, including mechanical, electrical and chemical equipment. We can supply all necessary copper and aluminium wire products, fittings and accessories. Some of the tests can be performed in icy conditions and/or at elevated temperatures. Our staff consists of highly trained, experienced and multilingual engineers. Fully dedicated to performing tests meticulously, they operate according to proven processes to address any customer need. Located in the heart of Europe, our lab is easily accessible and connected to major economic hubs.

FIELD EXPERIENCE

Lamifil has over 90 years of experience in cable and wire products and specialty wires, with over 100000 km of catenary wires and 65000 km of overhead lines installed in over 30 countries worldwide. This extensive know-how from real life projects and training in the field allows us to quickly assess any customer challenge and embark on full scope testing without delay. We think out of the box whenever necessary to proactively meet the toughest demands with custom jobs.

TOTAL LAB PACKAGE

As a true one-stop-shop our lab offers all prevalent multi-standard conductor and wire tests including breaking load, stress strain, creep, mechanical fatigue, sag temperature, impact, heat cycle and mechanical fitting tests, amongst others. Our customers benefit from additional test related services including the development of custom testing programmes, possibilities to join participatory research, assessments, analysis and training.



OUR INFRASTRUCTURE

Fully equipped lab

MECHANICAL

- > ATJ tensile tester 500 kN
- > Tensile strength machines Instron
50 kN/100 kN /250 kN
- > Creep station
- > 100 m span towers
- > Axial impact test
- > 3 ovens
- > Impact test device
- > Torsion test device
- > Hardness meter
- > Cyclic bend test
- > Rotating bend test
- > Wear test device

ELECTRICAL

- > Transformer 2000 A / 4000A
- > DC resistance test bank

CHEMICAL

- > Spectrometer
- > Oxygen analyser

PRODUCTS AND ACCESSORIES

- > Conductors
- > Cables
- > Fittings



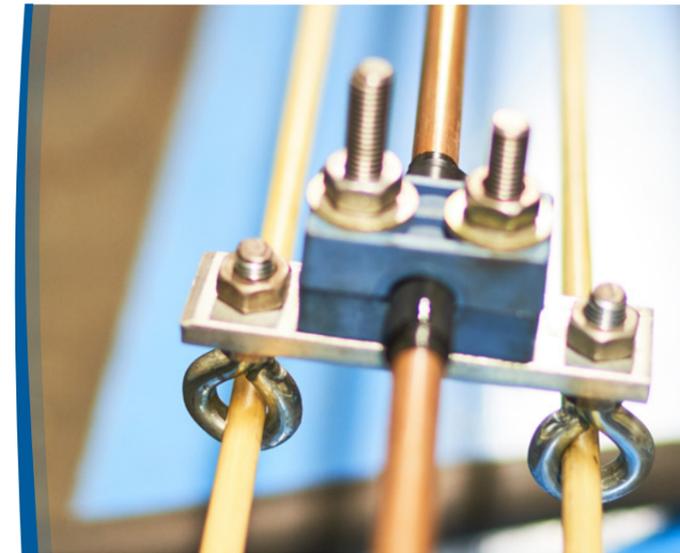
OUR TEST OFFERING

Lamifil's lab provides a comprehensive range of accredited and non-accredited tests for stranded conductors, contact wires and specialty wires in aluminium, copper and their alloys, as well as fittings. Based on many years of experience performing hundreds of tests for world leading players, we can promptly address any standard or custom demand. We keep abreast of market developments and changing customer demands to extend and strengthen our test offering.

OVERHEAD CONDUCTOR TESTS

Our lab offers a comprehensive range of accredited and non-accredited tests for overhead conductors according to standards including EN50182, IEC61089 and IEC61395. Our key offering of accredited tests includes the breaking load test, stress strain test, creep test, sag tension/temperature test, axial impact test and heat cycle test.

If needed, a cooperation with an external partner can be set up to allow for the most complete package of testing.



CATENARY WIRES TESTS

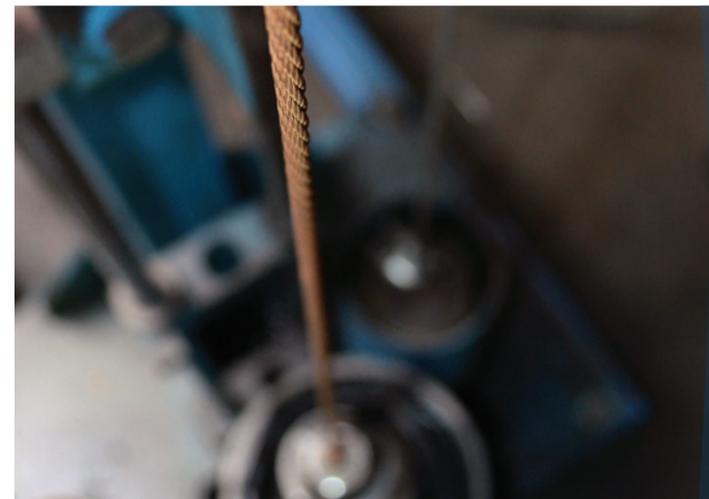
Specialised in copper and copper alloy wires for railway applications, our lab masters a number of fundamental tests to assess their mechanical and electrical properties and performance. The main tests requested by our customers are the creep test for contact wires and the mechanical fatigue test for dropper wires.

