Topsides Structure

ANSI/API RECOMMENDED PRACTICE 2TOP
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American Petroleum Institute

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Contents

Page

1 Scope . . . 1
2 Normative References . . . 2
3 Terms and Definitions . . . 3
4 Symbols and Abbreviated Terms . . . 6
4.1 Symbols . . . 6
4.2 Abbreviated Terms . . . 8
5 Overall Considerations . . . 9
5.1 Design Situations . . . 9
5.2 Codes and Standards . . . 9
5.3 Deck Elevation and Green Water . . . 10
5.4 Exposure Level . . . 10
5.5 Operational Considerations . . . 11
5.6 Selecting the Design Environmental Conditions . . . 11
5.7 Assessment of Existing Topsides Structures . . . 11
5.8 Reuse of Topsides Structure . . . 11
5.9 Modifications and Refurbishment . . . 11
6 Design Requirements . . . 11
6.1 General . . . 11
6.2 Materials Selection . . . 12
6.3 Design Conditions . . . 12
6.4 Structural Interfaces . . . 12
6.5 Design for Serviceability Limit States . . . 12
6.6 Design for Ultimate Limit States . . . 14
6.7 Design for Fatigue Limit States . . . 15
6.8 Design for Accidental Limit States . . . 15
6.9 Robustness . . . 15
6.10 Corrosion Control . . . 16
6.11 Design for Fabrication and Inspection . . . 16
6.12 Design Considerations for Structural Integrity Management . . . 17
6.13 Design for Decommissioning, Removal, and Disposal . . . 17
7 Actions . . . 18
7.1 General . . . 18
7.2 In-place Actions . . . 18
7.3 Action Factors . . . 19
7.4 Vortex-induced Vibrations . . . 21
7.5 Deformations . . . 21
7.6 Wave and Current Actions . . . 22
7.7 Wind Actions . . . 22
7.8 Seismic Actions . . . 22
7.9 Actions during Fabrication and Installation . . . 24
7.10 Accidental Situations . . . 24
7.11 Other Actions . . . 33
8 Strength and Resistance of Structural Components . . . 35
8.1 Use of Local Building Standards . . . 35
8.2 Cylindrical Tubular Member Design . . . 36

Contents

Page

8.3 Design of Noncylindrical Sections . . . 36
8.4 Connections . . . 37
8.5 Castings . . . 38
8.6 Design for Stability . . . 38

9 Structural Systems . . . 40
9.1 Topsides Design . . . 40
9.2 Topsides Structure Design Models . . . 40
9.3 Substructure Interface . . . 41
9.4 Flare Towers, Booms, Vents, and Similar Structures . . . 41
9.5 Helicopter Landing Facilities (Helidecks) . . . 42
9.6 Crane Support Structure . . . 42
9.7 Derrick Design . . . 44
9.8 Bridges . . . 44
9.9 Bridge Bearings . . . 44
9.10 Antivibration Mountings for Modules and Major Equipment Skids . . . 45
9.11 System Interface Assumptions . . . 45
9.12 Fire Protection Systems . . . 46
9.13 Penetrations . . . 46
9.14 Difficult-to-inspect Areas . . . 46
9.15 Drainage . . . 46
9.16 Actions due to Drilling Operations . . . 46
9.17 Strength Reduction due to Heat . . . 46
9.18 Walkways, Laydown Areas, and Equipment Maintenance . . . 47
9.19 Muster Areas and Lifeboat Stations . . . 47

10 Materials . . . 47
10.1 General . . . 47
10.2 Carbon Steel . . . 48
10.3 Stainless Steel . . . 49
10.4 Aluminum Alloys . . . 49
10.5 Fiber-reinforced Composites . . . 50
10.6 Timber . . . 51

11 Fabrication, Quality Control, Quality Assurance, and Documentation . . . 51
11.1 Assembly . . . 51
11.2 Welding . . . 52
11.3 Fabrication Inspection . . . 52
11.4 Quality Control, Quality Assurance, and Documentation . . . 52
11.5 Corrosion Protection . . . 52

