

# INTRODUCTION COURSE IN BONDED COMPOSITE REPAIR OF WIND TURBINE BLADES

(24 hours)

	TOPICS	DURATION-Hours
1	<b><i>Introduction to composite materials</i></b>	5
	Content	General introduction to composite materials. Type of Structures ; Materials Constitutive ; safety rules; manipulation, quality control
	Knowledge	Damages in Composites, Nature , Classification Identification; Assessment Repair Principles. Class of Repairs. General presentation of a repair scheme. Structural Repair Manuals
	Skills	Ability to identify composite materials, take precautions / safety measures and understand fundamentals of repair.
	Competences	Understanding of advantages, disadvantages and constraints of composite materials, focusing in wind turbine blade repairs.
2	<b>Manipulation of typical composite materials for wind turbines</b>	5
	Content	Fabrication of Panels. Use of the Bonding Consoles and fabrication of bagging (review of questions), use of heating blanket. Bonding the skins of the panel. Damage of panels and preparation of Repair. Start of the use of the Mobile Workshop specific Tooling to implement first repair generic works : routing, stepping
	Knowledge	Basic knowledge on how to perform the main steps required in a bonded composite repair
	Skills	Ability to perform fundamental composite repair operations, especially those related to wind turbines.
		Understanding of basic composite repair

	Competences	theoretical principles and practical applications, mainly related to wind turbine blades.
3	<b><i>Machining of Composites</i></b>	5
	Content	Principles and applications to typical cases: laminates sandwiches, carbon, glass fibers. End of the Repair of Panels; “cold repair” is conducted; potting and patch installation. Introduction to Hot Bonding Principles.
	Knowledge	Application of cold / hot bonded composite repair to typical wind turbine structures
	Skills	Ability to perform machining of composites, including stepping and scarfing operations..
	Competences	Manipulation of hand-held semi-automatic equipment to scarf or mill composites, in order to subsequently repair.
4	<b><i>Hot Repair of Panels</i></b>	5
	Content	A typical repair is conducted on a sandwich part. Review of all fundamental notions: heating blanket, thermocouple positioning.
	Knowledge	Use and characteristics of various repair equipment, including heat transfer principles and temperature measuring strategy.
	Skills	Ability to create vacuum bags and perform hot bonded composite repairs
	Competences	Insight of vacuum bagging characteristics and constraints, together with tips for successful application.
5	<b><i>Overview and practical applications</i></b>	4
	Content	A full repair from A to Z is performed by trainees in order to confirm their knowledge and answer any questions still pending.
	Knowledge	Insight of bonded composite repair operations
	Skills	Ability to autonomously perform a full bonded composite repair.

	Competences	Understanding of composite repair operations, focusing of wind turbines, including limitations and constraints.
	<b>Total</b>	<b>24</b>