

Specification for Marine Drilling Riser Equipment

API SPECIFICATION 16F
FIRST EDITION, AUGUST 2004

EFFECTIVE DATE: FEBRUARY 1, 2005

REAFFIRMED, AUGUST 2010

ADDENDUM 1, SEPTEMBER 2014

ADDENDUM 2, NOVEMBER 2014



AMERICAN PETROLEUM INSTITUTE

Specification for Marine Drilling Riser Equipment

Upstream Segment

API SPECIFICATION 16F
FIRST EDITION, AUGUST 2004

EFFECTIVE DATE: FEBRUARY 1, 2005

REAFFIRMED, AUGUST 2010

ADDENDUM 1, SEPTEMBER 2014

ADDENDUM 2, NOVEMBER 2014



AMERICAN PETROLEUM INSTITUTE

SPECIAL NOTES

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

API is not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, or federal laws.

Information concerning safety and health risks and proper precautions with respect to particular materials and conditions should be obtained from the employer, the manufacturer or supplier of that material, or the material safety data sheet.

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. Sometimes a one-time extension of up to two years will be added to this review cycle. This publication will no longer be in effect five years after its publication date as an operative API standard or, where an extension has been granted, upon republication. Status of the publication can be ascertained from the API Standards department telephone (202) 682-8000. A catalog of API publications, programs and services is published annually and updated biannually by API, and available through Global Engineering Documents, 15 Inverness Way East, M/S C303B, Englewood, CO 80112-5776.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this standard or comments and questions concerning the procedures under which this standard was developed should be directed in writing to the Director of the Standards department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005. Requests for permission to reproduce or translate all or any part of the material published herein should be addressed to the Director, Business Services.

API standards are published to facilitate the broad availability of proven, sound engineering and operating practices. These standards are not intended to obviate the need for applying sound engineering judgment regarding when and where these standards should be utilized. The formulation and publication of API standards is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

All rights reserved. No part of this work may be reproduced, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Contact the Publisher, API Publishing Services, 1220 L Street, N.W., Washington, D.C. 20005.

FOREWORD

This publication is under jurisdiction of the API Subcommittee on Drilling Well Control Systems. This specification was formulated to serve as an aid to procurement of standardized equipment and materials as well as provide instructions to designers and manufacturers of marine drilling riser equipment. It identifies requirements for design, materials, processing and testing of standardized equipment.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state, or municipal regulation with which this publication may conflict.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

CONTENTS

	Page
1 SCOPE.....	1
1.1 Purpose.....	1
1.2 Coverage.....	1
2 NORMATIVE REFERENCES.....	1
3 DEFINITIONS AND ABBREVIATIONS.....	3
4 COMPONENTS OF A MARINE DRILLING RISER SYSTEM.....	6
4.1 General.....	6
4.2 Functions of Marine Drilling Riser System.....	6
4.3 System Dimensions.....	6
4.4 Tensioner Equipment.....	7
4.5 Riser Spider.....	7
4.6 Surface Diverter.....	8
4.7 Flex/Ball Joint.....	8
4.8 Telescopic Joint and Tensioner Ring.....	8
4.9 Riser Joints.....	8
4.10 Choke, Kill and Auxiliary Lines.....	8
4.11 Lower Riser Adapter.....	8
4.12 Lower Marine Riser Package (LMRP).....	8
4.13 Buoyancy Equipment.....	9
4.14 Riser Pup Joints.....	9
4.15 Riser Handling Tools.....	9
4.16 Special Marine Drilling Riser Components.....	9
5 DESIGN.....	9
5.1 General.....	9
5.2 Service Classifications.....	9
5.3 Riser Loading.....	11
5.4 Determination of Stresses by Analysis.....	11
5.5 Stress Distribution Verification Test.....	11
5.6 Riser Design Load.....	12
5.7 Design for Static Loading.....	12
5.8 Design of Lifting Attachments.....	12
5.9 Design Documentation.....	13
6 MATERIALS AND WELDING REQUIREMENTS.....	13
6.1 General.....	13
6.2 Materials Selection.....	13
6.3 Written Specifications.....	13
6.4 Metallic Materials.....	14
6.5 Chemical Composition.....	14
6.6 Mechanical Properties.....	14
6.7 Qualification Test Coupons (QTC).....	15
6.8 Mechanical Testing.....	15
6.9 Materials for Low-temperature Service.....	16
6.10 Materials to Resist Sulfide Stress Cracking.....	16
6.11 Manufacturing Practice.....	16