12 Corrosion Control . . . 53
12.1 General . . . 53
12.2 Forms of Corrosion, Associated Corrosion Rates, and Corrosion Damage . . . 53
12.3 Design of Corrosion Control . . . 53
12.4 Fabrication and Installation of Corrosion Control . . . 54
12.5 In-service Inspection, Monitoring, and Maintenance of Corrosion Control . . . 55

13 Loadout, Transportation, and Installation . . . 55

14 In-service Inspection and Structural Integrity Management . . . 56
14.1 General . . . 56

Contents

Page

14.2 Particular Considerations Applying to Topsides Structures 56
14.3 Topsides Structure Default Inspection Scopes 56

15 Assessment of Existing Topsides Structures 58

16 Reuse of Topsides Structure 58

Annex A (informative) Commentary Additional Information and Guidance 59

Annex B (informative) Example Calculation of Building Code Correspondence Factor 112

Annex C (informative) Regional Information 118

Bibliography 119

Figures
1 Assessment of Accidental Events 28
2 Detailed Structural Assessment for Fires and Explosions 29
3 Detailed Structural Assessment for Impact and Accidental Flooding Events 30
A.1 1000-year S_a (1.0 s Oscillation) Map of North America (from API 2EQ) 67
A.2 1000-year S_a (0.2 s Oscillation) Map of North America (from API 2EQ) 67
A.3 Generic Response Spectrum (from API 2EQ) 68
A.4 Example of Explosion Overpressure versus Time 74
A.5 Stress versus Strain Relationships of Typical Structural Steels at Different Temperatures 85
A.6 P-Δ Effects versus P-δ Effects 96
A.7 Braced Topsides 99
A.8 Unbraced Portal Frame between Lowest Deck and Jacket 100
A.9 Unbraced Portal Frame at Intermediate Deck Level 101
A.10 Unbraced Portal Frame between Main Legs 102
A.11 Unbraced Portal Frame Associated with Floatover Deck Configuration 103

Tables
1 Maximum Vertical Deflections 14
2 Partial Damage Design Factors, γ_{FD} 15
3 Description of Risk Levels 25
4 Indication of Risk Level for Accidental Events 27
5 Material Category—Material Selection for Topsides 48
A.1 Normative References for Exposure Level 60
A.2 Normative References for Assessment of Existing Topsides Structures 60
A.3 Normative References for Reuse of Topsides Structures 61
A.4 Normative References for Modification and Refurbishment 61
A.5 Site Seismic Zone (from API 2EQ) 68
A.6 Site Amplification Factors (from API 2EQ) 69
A.7 Scale Factors for ALE Spectra (API 2EQ) 69
A.8 Yield Strength Reduction Factors for Steel at Elevated Temperatures 84
A.9 Maximum Allowable Steel Temperature as a Function of Strain for Use with the Zone Method 86
A.10 Maximum Allowable Steel Temperature as a Function of Utilization Ratio 86
A.11 Summary of Fire Ratings and Performance for Fire Walls 90
A.12 Effective Length Factors 97
A.13 Normative References for Assessment of Existing Topsides Structures 111
A.14 Normative References for Reuse of Topsides Structures 111
B.1 Basic Data 112

Contents

Page

B.2 Design and Utilizations to API 2A-LRFD—Tension Case 113
B.3 Design and Utilizations to API 2A-LRFD—Compression Case 113
B.4 Design and Utilizations to API 2A-LRFD—Bending Case. 114
B.5 Design and Utilizations to API 2A-LRFD—Combined Compression and Bending 114
B.6 Design and Utilizations to AISC 360-05—Tension Case 115
B.7 Design and Utilizations to AISC 360-05—Compression Case 115
B.8 Design and Utilizations to AISC 360-05—Bending Case 116
B.9 Design and Utilizations to AISC 360-05—Combined Compression and Bending 116
B.10 Derivation of Building Code Correspondence Factor. 117
C.1 Value of Building Code Correspondence Factor 118

Foreword

The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing international standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and nongovernmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare international standards. Draft international standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an international standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19901-3 was prepared by technical committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee 7, *Offshore structures*.