If needed, a cooperation with an external partner can be set up to allow for the most complete package of testing.

“ Based on many years of experience performing hundreds of tests for world leading players, we can promptly address any standard or custom demand. ”

SPECIALTY WIRE TESTING SERVICES

We offer a range of specialised testing services for manufactures using wire rod, drawn and extruded wires, surface-treated wire, bunches and stranded conductors in aluminium, copper or their alloys. Our services allow them to ensure product quality and to improve or correct products and processes.



OUR TEST OFFERING

ALUMINIUM, STEEL AND COPPER WIRE TESTS	 OVERHEAD	 CATENARY	 SPECIALTY
Diameter	x	x	x
Tensile strength	x	x	x
Stress at 1% extension	x	x	x
Elongation	x	x	x
Resistivity	x	x	x
Wrapping	x	x	x
Torsion	x	x	x
Bending	x	x	x
Thermal-resistant property	x		
Welding	x		
Mass of zinc	x		
Zinc dip test	x		
Adhesion of zinc coating	x		
Cladding thickness/uniformity	x		
Hardness			x
Conductivity			x
Chemical tests: wire composition			x
Metallographical tests: wire structure			x
Oxygen level analysis			x

Typical standards: EN 50182 - EN 50540 - EN IEC 62420
- EN IEC 62219 - IEC 61089 - EN 62004

Italic = accredited test

CONDUCTOR TESTS	 OVERHEAD	 CATENARY	 SPECIALTY
Surface condition	x	x	
Diameter	x	x	
Inertness	x	x	
Lay ratio	x	x	
Direction of lay	x	x	
Number and type of wires	x	x	
Mass per unit length	x	x	
DC resistance	x		
AC resistance	x		
Stress strain	x		
Tensile breaking strength	x	x	
Stringing	x		
Creep	x	x	
Thermal expansion/CTE	x		
Sheave	x		
Radial crush	x		
Torsional ductility	x		
Sag temperature	x		
Axial impact	x		
Corrosion	x		
Fault current	x		
Temperature cycle	x		
Damage and failure load	x		
Tensile test	x		

Typical standards: EN 50182 - EN 50540 - EN IEC 62420
- EN IEC 62219 - IEC 61089 - IEC 61395

Italic = accredited test

DEAD ENDS, JUMPERS, RODS, SPLICES, SLEEVES TESTS	 OVERHEAD	 CATENARY	 SPECIALTY
Damage and failure load test	x		
Tensile test	x	x	
Corona/RIV	x		
Heat cycle test/current cycling	x	x	

Typical standards: IEC 61284

Italic = accredited test

SUSPENSION CLAMPS TESTS	 OVERHEAD	 CATENARY	 SPECIALTY
Damage and failure load	x		
Slip	x		
Corona/RIV	x		
Aeolian vibration	x		
Galloping	x		

Typical standards: IEC 61284

CONTACT WIRE TESTS	 OVERHEAD	 CATENARY	 SPECIALTY
Material composition		x	
Visual inspection		x	
Profiles and dimensions		x	
Electrical resistance		x	
Tensile test		x	
Elongation		x	
Reverse bending		x	
Torsional strength/torsion test		x	
Winding property/wrapping		x	
Mass per unit length		x	
Creep		x	
Hardness		x	
Wear		x	
Joints		x	

Typical standards: EN 50149 - DIN 43140 - DIN 43141
- UIC 870 - NF C 34 800 - BS 23

Italic = accredited test

DROPPER TESTS	 OVERHEAD	 CATENARY	 SPECIALTY
Mechanical fatigue test/cyclic bending		x	

Typical standard: EN 50119 - NF C 34 110 2

STRESS STRAIN TEST



This test determines a stranded conductor's or wire's performance in terms of tensile strength and elongation when exposed to increased tensions levels. It establishes the short-term strain when applying a stepwise increase of the tension. Based on the outcome of the test, the E-modulus of the conductor is defined. The results can be used for simulations in software such as PLS-CADD.

APPLICATION

Apart from being typically carried out on stranded conductors, this test is suited for a variety of wires and cables, including catenary wires and messenger wires.

