

Tubular Composites Manufacturing Process

Wrapping Self Evaluation Form – Structural Tubulars

Product: Date:

	Your State	Grade	Weight	Weighted Grade
Tape Braking Device 1 – Combined with the tensioning device 2 – Separate, manual control 3 – Separate, gradual control (dancing roll) 4 – Separate, digitally controlled (PLC or PC)	0	0	1	0
Tape Tensioning Device 1 – Combined with the braking device 2 – Separate, manual control 3 – Separate, automatic control 4 – Separate, digitally controlled (PLC or PC)	0	0	1	0
Number and Types of Tapes Employed 1 – One generic tape of resin containment and release after cooking 2 – One specialised tape of resin containment, layers compaction, compression through heat shrinkage, single taping 3 – One specialised tape of resin containment, layers compaction, compression through heat shrinkage, double taping 4 – Two specialised tapes, each performing resin containment, layers compaction, compression through heat shrinkage functions 5 – Three or more specialised tapes, each performing resin containment, layers compaction, compression through heat shrinkage functions	0			
If you have answered 4 or 5 at the previous answer, fill in the following 3 answers, otherwise leave the field at 0				
Compacting Tape Do you use a tape specifically designed to compact prepreg layers? 1 – No 2 – Yes	0	0	2	0
Compression Tape Do you use a tape specifically designed to compress the tubular through heat shrinkage? 1 – No 2 – Yes	0			
Heat Shield Tape Do you use a tape specifically designed for making an heat shield? 1 – No 2 – Yes	0			
Pitch/Reel Width Ratio (example: pitch 4 millimetres/reel width 20 millimetres=ratio 0,2) 1 – Bigger than 0,5 2 – Between 0,3 and 0,5 3 – Between 0,2 and 0,3 4 – Between 0,1 and 0,2 5 – 0,1 or smaller	0	0	1	0
Tape/Tapes Tensioning 1 – Manual or not controlled tensioning 2 – Fully controlled tensioning. Working tension bigger than tape yield stress 3 – Manual controlled tensioning. Stable tension 4 – Fully controlled tensioning with graduated scale. Working tension slightly smaller than tape yield stress 5 – Fully digitally controlled tensioning with a Newton measured graduated scale. Working tension slightly smaller than tape yield stress	0	0	1,5	0
Cooking Resin Leakages 1 – Copious resin leakages, considerable weight loss 2 – Widespread resin leakages between tape spirals 3 – Limited, few resin leakages between tape spirals 4 – Very limited resin loss, mainly on the tubular heads	0	0	0,5	0
Film Release 1 – At the end of polymerization the film doesn't release from the composite 2 – Partial release, small parts of film are left on the surface 3 – Full release of the tape, by unwrapping or cutting	0	0	0,5	0
Tubulars Surface Finish 1 – Uneven surface, existence of grooves, grinding impossible. 2 – Existence of small holes/resin deficits, grinding needed 3 – Slightly irregular surface, irregular steps on the surface 4 – Surface finish as requested (shiny, matt, coloured), light steps on the surface	0	0	0,5	0
Structural Compactness of the Tubular 1 – Non compacted structure, existence of faults, possible fractures 2 – Compacted structure 3 – Well compacted and squeezed structure, low resonance frequency 4 – Very well compacted and squeezed structure, high resonance frequency	0	0	2	0
Total Grade of the Wrapping Process			0	

Structural Tubular Composite wall thickness 3-5 millimetres, excellent structural or dynamic performances:
Ex: high end sporting equipments (roubasienne fishing rods, windsurf masts, golf shafts, paddles, ski poles)

Composite wall thickness 5-8 millimetres, excellent structural or dynamic performances:
Ex: structural items (industrial rolls, sleeves and printing plates rolls, rubber covered rolls)

Composite wall thickness >= 10 millimetres, heavy duty items:
Ex: items for sailing or aviation (sailing masts, air fuselages, carbon riggings)

Updated 2017-09-11

Comment: Grades of each question can vary from 1 to 10. 6 is the minimum acceptable value.
The overall grade "weights" the importance of each question on the whole grade
Overall graduation is from 1 to 100.
In this case, due to the calculation algorithm, 60 could not be the minimum acceptable value.
Hence overall grade has to be considered as a measurement in comparison with state of the art, with the best practise (100).
With any grade bigger than 0 you should be able to get a tubular composite whatsoever
If in any question the grade you get is lower than 6 the manufacturing process has:
- some flaws (grades 4 or 5), which may compromise the final outcome;
- heavy flaws (grades 1, 2 or 3), which very likely heavily compromise the final outcome.
For any grade lower than 6 we suggest you to intervene and, if possible, to modify the manufacturing process
Grades are based on our present best knowledge, and could be changed without advise
Evaluation models are experimental and will be reviewed thanks to the feedbacks obtained from users

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Tubular Composites Manufacturing Process

Polymerization Self Evaluation Form

Product: Date:

Oven	Your State	Grade	Weight	Weighted Grade
1 – Conventional oven, with thermostat on the heating elements.	0	0	2	0
2 – Convection (fan-assisted) oven, uniform temperatures, manual thermostats				
3 – Convection (fan-assisted) oven, uniform temperatures, programmable thermostats.				
4 – Convection (fan-assisted) oven, uniform temperatures, with controlled (PC or PLC) cycle and temperature curve.				
5 – Autoclave with controlled (PC or PLC) cycle, temperature curve and pressure.				
Tubular Position during Polymerization				
1 – Laid down	0	0	3	0
2 – Laid down, with rotating device during the cooking				
3 – Standing				
Cooking Cycle and Temperature Curves				
1 – Single curve (heating up, cooking, cooling down)	0	0	2,5	0
2 – With an "S" curve, manual control				
3 – With an "S" curve, automatic control				
4 – With an "S" curve, fully digitally temperature and pressure controlled				
Shape of the Tubular Obtained				
1 – Not straight, bended on the axis.	0	0	2,5	0
2 – Heavily oval, elliptical cross section. Heavy grinding needed				
3 – Slightly oval, elliptical cross section. Light grinding needed.				
4 – Circular cross section. Light grinding needed.				
5 – Circular cross section. Grinding is optional				

Total Grade of the Polymerization Process

0

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 6 is the minimum acceptable value.
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 Overall graduation is from 1 to 100.
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