ISO 19901 consists of the following parts, under the general title *Petroleum and natural gas industries — Specific requirements for offshore structures:*

— *Part 1: Metocean design and operating considerations*

— *Part 2: Seismic design procedures and criteria*

— *Part 3: Topsides structure*

— *Part 4: Geotechnical and foundation design considerations*

— *Part 5: Weight control during engineering and construction*

— *Part 6: Marine operations*

— *Part 7: Stationkeeping systems for floating offshore structures and mobile offshore units*

ISO 19901 is one of a series on international standards for offshore structures. The full series consists of the following international standards:

— ISO 19900, *Petroleum and natural gas industries — General requirements for offshore structures*

— ISO 19901 (all parts), *Petroleum and natural gas industries — Specific requirements for offshore structures*

— ISO 19902, *Petroleum and natural gas industries — Fixed steel offshore structures*

— ISO 19903, *Petroleum and natural gas industries — Fixed concrete offshore structures*

— ISO 19904-1, *Petroleum and natural gas industries — Floating offshore structures — Part 1: Monohulls, semi-submersibles and spars*

— ISO 19905-1, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 1: Jack-ups*

— ISO/TR 19905-2, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 2: Jack-ups commentary and detailed sample calculation*

— ISO 19906, *Petroleum and natural gas industries — Arctic offshore structures*

Introduction

The API Subcommittee on Offshore Structures (SC 2) voted to adopt a modified version of ISO 19901-3:2010 (corrected version, December 15, 2011) as American National Standard (ANSI)/API Recommended Practice 2TOP. SC 2 has also ensured that 2TOP is consistent with ISO 19901-3:2014, which was issued subsequent to the initial draft of this document.

API decided to adopt a modified version of ISO 19901-3 covering the design of topsides structures on offshore platforms, including certain planning and construction considerations, using a limit state approach with partial load and resistance factors. The result is this recommended practice (RP), API 2TOP. The modifications of the aforementioned ISO standard have been incorporated directly into the text.

API 2TOP reflects the evolution in structural design methodology from allowable strength design (ASD) to load and resistance factor design (LRFD). ASD, also known as working stress design (WSD), essentially utilizes a uniform factor of safety, whereas LRFD utilizes different partial factors to better capture the level of certainty with which the various loads and resistances are known. Whereas API 2TOP covers topsides structures, other API documents cover the design of the associated supporting substructures, either fixed (2A-LRFD) or floating (2FPS, etc.). ASD/WSD and LRFD are two separate and distinct design methodologies, which shall not be mixed when designing a given facility, including the topsides and substructure. API 2A-WSD continues to be an acceptable, alternate design choice, and it shall be followed when executing allowable strength or WSD.

The API offshore structures standards constitute a common basis covering those aspects that address design requirements and assessments of offshore structures used by the petroleum and natural gas industries worldwide. Through their application, the intention is to achieve consistent reliability levels appropriate for manned and unmanned offshore structures, whatever the type of structure and the nature of the materials used.

It is important to recognize that structural integrity is an overall concept comprising models for describing actions, structural analyses, design rules, safety elements, workmanship, quality control procedures, and national requirements, all of which are mutually dependent. The modification of one aspect of design in isolation can disturb the balance of reliability inherent in the overall concept or structural system. The implications involved in modifications, therefore, need to be considered in relation to the overall reliability of offshore structural systems.

The API and international standards for offshore structures are intended to provide wide latitude in the choice of structural configurations, materials, and techniques without hindering innovation. Sound engineering judgment is therefore necessary in the use of these standards.

API 2TOP is focused on the topsides structures of offshore platforms. Other standards are focused on the substructures supporting the topsides, whether they be fixed or floating. Previous national and international standards for offshore structures have concentrated on design aspects of the substructures, and the approach to the many specialized features of topsides has been variable and inconsistent, with good practice poorly recorded.

Historically, the design of structural components in topsides has been performed to national or regional codes for onshore structures, modified in accordance with experience within the offshore industry, or to relevant parts of classification society rules. While API 2TOP permits use of national or regional codes, and indeed remains dependent on them for the formulation of component resistance equations, it provides modifications that result in a more consistent level of component safety between substructures and topsides structures.

