

KVE INDUCT.

INDUCTION WELDING OF THERMOPLASTIC COMPOSITES





KVE COMPOSITES GROUP

KVE Composites Group is a unique design and build organization of highend composite structures located in the Netherlands, supported by a well-established parent company Daher Aerospace. KVE's strength is the in-depth knowledge of composite engineering, materials and manufacturing processes, in combination with a creative mind to provide the right solutions for its customers.

KVE INDUCT

KVE Composites Group is structured in business lines, based on different technologies or application areas. One of the business lines focusses on the assembly of thermoplastic composites by means of induction welding. The technology is commercialized under the KVE INDUCT brand.

Thermoplastic assembly

KVE INDUCT is an assembly concept based on induction welding, where eddy currents are induced in carbon fibre reinforced laminates, resulting in a heat generation which melts the polymer and creates strong joints. KVE has patented the process in 2005.



Welding is performed in a rigid moulded set-up where the laminates are fixated in position. A welding coil moves over the assembly to melt the polymer at the desired location. Temperatures in the welding zone are controlled by a proprietary cooling mechanism.



Advantages

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The use of induction welding as an assembly method enables seamless joining without rivets, fasteners or susceptor materials. Furthermore, the technology allows for new structural design concept and manufacturing methods. Applications have shown to provide a 20 % cost reduction and 10 % weight reduction relative to their thermoset counterparts.

Materials applications:

- Carbon & glass fiber
- UD tapes, fabrics & short fiber compounds
- PA, PPS, LM-PAEK, PEKK, PEEK

Weld speed:

- for CF fabric/PPS: 100 cm/min
- for CF UD/PAEK: 10-20 cm/min

TOOLING FIXTURE

INDUCTION COIL

PRESSURE BELLOW



Characteristics of KVE INDUCT technology

Laminate thickness:

- Typical ranging from 0.5mm to 5mm
- Welding demonstrated up to 15 mm

Weld length:

- Experience up to 2.5 meter
- Demonstrated up to 4 meter
- Feasibility expected > 6 meter

Flying applications

The welding technology has been industrialized under KVE license in various aerospace applications by our customers. Examples are the rudders and elevators of the Gulfstream G650 and the Dassault F6X and the fuel tank access panels of the Airbus A220.



Dassault F6X production line





Airbus A220 fuel tank access panel

Technology demonstrators

In addition to the commercial applications, KVE has developed many demonstrators such as:

- Rudder for Boeing's Phantom Eye unmanned aircraft
- Overhang panel using standard carbon fabric PPS elements
- Thermoplastic rudder for Aerosud, Carbon fabrics PPS laminates + Compression moulded rings
- Compression moulded carbon PEEK window frame welded to a carbon PEEK laminate
- UD PEKK omega stiffened fuselage panel
- Bell V-280 Valor Ruddervators (developed by Fokker GKN)

Boeing Phantom Eye

Bell V-280 Valor





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Licensing

Use of the patented KVE INDUCT technology by customers is managed via a licensing structure. KVE offers a R&D license for research and qualification purposes in the industry. Commercial manufacturing of assemblies is arranged via a manufacturing license. For non-commercial research at universities and institutes, an academic license is offered.

More details on the licensing conditions are specified in the licensing structure table on page 6.

Equipment

To facilitate process development and qualification, KVE has developed a mobile welding cell, which allows for welding single-lap shear and L-profile pull-off assemblies. This set-up can be purchased in combination with an academic or R&D licence.

For process development up to serial manufacturing in a industrialised environment, KVE offers a robotic welding cell. This set-up can be purchased in combination with all license options.

Both welding cells are described in more detail on page 7.

Customers with specific needs which require a tailored welding setup are served via an "open license". In agreement, the equipment shall be customised by KVE. The options are specified in the licensing structure table on page 6.

Services

For customers who are interested in exploring the welding technology or require support and consultancy, KVE offers the following services:

- Design guidelines & simulation
- Tooling development
- Welding trails
- Demonstrators
- Training
- Testing & Inspection
- Customer support

Licensing

LICENSE TYPE	ACADEMIC	R&D		MANUFACTURING	
Description	License for academic research	License for qualif from coupon testing demonstrators	ication programmes g up to component	License for serial thermoplastic assemb	manufacturing of lies
Field of use	Non commercial R&D at research centers or universities	R&D and limited demo aerospace industry wit and qualify compon application	onstrator series in the h the intend to develop ents for commercial	Commercial serial production of specified aerospace components without volume limitation	
TRL LEVEL	3-5	3-7		8-9	
Duration contract	Minimum license term 2 years	Minimum license term 3 years		Programme dependent	
Support (annual)	50h of support included in license	50h of support included in license		50h of support included in license	
OPTIONS	FULL SUPPORT *	FULL SUPPORT *	OPEN **	FULL SUPPORT *	OPEN **
Welding setup (not included in license)	Mobile cell or Robotic cell	Mobile cell or Robotic cell	Robotic cell tailored to customer needs	Robotic cell	Robotic cell tailored to customer needs

OPTIONS	* FULL SUPPORT	** OPEN	
Equipment (not included in license fee)	Complete welding cell Including: • Welding head • Welding coil • Control software & hardware	KVE equipment in cell: • Welding head • Welding coil	
	Coupon weld toolAll hardware for cell	Tailored to customer needs: • Control software & hardware • Weld tooling • Hardware	



Equipment



Robotic Induction Welding Cell (RIWC)

 Purpose: (TRL 3-9) Coupon welding for material testing / certification Welding trails Demonstrators Serial manufacturing

Mobile Induction Welding Cell (MIWC)

- Purpose: (TRL 3-5) Coupon welding for material testing / certification Flat welding trails
- Key characteristics Compact & flexible (1 x 2.8m) 10 kW generator Only linear welding (X-axis linear guidance) Coupon thickness: 0.5-4.5 mm Materials range include: PPS, PEEK, PEKK and LM-PAEK



 Key characteristics 7 x 7 m robotic cell (space for large tooling) 10 kW generator 3D welding envelope Materials range include: PPS, PEEK, PEKK and LM-PAEK



KVE INDUCT.

For more information please contact us at info@kve.nl. Other information and our latest news can be found on our website or follow us at LinkedIn.

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