9 RECOMMENDATIONS

Design and manufacturing

- Design the flange laminate such that the load path follows the fibre dominated regions within the laminate.
- Ensure consistent material distributions in the flange laminate at the manufacturing stage.
- Reduce possible unfavourable residual stresses generated during the cure and post-cure processes especially in the areas where additional glass fibres are incorporated into the flange to give stub thickness. This may be achieved by using laminates that have similar material properties (coefficient of thermal expansion and shrinkage) to the flange laminate or by using adequate fibre contents.
- Avoid matrix dominated regions at the flange radius. This minimizes the pull-back effect experienced by the stub and minimizes creep effects.
- At the final manufacturing stage, care must be taken as the flange is machined to get the required shape and size because some plies might be cut out or completely removed from the flange laminate.

Testing

- Research performed in this project considered the short-term effects of internal pressure on the flange. However, research that takes into account the long-term behaviour of stub flange under thermal and mechanical loads should be conducted. Such research should consider possible effects of induced residual thermal stresses within the flange laminate and the change in time of loading conditions of different components (backing ring, bolts and gasket).
- Since, in practice, the pipe flanges are not only subjected to pressure loads, experimental work needs to be performed to evaluate the flange performance when subject to pressure load and external bending load.
- The flange analysis must be performed keeping in mind the behaviour of other joint components (bolt, backing ring and gasket) since the reliability of the joint depends on the way the clamping load is transmitted.