In some respects, the requirements for topsides structures are the same as, or similar to, those for fixed steel structures; in such cases, reference is made to API 2A-LRFD, Second Edition, with modifications where necessary. Annex A provides background to, and guidance on, the use of API 2TOP and is intended to be read in conjunction with the main body of API 2TOP. The clause numbering in Annex A follows the same structure as that in the body of the normative text in order to facilitate cross-referencing.

Annex B provides an example of the use of national standards for onshore structures in conjunction with this document.

The modifications to ISO 19901-3 that have been made for API 2TOP are based on industry practices applicable to US waters. Regional information relevant to US waters is provided in Annex C.

A comparison of the API documents corresponding to the aforementioned ISO documents is given in the table below, as applicable. In API 2TOP, the relevant API document is referenced wherever appropriate. Where there is not an appropriate API document to reference, the relevant ISO document is referenced.

API/ISO Document Comparison

Topic	API Document	ISO Document
General/Introduction	N/A	19900
Topsides Design	2TOP	19901-3
Fixed Steel Structures—LRFD	2A-LRFD	19902
Fixed Steel Structures—WSD	2A-WSD	N/A
Concrete Structures	N/A	19903
Floating Structures	2FPS	19904-1
TLP	2T	N/A
Mobile Offshore Units—Part 1: Jack-ups	N/A	19905-1
Metocean Considerations	2MET	19901-1
Seismic Design	2EQ	19901-2
Structural Integrity Management (SIM)	2SIM	19902 (as pertains to fixed steel structures) 19904-1 (as pertains to floating structures)
Arctic Offshore Structures	2N	19906
Marine Operations	2MOP	19901-6
Fire and Blast	2FB	19901-3
Weight Control	N/A	19901-5
Plates	2V	N/A
Shells	2U	N/A

NOTE 1 N/A = not applicable or not available.

NOTE 2 There are additional API and ISO documents not listed, including for geotechnical/foundations (API 2GEO), stationkeeping, floating MODUs, and riser design. See ISO 19900 for information on these documents as well as for general information on the basis of the various documents.

Topsides Structure

1 Scope

This document provides requirements for the design, fabrication, transportation, installation, modification, and structural integrity management for the topsides structure for an oil and gas platform; API 2TOP complements API 2A-WSD, API 2A-LRFD, ISO 19903, API 2FPS, API 2T, ISO 19905-1, and API 2N, which give requirements for various forms of substructures. It is based on ISO 19901-3:2010 (Corrected version, 15-Dec-2011) and is consistent with ISO 19901-3:2014 to the fullest extent possible and modified only where needed for API purposes. Requirements in this standard concerning modifications and maintenance relate only to those aspects that are of direct relevance to the structural integrity of the topsides structure.

The actions on the topsides structure and structural components are derived from this document and where necessary, in combination with API, other international standards and the ISO 19900 series. The resistances of structural components of the topsides structure are determined by the use of international or national building codes, as specified in this document. If the topsides structure is integrated with the supporting substructure to help resist global platform forces, the requirements of this standard are supplemented with applicable requirements of the associated substructure such as API 2A-LRFD for fixed steel structures and API 2FPS for floating structures. This document is applicable to:

— topsides of fixed offshore structures;

— topsides on the hulls of floating offshore structures and mobile offshore units as long as interface displacements and internal forces associated with the hull or substructure are correctly accounted for in the analysis (see A.1).

For those parts of floating offshore structures and mobile offshore units that are chosen to be governed by the rules of a recognized classification society, the corresponding class rules supersede the associated requirements of this standard.

This document has limited guidance on corrosion control, alternate structural materials, and other miscellaneous topics that the structural engineer often has to consider.

This document contains requirements for, as well as guidance and information on, the following aspects of topsides structures:

— design, fabrication, transportation, installation, and modification;

— in-service inspection and structural integrity management;

— assessment of existing topsides structures;

— reuse;

— decommissioning, removal, and disposal;

— prevention, control, and assessment of fire, explosions, and other accidental events.

This document applies to structural components including the following:

— structural components in decks, module support frames, and modules;

— flare structures;

— crane pedestal and other crane support arrangements;

— helicopter landing decks (helidecks);