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# The Free Standing Flexible Riser: A Novel Riser System for an Optimised Installation Process

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## Abstract

Free Standing Hybrid Risers (FSHR) are being selected more and more often for floating production systems into ever deeper water, in particular beyond 6500 ft, (2000 m). The main advantages of free standing riser systems are the possibility to disconnect the project execution of the host platform and the riser system and to reduce the load applied by the risers on the host. However a draw back of those systems is the need for installation spreads with high lifting and top tension capabilities to install the buoyancy cans and rigid steel riser pipe as well as the criticality of the supply of some long lead items.

The Free Standing Flexible Riser (FSFR™) allows keeping these advantages but at the same time reducing the requirement for large offshore equipment for the installation associated with a Free Standing Hybrid Riser (FSHR). Beyond the obvious difference of the replacement of rigid steel pipe by flexible pipe the FSFR™ allows a reduction of the riser top assembly and avoids the large size tapered stress joints required for a FSHR. Offshore, flexible pipe installation vessels can be used and the installation method, based on an initiation at the buoy, allows a significant reduction of the suspended length of pipe and of thus of installation top tensions. Due to the pretension in the riser pipe at the seabed, the design challenges related to the axial compression induced by the external pressure are avoided, and the flexible pipe design can be optimised.

The paper describes the FSFR™ in detail as well as the implication in terms of design of the flexible pipe and other elements of the system. To give a complete picture the installation method and equipment used are also presented. Several case studies are performed for different offshore areas and for different riser systems. Aspects as design, fabrication, installation and cost are included in the comparison allowing to point out in which conditions the FSFR™ (for which a patent has been applied for) is technically and economically a viable solution.

## Introduction

Free Standing Risers are more and more often selected for very deepwater developments (PDET oil Export system on Petrobras P52, Petrobras Cascade Chinook, BP Block 31, Exxon Kizomba). These systems are generally less cost efficient than more traditional free hanging flexible risers and steel catenary risers but they can be of interest when the project needs exceed the current proven capabilities of the more traditional technologies or when the system needs to be free standing to allow a development of the subsea and risers independently from the host/topsides part of the field. A free standing riser also allows disconnection of the risers in case of hurricanes for example. In addition a free standing riser system will allow reducing the loads acting on the host floater (Ref 1.).

Several variations on such systems exist, the Free Standing Flexible Riser is another one in the family but with some very specific particularities that allows a simplification of the offshore installation process.