ABSTRACT
The present paper is related to the verification of unbonded flexible pipes designed and manufactured as per API 17J [1].

Back in the early nineties, in response to the needs of the industry for better quality, reliability and safety in unbonded flexible pipe products, Bureau Veritas established an innovative verification scheme relying not only on qualification testing, but also on the assessment of design methods, materials as well as manufacturing processes. This approach has proven particularly relevant considering several specificities of the flexible pipe industry: no ‘on-the-shelf’ design (each pipe being designed for project specific conditions), manufacturer specific local design methodologies, specific materials and manufacturing methods, high complexity and cost of testing.

This paper presents the verification methodology, its application as well as its ability to embody the latest normative requirements given in [1]. The specificity of the verification scheme, which consists in a breakdown between a Type Approval phase and a project phase, is also presented.

INTRODUCTION
Flexible unbonded pipes are complex products, consisting of an assembly of multiple metallic and polymeric layers, submitted to severe loadings in terms of service conditions, transported fluid characteristics and extreme and dynamic mechanical loadings. This product belongs to the few key technologies that have enabled the early subsea oil and gas fields development around FPUs/FPSOs. The standard arrangement of an API 17B [2] Family III flexible pipe as well as the basic function of each layer is recalled hereafter. Figure 1 presents the typical arrangement of such flexible pipe, composed of the following layers:

- A carcass, which is an interlocked metallic strip made of stainless steel and aimed at providing the radial strength of the pipe towards hydrostatic collapse and crushing loads (Layer 1 on Figure 1)
- An internal pressure sheath manufactured from an extruded polymer material and aiming at providing the fluid containment (Layer 2 on Figure 1)
- A pressure armour layer made of interlocked steel wires wound at a short pitch and aimed at providing the basic pressure capacity of the pipe (Layer 3 on Figure 1)
- A tensile armour wires (one or two pairs of layers) made of steel rectangular wires and aimed at providing the resistance to axial loads (Layers 5 and 7 on Figure 1)
- An antibuckling layer made of high strength composite materials wound to prevent the radial