DESCRIPTION

- > The conductor is mounted in between one static point and one movable point;
- > Depending on the customer's choice, the conductor is cast in resin or mounted in a fitting;
- > Once mounted, tension is gradually increased and released again after each step;
- > The steps (tension & duration) are defined in the applicable standard;
- > A full report is prepared including test object data, test description, set-up, procedure results and conclusions;
- > Usually this test is followed by a breaking load test.

OUR STRENGTHS

- > Lamifil has a 500kN, 20m test bench which is digitally controlled and logged, improving test precision.
- > We have experience with all conductor types (HTLS, composite core, GAP,...), railway products (catenary wires, feeders, ...) and various anchoring types, including press fittings, epoxy/resin casts and wedge type clamps.
- > We are fully flexible in the choice of fittings to be used and can advise based on experience.
- > This test can be executed while running a current of up to 2000A through the conductor.
- > The same set-up can be used for testing the accessories of the conductor.

STANDARDS

Our lab is accredited for all standards including the common standards such as EN50182 and IEC61089.

BREAKING LOAD TEST



Stranded conductors are installed and operated under heavy and sometimes extreme environmental conditions. This test determines and verifies the ultimate tensile strength of a conductor in order to ensure long term reliability under all circumstances, including during installation or when subject to climatic loads.

APPLICATION

Apart from being typically carried out on stranded conductors, this test is suited for a variety of wires and cables, including catenary wires and feeders.

DESCRIPTION

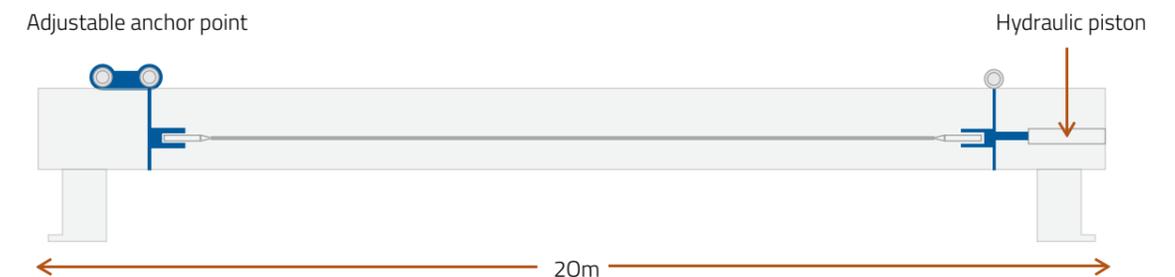
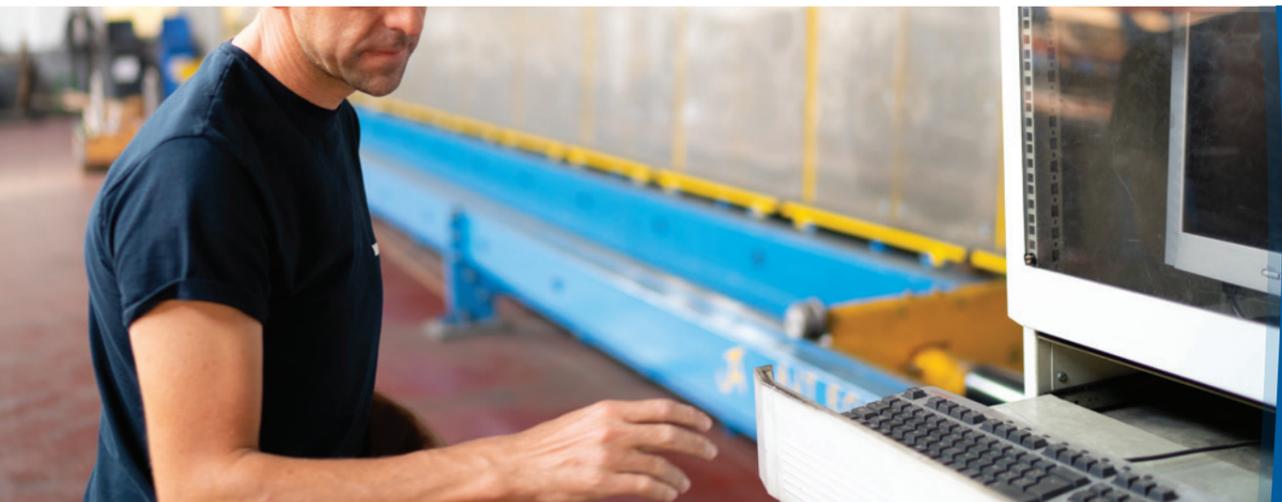
- > The conductor is mounted in between one static point and one movable point;
- > Depending on the customer's choice, the conductor is cast in resin or mounted in a fitting;
- > Once mounted, tension is gradually increased until breakage;
- > The breakage is examined and a graph is created to reflect tensile strength versus strain;
- > A full report is prepared including test object data, test description, set-up, procedure, results and conclusions.

