

## Methodology for Preliminary Evaluation of Top Tension of Drilling Riser considering the Dynamic Coupling Effects of the Tensioner System

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### ABSTRACT

Since the first issue in 1993 of the API recommended practice RP 16Q, drilling operations in deep water have significantly increased. Thus, following the evolution of the oil & gas industry in such scenarios, there is the need to review, update and optimize the design methodology to ensure the safety and integrity of drilling risers.

This paper focus specifically in the modeling of the tensioner system, associated to the global analysis of the drilling risers, for a more realistic estimation of their operational limits. The tensioner load variation due to dynamic effects is not adequately accounted for in this recommended practice RP 16Q, which can be up to 50% of tension, and therefore may lead to unsafe operations. The level of tension variation is dependent on several factors such as stroke amplitude, stroke velocity, environmental conditions and initial static load. The modeling of actual tensioners can be arduous depending on the complexity of the hydro-pneumatic systems. An accurate modeling of tensioner system is required to ensure that the system components do not experience excessive stresses or compression. Thus, this paper presents a methodology for preliminary evaluation of tensioner system modeled by a non-linear formulation to represent its behavior.

The analysis procedure follows a two-step approach: a preliminary tension estimate, and the verification of operational limits considering the complete matrix of environmental cases, where operational limit values are checked according to the API standard. The nonlinear dynamic analyses are performed using the in-house program. Several simulations of operational cases are executed in order to illustrate the application of the proposed model; the results indicate a safe and expedited approach has been obtained for the tension estimation including dynamic effects, delivering a safer top tension to be set for drilling riser operational conditions.