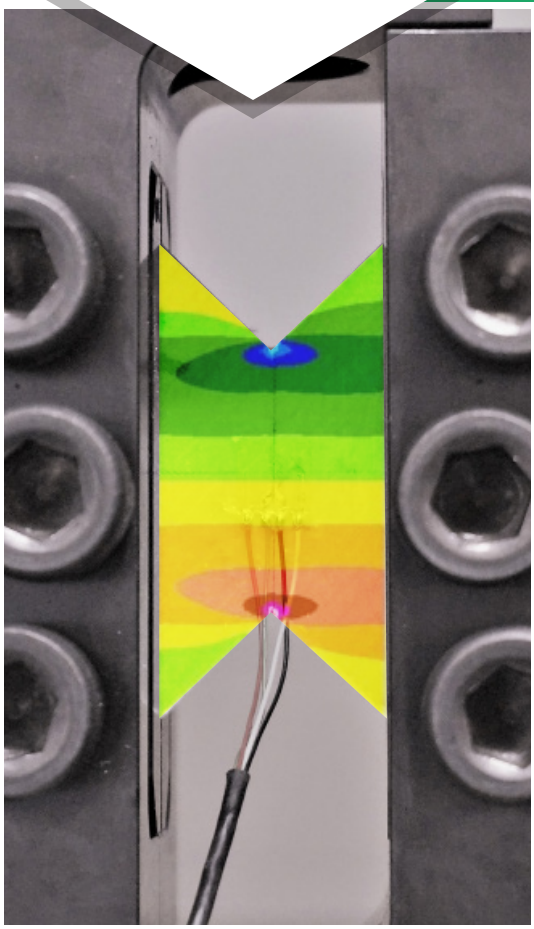
SOLICO

ADDING VALUE TO COMPOSITES



COMPOSITE MATERIAL TESTING

Solico Lab

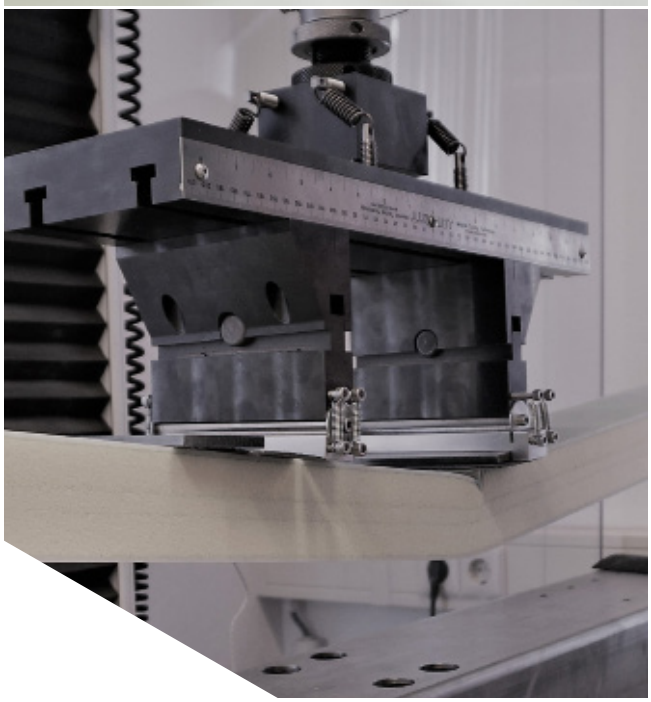
COMPOSITE MATERIAL TESTING

Solico has its own, fully equipped, testing facility that specializes in the testing of FRP composites. A wide variety of mechanical testing and thermal analysis can be performed using standard ISO and ASTM methods to determine the properties of FRP materials.

Solico's independent in-house test facilities provide an invaluable resource not only for customers, but also for Solico's own engineers, who use the lab to continuously enhance composite material databases and validate simulations.

Composite samples can be mechanically tested using a wide range industry standard tensile, compressive or shear tests methods whilst detailed material compositions can also be determined using an incineration furnace and digital scanning calorimeter (DSC).

Whatever the composite testing requirement, from a comprehensive pre-production material test verification to on-site strain gauge measurement, or even analysis of damaged composite products, Solico can provide a solution.