OUR STRENGTHS

- > Lamifil has a 500kN, 20m test bench that is digitally controlled and logged, improving test precision.
- > We have experience with all conductor types (HTLS, composite core, GAP, catenary wires, feeders,...) and various anchoring types, including press fittings, epoxy/resin casts and wedge type clamps.
- > We are fully flexible in the choice of fittings to be used and can advise based on our experience.
- > This test can be executed while running a current of up to 2000A through the conductor.
- > The same set-up can be used for testing the accessories of the conductor.

STANDARDS

Our lab is accredited for all standards including the common standards such as EN50182 and IEC61089.



CREEP TEST



This test is designed to verify the long-term creep of a conductor or wire when holding a fixed tension. Creep results in further sagging after installation. For overhead lines, excessive sagging may result in power outages due to violation of electrical clearance distances, line breakage, tower or pole damage or even collapse. It is therefore critical to correctly estimate the creep that will occur over time. In the case of a railway contact wire sagging may lead to a bad contact between the pantograph and the contact wire. It is therefore critical to correctly estimate the creep that will occur over time.

APPLICATION

Creep tests can be performed on stranded conductors, messenger wires and contact wires.

DESCRIPTION

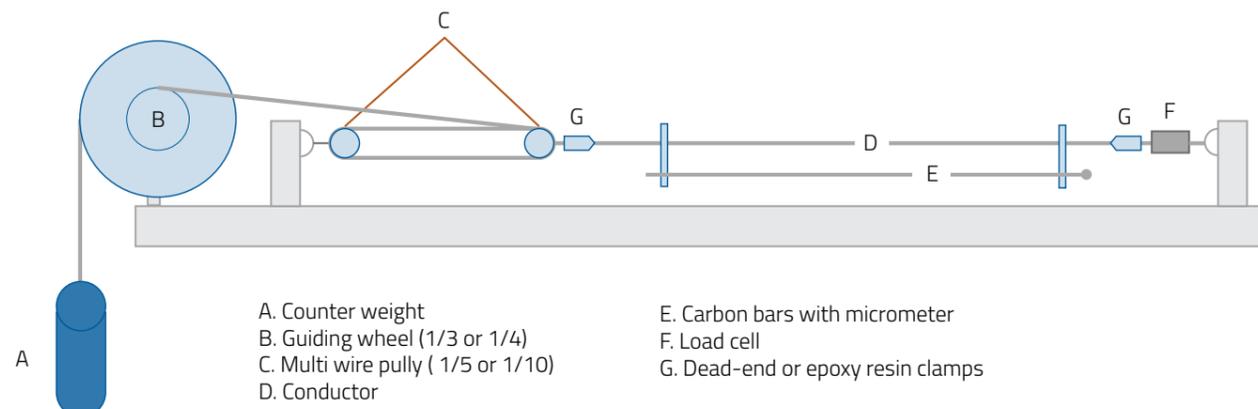
- > The conductor/wire is mounted in a fitting on both sides (one fixed point and one movable point);
- > Tension is added by counter weights;
- > This set-up is held for a longer span of time (usually 1000 hours);
- > During this time span the elongation of the conductor/wire is measured versus time and applied force;
- > This result leads to the definition of the specific creep formula for the tested conductor/wire;
- > A full report is prepared including test object data, test description, set-up, procedure results and conclusions.
- > A creep test can be performed at elevated temperature.

OUR STRENGTHS

- > Up to 3 creep tests can be run simultaneously.
- > Data is digitally collected, ensuring high accuracy.
- > Realistic simulations are possible thanks to climatized room and load controlled gravity and auto tensioning.
- > Temperature regulation: a transformer with rectifier is connected to the sample for testing at high temperature. The transformer is controlled via temperature feedback.
- > Our lab offers meticulous sample preparation.
- > It is possible to combine creep testing with heat testing, with currents up to 2000A.
- > Tests can be performed up to 25kV AC.

STANDARDS

Our lab is accredited for the common standard IEC61395.



SAG TENSION / TEMPERATURE TEST



Sag is the vertical distance between the anchor point and lowest point of the conductor. This test is usually carried out on overhead conductors, as excessive sagging can have severe consequences on overhead systems, including violation of electrical clearance distances, line breakage, tower or pole damage or even collapse. This test will determine the sag of the conductor at a given span at various temperatures. It will confirm if preliminary sag calculations are correct and provide proof of reliability of a given conductor. A similar set-up can be used to simulate ice-loading.

APPLICATION

This test can be carried out on stranded conductor and overhead catenary systems.