6.12	Heat Treating	17
6.13	Welding	17
7	RISER TENSIONER EQUIPMENT	18
7.1	General	18
7.2	Service Ratings	19
7.3	Tension Versus Stroke	19
7.4	Pressure	19
7.5	Design Standards	19
7.6	Tensioner Foundations	20
7.7	Operational Controls and Monitoring Equipment	20
7.8	Temperature Considerations	20
7.9	Fluids	20
7.10	Failure Control Provisions	21
7.11	Marking	21
8	FLEX/BALL JOINTS	21
8.1	Service Classification	21
8.2	Load/Deflection Curve	21
8.3	Design	21
8.4	Material Selection	22
8.5	Dimensions	22
8.6	Testing	22
8.7	Marking	22
9	CHOKE, KILL AND AUXILIARY LINES	23
9.1	Design	23
9.2	Materials	23
9.3	Welding and Quality Process Control	23
10	DRAPE HOSES AND JUMPER LINES FOR FLEX/BALL JOINTS	23
10.1	Service Classification	23
10.2	Design	23
10.3	Process Control	24
11	TELESCOPIC JOINT (SLIP JOINT)	24
11.1	Service Classification	24
11.2	Design	24
11.3	Materials	25
11.4	Dimensions	25
11.5	Process Control	25
11.6	Testing	25
11.7	Marking	26
12	RISER JOINTS	26
12.1	Service Classification	26
12.2	Design	26
12.3	Materials and Welding	27
12.4	Dimensions	27
12.5	Drift	27
12.6	Process Control	27
12.7	Marking	27

	Page
13 BUOYANCY EQUIPMENT	27
13.1 General	27
13.2 Syntactic Foam Modules	27
13.3 Air Can Systems (Informative)	31
14 RISER RUNNING AND HANDLING EQUIPMENT	32
14.1 Introduction	32
14.2 Design	32
14.3 Testing	34
14.4 Material	35
14.5 Repair Welding	37
14.6 Quality Control	37
14.7 Dimensions	39
14.8 Process Control	39
14.9 Marking	40
15 SPECIAL RISER SYSTEM COMPONENTS	40
15.1 General	40
15.2 Service Classification	40
15.3 Design	40
15.4 Testing	40
16 LOWER RISER ADAPTER	40
16.1 General	40
16.2 Marking	40
17 OPERATION AND MAINTENANCE MANUALS	40
17.1 General	40
17.2 Equipment Description	41
17.3 Functional Description	41
17.4 Instructions for Equipment Usage	41
17.5 Maintenance Instructions	41
17.6 Repair Instructions	41
17.7 Warnings and Cautions	41
18 QUALITY CONTROL REQUIREMENTS	41
18.1 General	41
18.2 Sour Service	41
18.3 Equipment Traceability	42
18.4 Quality Control Documents	42
ANNEX A STRESS ANALYSIS	43
ANNEX B DESIGN FOR STATIC LOADING	45
ANNEX C API MONOGRAM	49
ANNEX D BIBLIOGRAPHY	51

Figures

1 Marine Drilling Riser System and Associated Equipment	7
B-1 Stress Distribution Across Section A-A	48

Tables

14.1 Elongation Requirements	36
14.2 Adjustment Factors for Sub-size Impact Specimens	36
C-1 Marking Requirements	50

Specification for Marine Drilling Riser Equipment

1 Scope

1.1 PURPOSE

These specifications establish standards of performance and quality for the design, manufacture, and fabrication of marine drilling riser equipment used in conjunction with a subsea Blowout Preventer (BOP) Stack.

1.2 COVERAGE

This specification provides the requirements for the following major subsystems in the marine drilling riser system:

- a. Riser tensioner equipment.*
- b. Flex/ball joints.*
- c. Choke, kill and auxiliary lines.
- d. Drape hoses and jumper lines for flex/ball joints.
- e. Telescopic joint (slip joint) and tensioner ring.*
- f. Riser joints.*
- g. Buoyancy equipment* (only syntactic foam modules eligible for API Monogram).
- h. Riser running equipment.*
- i. Special riser system components.
- j. Lower riser adapter.*

Note: Only those subsystems above that are marked with an asterisk may be considered for API monogramming.

Section 4 of the specification gives a general description of each of these components listed above. Section 5 provides general design requirements for riser components. Section 6 addresses materials, including the riser pipe. Paragraph 6.13 covers welding of couplings to riser pipe and welding of pipe to pipe. It also covers other types of welds used in the fabrication of riser equipment.

Sections 7 through 16 address the following for each component:

- a. Service classification.
- b. Design.
- c. Materials.
- d. Dimensions.
- e. Process control.
- f. Testing.
- g. Marking.
- h. Packing/Shipping.

2 Normative References

This specification includes by reference, either in total or in part, other API and industry standards listed below. The latest edition of these standards shall be used unless otherwise noted.

API

RP 2RD	<i>Design of Risers for Floating Production Systems (FPSs) and Tension-Leg Platforms (TLPs)</i>
Bull 5C3	<i>Formulas and Calculations for Casing, Tubing, Drill Pipe, and Line Pipe Properties</i>
Spec 5L	<i>Line Pipe</i>
Spec 6A	<i>Wellhead and Christmas Tree Equipment</i>
TR 6AM	<i>Material Toughness</i>
Spec 8C	<i>Specification for Drilling and Production Hoisting Equipment</i>
Spec 9A	<i>Wire Rope</i>
RP 9B	<i>Application, Care and Use of Wire Rope for Oil Field Service</i>
Spec 16A	<i>Drill-through Equipment</i>
Spec 16C	<i>Choke and Kill Systems</i>
Spec 16D	<i>Control Systems for Drilling Well Control Equipment</i>
RP 16Q	<i>Design, Selection, Operation and Maintenance of Marine Drilling Riser Systems</i>