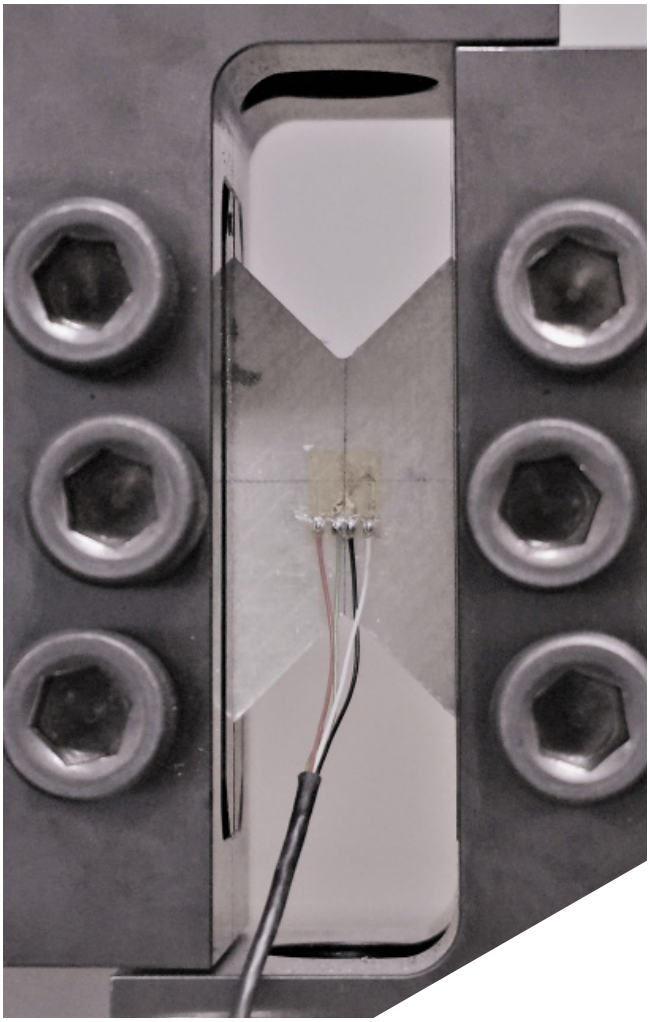
MECHANICAL TESTING

Solico's Instron 3382 100kN Universal Testing Machine runs the most up to date Bluehill® Universal materials testing software and is equipped with a huge range of test fixtures and sample grips, providing a highly versatile machine set up for wide range of composite applications.

Typical test methods and standards are detailed below:

- **ISO 527 - Determination of tensile properties**
- **ISO 14125 - Determination of flexural properties**
- **ISO 14130 - Determination of apparent interlaminar shear strength by short beam method**
- **ASTM C 273 - Shear properties of sandwich core materials**
- **ISO 14126 - Determination of compressive properties**

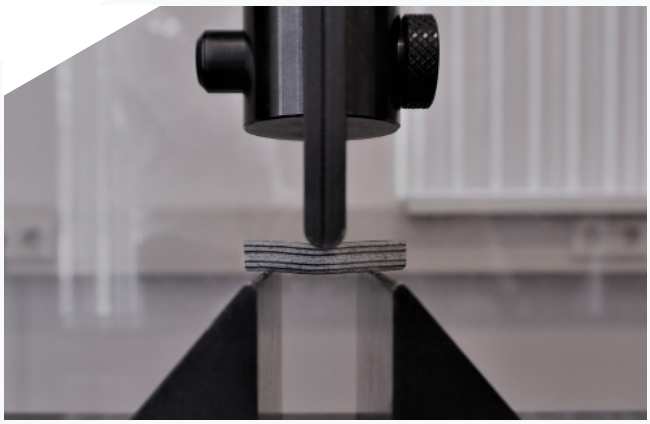
Solico has also installed its own creep testing rig and up to five samples can be tested in parallel to determine the long term creep factor according to NEN-EN 13121-3:2016.



STRAIN GAUGE MEASUREMENT

In addition to the clip on extensometer and strain gauges for the Instron test machine, Solico has recently invested in additional strain gauging equipment for lab-based as well as on-site strain measurement. With a variety of strain gauge options and a portable 4 channel datalogger, Solico's engineers can now test full size composite parts in their end use application where lab scale sample testing is not possible.