DESCRIPTION

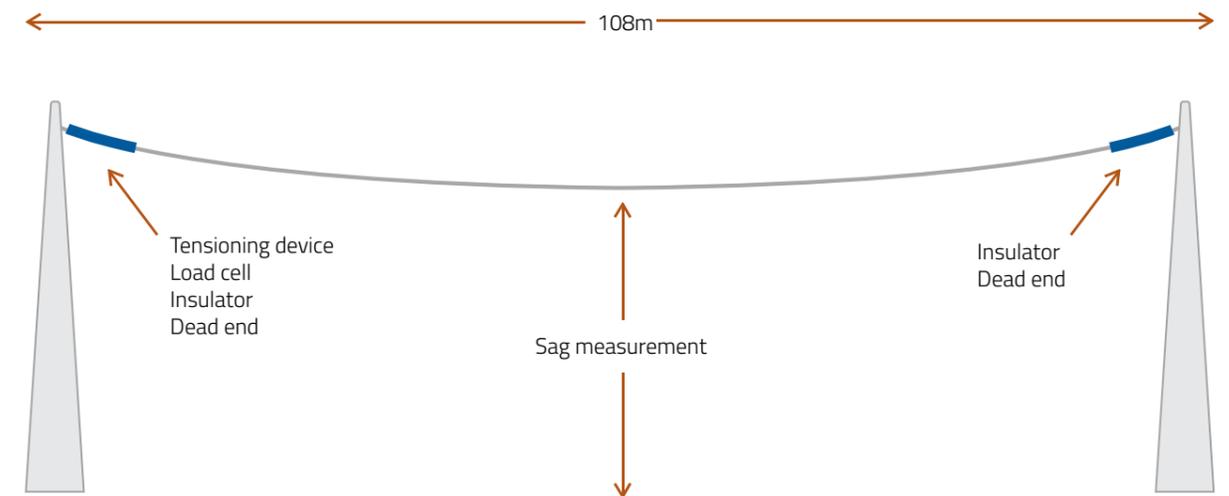
- > A realistic simulation is set up by mounting a conductor between two dead-ends. The dead-ends are fixed between two towers with a span length of 108 m;
- > Current is applied to the conductor (up to 4000A), causing the conductor to heat and sag;
- > Both temperature and the resulting sag are measured throughout time, respectively by a data logger and a string potentiometer;
- > Measurements are plotted in a sag/temperature curve and are subsequently compared to sag calculations;
- > A full report is prepared including test object data, test description, set-up, procedure results and conclusions.

OUR STRENGTHS

- > Lamifil has a unique indoor sag temperature testing facility allowing span lengths of 108 m.
- > Currents of up to 4000A and up to 10 tons of force can be handled.
- > All sag temperature tests are fully accredited.
- > Lamifil has unique in-house expertise to interpret results.
- > Our lab has experience with all conductor types (HTLS, GAP,...).

STANDARDS

Lamifil internal method based on the CIGRE 426 § 4.12 standard.



HEAT CYCLE TEST



Heat cycle tests establish the long-term electrical properties of all current carrying fittings and clamps. Their purpose is to ensure that fittings do not deteriorate after long-term usage. They provide insights on the behaviour of the used wire or cable.

APPLICATION

The heat cycle test can be carried out on class A fittings, conductors and overhead catenary systems.

DESCRIPTION

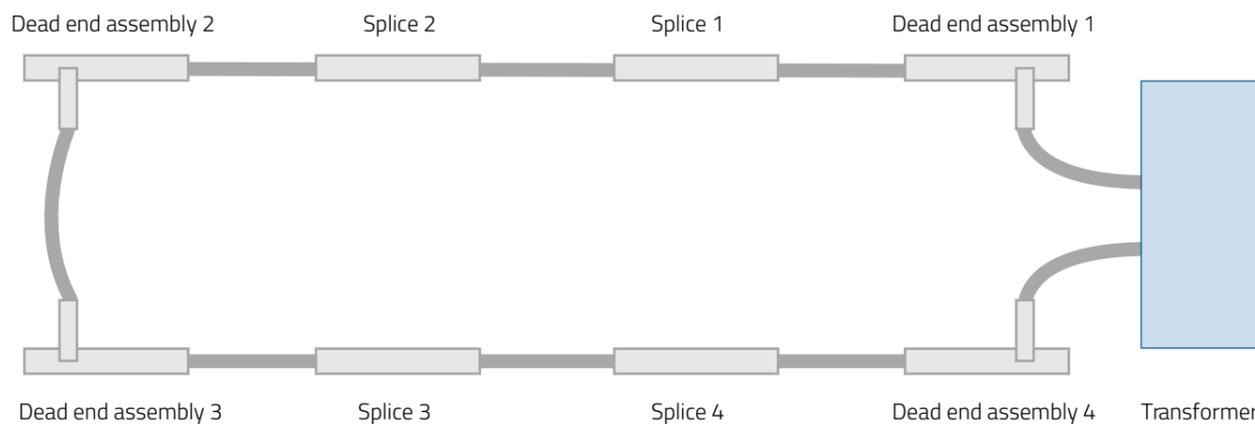
- > A realistic simulation is made of a fitting/ conductor combination using various types of fittings such as dead ends and splices;
- > Current up to 4000A can be applied to the combination;
- > With or without mechanical tension;
- > Typically, 500 cycles are performed. After each cycle temperature of both conductor and fitting and the resistance of the fitting are measured;
- > These results are then cross-checked with the different applicable limitations;
- > A full report is prepared including test object data, test description, set-up, procedure results and conclusions.

