

# Planning, Designing, and Constructing Tension Leg Platforms

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This recommended practice for planning, designing, and constructing tension leg platforms incorporates the many engineering disciplines that are involved with offshore installations, whether floating or fixed. Defined herein are guidelines developed from the latest practices in tension leg platforms, and adapted from successful practices employed for related structural systems in the offshore and marine industries.

A tension leg platform (TLP) is a vertically moored, buoyant, compliant structural system wherein excess buoyancy of the platform (in excess of weight and riser loads) maintains tension in the mooring system. A TLP may be designed to serve a number of functional roles associated with offshore oil and gas exploitation. It is considered particularly suitable for deepwater applications. A TLP system consists of many components, each of which has a precedent in the offshore or marine industry. The uniqueness of a TLP is in the systematic influence of one component on another. Consequently, the design is a highly interactive process which should account for functional requirements, component size and proportion, equipment layout and space allocation, hydrodynamic reaction, structural detail, weight and centers of gravity, etc. All disciplines involved in the design process should anticipate several iterations to achieve proper balance of the design factors. This publication summarizes available information and guidance for the design, fabrication, and installation of a TLP system.

These recommendations are based on published literature and the work of many companies who are actively engaged in TLP design. As with earlier editions of this publication, it represents a snapshot of the state of the art and practice of TLP design. As new technology develops, this publication will be updated to reflect the latest accepted design and analysis methods.

Each section of this publication covers a specific aspect of tension leg platforms. The main text contains basic engineering design principles which are applicable to the design, construction, and operation. Equations for analyses are included when appropriate. In many cases these equations represent condensations of more complete analysis procedures, but they can be used for making reasonable and conservative predictions of motions, forces, or component strength. More detailed discussions of these engineering principles, describing the logic basis and advanced analytical concepts from which they were developed, are given in the commentary. The designer and operator are encouraged to use the most current analysis and testing methods available, and bring forth to the Institute any newfound principles or procedures for review and consideration.

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# Planning, Designing, and Constructing Tension Leg Platforms

## 1 Scope

This recommended practice is a guide to the designer in organizing an efficient approach to the design of a tension leg platform (TLP). Emphasis is placed on participation of all engineering disciplines during each stage of planning, development, design, construction, installation, and inspection.

## 2 Normative References

The following referenced documents are indispensable in the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Specification 5L, *Specification for Line Pipe*

DNV-RP-B401<sup>1</sup>, *Cathodic Protection Design*

NACE SP0176<sup>2</sup>, *Corrosion Control of Submerged Areas of Permanently Installed Steel Offshore Structures Associated With Petroleum Production*

## 3 Terms, Definitions, Acronyms, Abbreviations and Symbols

### 3.1 Terms and Definitions

For purposes of this document, the following terms and definitions apply.

#### 3.1.1

##### **added mass**

Effective addition to the system mass, which is proportional to the displaced mass of water.

#### 3.1.2

##### **bluff body**

An opaque object located in a fluid flow stream and developing a high drag force because it lacks streamlining.

#### 3.1.3

##### **braces**

Structural members that serve to stiffen the hull structure and provide deck support.

#### 3.1.4

##### **bulkhead**

Stiffened vertical or horizontal load bearing diaphragm.

#### 3.1.5

##### **connector**

A riser device used to latch and unlatch risers and lower marine riser packages to subsea equipment, or a tension device used to latch and unlatch tendons to the foundation system and to connect the tendon to the platform.

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<sup>1</sup> Det Norske Veritas, Distribution Department, NO-1322 Høvik, Norway, e-mail: [distribution@dnv.com](mailto:distribution@dnv.com).

<sup>2</sup> NACE International, 1440 South Creek Drive, Houston, Texas, 77084-4906, [www.nace.org](http://www.nace.org).