# Dynamic Risers for Floating Production Systems

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## Introduction

The First Edition of API 2RD, *Design of Risers for Floating Production Systems (FPSs) and Tensioned-Leg Platforms (TLPs)*, was issued in June 1998 and was based on a working stress design methodology. At the time, the first steel catenary risers had only been in the water for a few years. Hence, the first edition was focused primarily on top-tensioned risers and did not consider the interfaces with pipeline design codes for steel catenary risers.

The Second Edition, issued in September 2013, was renamed API 2RD, *Dynamic Risers for Floating Production Systems*, reflecting the broader application to all floating systems. The Second Edition was a complete rewrite of the document, replacing working stress design with limit state design methods, with the intention of being issued as an ISO standard, and subsequently adopted by API. It was also generalized for compatibility with pipeline design codes and other limit state design standards. It included four alternative methods for combined stress design, including one method based on DNV-ST-F201 and one method considering large strain. In the end, the connection with ISO was severed, and it was issued by API as API 2RD. Technically, it also became an API standard rather than an API recommended practice, which was an API administrative change that had no material effect on the content.

Since the issuing of the Second Edition in 2013, a number of shortcomings have been identified, including a lack of guidance on the use of the large strain method 4 and a lack of compatibility with the First Edition working stress design method for reassessment of existing risers. In addition, important feedback was provided from the development of API 2RIM, *Integrity Management of Risers from Floating Production Systems*, as well as industry experience with the reassessment of risers. The Second Edition also lacked a commentary annex, or the extensive embedded informative text from the First Edition.

This Third Edition makes several changes from the Second Edition, including the following:

— incorporating an optional working stress design method compatible with the First Edition;

— maintaining compatibility with API 1111 for pipeline risers;

— restructuring the design criteria (see Section 5), combining common elements of the working stress (First Edition) and limit state (Second Edition) design methods, and including clearer guidance on the use of the different design methods;

— removing Method 3 (based on DNV-ST-F201) from Section 5 to maintain compatibility with the underlying API pipeline design codes;

— removing Method 4 from Section 5 and incorporating the provisions of Method 4 into other sections;

— incorporating safety class into the design criteria;

— clarifying fatigue design requirements (see 5.6);

— adding an extensive informative commentary (see Annex A) to provide guidance and supplemental reference material for specific sections of the normative;

— adding informative Annex B to address general riser design topics applicable to more than one section of the normative;

— updating examples (see Annex C) to illustrate the differences between design methods;

— referring to existing standards by reference, replacing some explicit material and welding requirements (see Section 7).

# Dynamic Risers for Floating Production Systems

## 1 Scope

This document addresses dynamic riser systems that are part of a floating production system (FPS). A dynamic riser is a subsystem in an FPS. For guidelines for design, construction, installation, operation, and maintenance of FPS, refer to API 2FPS and API 2T.

The provisions of this standard do not apply to the riser systems of mobile offshore drilling units (MODUs). For MODU riser design, refer to API 16Q.

There is significant interaction among the subsystems in an FPS. Hull motions affect risers and moorings, and conversely, risers and moorings affect hull motions. Global behavior of the system provides input to assessment of subsystems. Assessment of a subsystem provides feedback (e.g. loads and motions) for assessment of the hull and other subsystems.

Determination of the boundaries of a riser system and management of the interactions with other subsystems is the responsibility of the operator.

A riser system is an assembly of components, including pipe and connectors. A riser system can include a riser tensioning system, buoyancy modules, vortex-induced vibration (VIV) suppression devices, corrosion protection, thermal insulation, etc. Pipe components can be steel, titanium, or unbonded flexible pipe. Composite materials may be considered, but they are not directly addressed in this document. Design considerations for unbonded flexible pipe are included primarily by reference to API 17B and API 17J. Steel and titanium pipes are referred to as rigid pipe, and unbonded flexible pipe is referred to as flexible pipe.

All or part of several existing codes, standards, specifications, and recommended practices are included by reference.

Design loads and conditions are described in Section 4. Structural design criteria for rigid pipe are provided in Section 5. Structural capacity criteria for steel pipe are also in Section 5. Additional requirements for riser components are included in Section 6. Material requirements are provided in Section 7. Fabrication and installation requirements are detailed in Section 8. Integrity management (IM) is addressed in Section 9 and by reference in API 2RIM.

## 2 Normative References

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Recommended Practice 2RIM, *Integrity Management of Risers from Floating Production Systems*

API Recommended Practice 5L1, *Recommended Practice for Railroad Transportation of Line Pipe*

API Recommended Practice 5LW, *Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels*

API Specification 17D, *Design and Operation of Subsea Production Systems—Subsea Wellhead and Tree Equipment*

API Recommended Practice 1111, *Design, Construction, Operation, and Maintenance of Offshore Hydrocarbon Pipelines (Limit State Design)*

API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*