OUR STRENGTHS

- > Lamifil has an indoor test environment consisting of an DC generator to generate heat by adding currents up to 4000A.
- > Our lab's extensive expertise allows us to advise on the fittings to be used.
- > Heat cycle tests are fully accredited and have been performed by Lamifil for over 5 years for various customers.

STANDARDS

The IEC 61284 standard is commonly used for class A fittings. Customer specific requirements are possible as well.



Example (Test set-up can be customized)

AXIAL IMPACT TEST



The objective of the test is to investigate if the cable, such as a conductor or catenary wire, could sustain a high dynamic impact load. Such an impact can potentially be generated by accidents during operation of the conductor/ wire e.g. tree damage.

APPLICATION

The axial impact test can be carried out on stranded conductors, catenary wires or individual wires.

DESCRIPTION

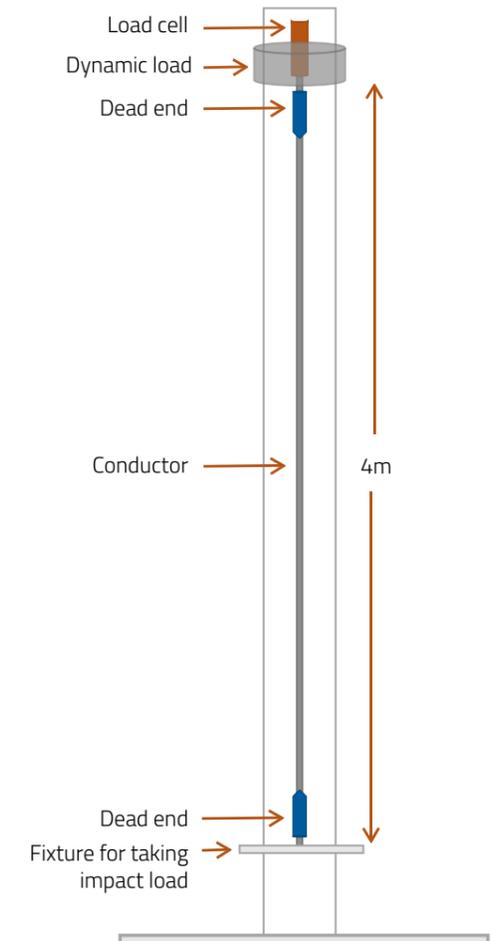
- > A sample with mounted compression clamps is prepared, the free length between the compression clamps is approximately 3m;
- > The conductor or cable is suspended vertically with a pretension of 200 kg to straighten it;
- > A dynamic load is applied by dropping 666 kg weight from an elevation of 4m;
- > The measurement sample frequency of the load cell is 2500 measurements/s;
- > A full report is prepared including test object data, test description, set-up, procedure, load vs. time curve and conclusions.

OUR STRENGTHS

- > Our lab, one of the few to perform this type of tests, has developed a unique expertise in impact testing.
- > Lamifil's test environment features high speed monitoring.
- > Impact resulting from up to 4m drop height can be simulated.

STANDARDS

According to customer specifications.



MECHANICAL FATIGUE TEST



This involves a specific test for dropper wires to simulate the long-term fatigue of the wire resulting from railway traffic over time. The standard typically requires a cable to resist a minimum of 2 million cycles. The test simulates a typical movement of a dropper wire in realistic conditions.

APPLICATION

Apart from being typically carried out on catenary wires, this test is suited for a variety of wires and cables.