Components such as yacht rigging, lifting davits or industrial equipment can now be tested to evaluate fatigue performance, validate simulation data or to check if a damaged part is still functional.



THERMAL ANALYSIS

Solico's Mettler Toledo Digital Scanning Calorimeter (DSC) is an invaluable tool for thermal analysis and characterization of composite raw materials and cured samples. Solico's lab technicians use the DSC to investigate and report a range of material properties such as glass transition temperature (Tg), melting temperature (Tm), specific heat capacity (Cp), cure kinetics of resins as well as other melting, crystallization, and reaction phenomena.

Lab technicians also use a Lenton AF 11/6B furnace for the determination of fibre fractions, weights, and fibre composition in composite material samples. Reaching temperatures of up to 1100˚C, the furnace quickly burns off any resin present in the laminate in order to analyse the glass, carbon or other reinforcement fibres left behind.

ADDITIONAL EQUIPMENT

Solico's test lab also provides equipment for a broad scope of additional composite and materials testing.

- **Mettler Toledo AB54SA high resolution analytical balance.**
- **Mettler Toledo AB-S 33360 density determination kit.**
- **Colman GYZJ-934-1 Barcol impressor hardness tester.**
- **Panametrics 25DL Plus ultrasonic thickness gauge for thickness determination of metals, plastics, glass, rubber, and other materials.**

SUMMARY OF SOLICO TESTING CAPABILITY

The tables below and opposite outline the test methods and standards currently available at Solico.

Tensile Testing	
Test Description	**Test Method**
Determination of tensile properties - plastics	ISO 527-2
Isotropic and orthotropic fibre reinforced composites	ISO 527-4
Unidirectional fibre reinforced plastics	ISO 527-5
Plastics	ASTM D638
Polymer matrix composites	ASTM D3039
Reinforced thermosetting plastics straight sided specimens	ASTM D5083
Rigid cellular plastics	ISO 1926
Fibre reinforced plastics plain pin bearing strenght	ISO 12815

Compression Testing	
Test Description	**Test Method**
Polymer composites using a combined loading compression test fixture	ASTM D6641
Edgewise compression of sandwich construction	ASTM C364
Flatwise compression of sandwich cores	ASTM C365
Rigid plastics	ASTM D695
Rigid cellular plastics	ASTM D1621
Rigid cellular plastics	ISO 844
Fibre reinforced plastic composites	ISO 14126

Shear and Interlaminar Shear Testing	
Test Description	**Test Method**
Composites materials by V-notched beam shear method (Iosipescu)	ASTM D5379
Composites materials by V-notched rail shear method	ASTM D7078
Sandwich core materials	ASTM C273
Composites materials by V-notched beam shear method (Iosipescu)	ASTM D5379
Fibre reinforced composites by short-beam method	ISO 14130
Fibre reinforced composites by short-beam method	ASTM D2344

Adhesive Shear Testing	
Test Description	**Test Method**
Metal to metal, single lap	ASTM D1002
Plastics to plastics, plastics to metal, single lap	ASTM D3164
Double lap	ASTM D3528
Reinforced plastics, single lap	ASTM D5868
Single lap	ISO 4587
Thick adherents, single lap	ISO 11003

Flexural Testing	
Test Description	**Test Method**
Fibre reinforced composites by 3 and 4 point bending	ISO 14125
Plastics by 3 point bending	ISO 178
Sandwich constructions	ASTM C393
Unreinforced and reinforced plastics by 3-point bending	ASTM D790
Unreinforced and reinforced plastics by 4-point bending	ASTM D6272

Creep Testing	
Test Description	**Test Method**
Long term flexural creep test	EN 13121-3

Density and Fibre Content Testing	
Test Description	**Test Method**
Density of plastics by displacement	ASTM D792
Density of plastics by displacement	ISO 1183-1
Ignition loss of reinforced plastics	ASTM D2584
Fibre content of reinforced plastics by calcination method	ISO 1172
Void content of reinforced plastics	ASTM D2734
Constituent content of composite materials	ASTM D3171

Glass Transition Temperature Testing	
Test Description	**Test Method**
Analysis of thermal properties of polymer by DSC	ISO 11357

Hardness Testing	
Test Description	**Test Method**
Hardness of rigid plastics by Barcol impressor	ASTM D2583

Please contact the Solico team for test specimen dimensions or any further details regarding composite material testing.

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