DESCRIPTION

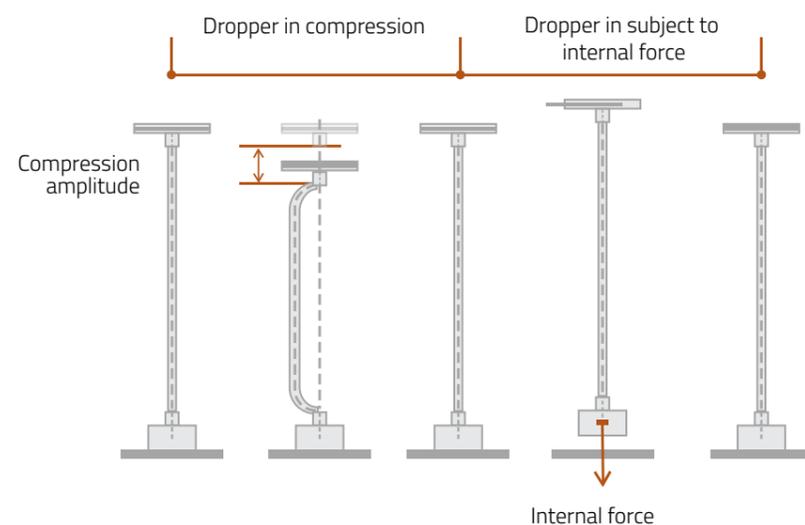
- > The sample dropper wire is embedded in copper fixing sleeves or clamped in specific devices in a test bench;
- > Weight is added to the test bench;
- > Each cycle consists of an alternate compression and load cycle. The dropper cable is subjected to sinusoidal oscillations with a specific amplitude, so that it bends at the extremities, subsequently lifting a weight over a short distance;
- > A successful test can be concluded when no breaking of constituent wires of the tested dropper wire sample occurs before completing 2 million cycles;
- > A full report is prepared including test object data, test description, set-up, procedure results and conclusions.

OUR STRENGTHS

- > Our unique new test bench allows up to six simultaneous tests, each of which can be performed under different conditions, including adjustable force and amplitude.
- > Our mechanical fatigue tests are fully accredited.
- > Our lab has over 5 years of experience with mechanical fatigue testing for numerous references worldwide.

STANDARDS

Typical standards are NFC 34 110-2/EN 50119 or customer specific requirements for speciality wires.



WEAR TEST



A contact wire's lifecycle is determined by the wear it is subject to due to contact with the pantograph. Typically, a contact wire needs replacement every 10 to 20 years depending on the circumstances. Heavily worn contact wires are not only unsafe, they show higher resistance resulting in increased line losses. Testing a desired set-up and realistically simulate a wire's lifecycle is key to make well-founded decisions on investments in contact wires and specific alloys. A contact wire wear test is designed to measure the real wear of the contact wire and its evolution in a matter of days.

APPLICATION

This test is designed for contact wires and their pantograph interface.

DESCRIPTION

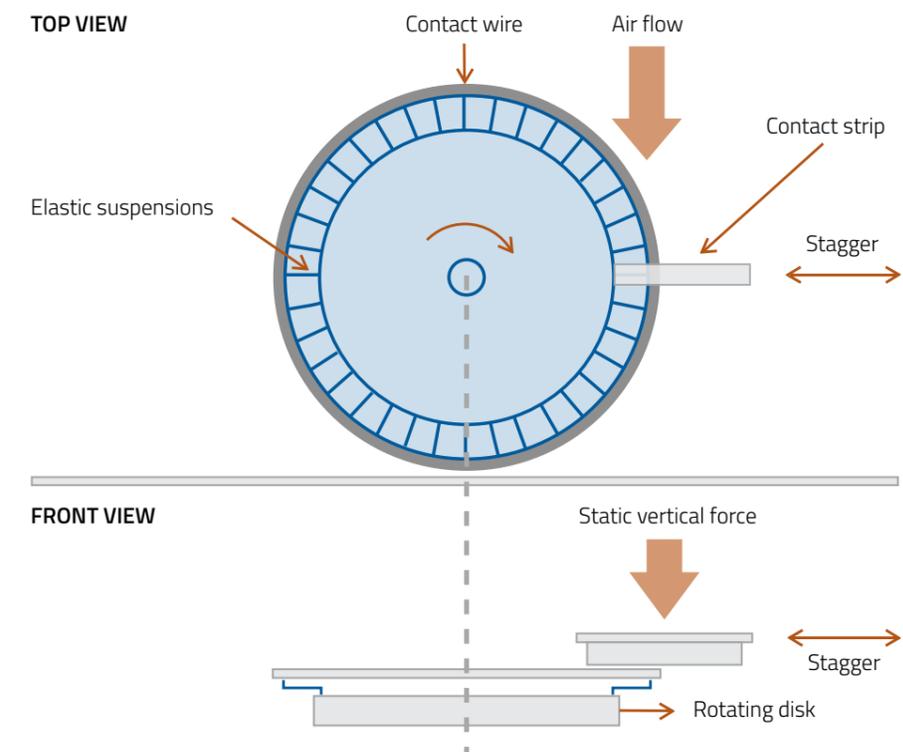
- > The contact wires are mounted on a stationary disk;
- > The pantograph is positioned above the contact wire with an adjustable static vertical force against the wire;
- > The pantograph will rotate at adjustable speeds up to 300 km/h;
- > Current is applied to the contact wire to up to 1000 A;
- > The pantograph makes a staggering movement touching the contact wire to simulate real-life conditions;
- > The test can run a predetermined number of cycles;
- > A full report is prepared including test object data, test description, set-up, procedure results and conclusions.

OUR STRENGTHS

- > Lamifil is one of the few test labs in the world to offer this test.
- > Testing of the entire lifecycle of a contact wire in a matter of days.
- > Possibility to simulate HST environments.
- > Different types of pantographs and contact wires.
- > Unique set-up to test new innovative alloys.

STANDARDS

According to customer specific requirements.



CO-DEVELOPMENT



Our customers trust us to help them to improve the products that they manufacture. Performing a variety of tests on the customer's samples by our specialized lab, we determine the products properties and with these test results we assist our customers to continuously improve quality.

The tests are performed to international standards or to customer requirements.

The most common tests we perform for our customers are:

- > Mechanical tests to determine tensile strength, elongation, fatigue resistance, dimensions, hardness
- > Functional tests like wrapping, torsion and bending properties
- > Electrical tests to establish electrical resistance, specific resistance and IACS (conductivity)
- > Chemical tests to determine composition
- > Metallographical tests to assess wire structure

“ We assist our customer to continuously improve quality.”



OUR LAB'S LOCATION

Our lab is located in the heart of Europe, highly accessible and close to all major economic hubs.

We welcome our customers to join us in our testing facilities to follow-up on their specific projects.



LAB SERVICES

When you turn to us as your reliable testing partner, our lab is the only stop you will need to make. We provide a complete lab package including additional services to support our wide range of tests.

LOGISTICS

Our lab handles any necessary logistics related to test samples, even when third parties are involved.

METALLURGICAL ASSESSMENTS

In case of uncertainty of how used materials or samples were composed or used, we provide visual, microscopic or chemical assessments.

PROTOTYPE DESIGN & TECHNIQUES

Based on many years of experience working with numerous providers, a wide range of products and projects, we help our customers design improved product prototypes and speed up installation with new techniques. We can benchmark materials from different sources and/or processes.

ADVICE ON PRODUCTION PROCESSES

Stranding, wire drawing, extrusion and cold forming are production processes our lab knows very well. Thanks to our extensive experience with these processes, we know which criteria and parameters are required for an optimal production. We advise our customers on the best materials and cable compositions for their specific industries.

PARTICIPATIVE RESEARCH & JOINT DEVELOPMENT

Together with our customers, we tackle specific R&D challenges to look for the best wire composition. In a joint development effort, we set up and conduct the tests required to work out the optimal solution.

COMPLETE TYPE TESTING

We manage your comprehensive type testing projects for new designs end-to-end, including specialised tests that need to be performed in collaboration with external parties.

IN-HOUSE WORKSHOP

In our in-house workshop we can flexibly and swiftly adjust samples and material requirements to avoid any delays in the test process.

INCIDENT ANALYSIS

Whether a cable or fitting breaks for any reason, older parts need to be assessed or a production deficiency needs to be looked at, our lab can perform a full-scale incident analysis, comparing results with millions of data records. Our service includes detailed measurements (tensile strength, resistance,...), chemical analysis as well as high-tech visual inspection.

TRAINING

Our highly-skilled engineering staff provides conductor and fitting installation and assessment trainings and demonstrations either on site or in our lab environment.





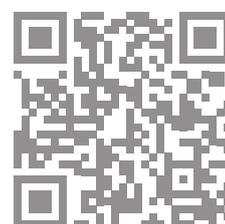
Bringing connections to life



At Lamifil, 90 years of technology, innovation and mastery are forged into smart wires that bring connections to life. Today, Lamifil is one of the world's leading manufacturers of high-end cables, wires and wire-based products in copper, aluminium and their alloys. We help supply energy to millions of people with high-tech overhead conductors. Our catenary wires make trains run more efficiently in dozens of countries. Our innovative alloys are used in superior semi-finished products for the steel, automotive, aviation, aerospace and consumer products industry. Lamifil has production sites in Hemiksem (Belgium), close to the port of Antwerp, and in Uglich (Russia) and a sales office in Philadelphia (US).

LAMIFIL NV
Frederic Sheidlaan
B-2620 Hemiksem, Belgium

T. + 32 (0)3 8700 611
F. + 32 (0)3 8878 059
info@lamifil.be
www.lamifil.be



ISO 9001 - ISO 14001 - ISO 45001 - ISO 17025