

Recommended Practice for Flowline Connectors and Jumpers

API RECOMMENDED PRACTICE 17R
FIRST EDITION, MARCH 2015



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.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

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 authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be utilized. The formulation and publication of API publications 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.

Users of this Recommended Practice should not rely exclusively on the information contained in this document. Sound business, scientific, engineering, and safety judgment should be used in employing the information contained herein.

All rights reserved. No part of this work may be reproduced, translated, 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, NW, Washington, DC 20005.

Copyright © 2015 American Petroleum Institute

Foreword

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.

Shall: As used in a standard, “shall” denotes a minimum requirement in order to conform to the specification.

Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required in order to conform to the specification.

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 publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually by API, 1220 L Street, NW, Washington, DC 20005.

Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

Contents

	Page
1	Scope 1
2	Normative References 2
3	Terms, Definitions, Acronyms, and Abbreviations 3
3.1	Terms and Definitions 3
3.2	Acronyms and Abbreviations 5
4	System Selection 6
4.1	General 6
4.2	Subsea Jumper System Selection Considerations and Comparisons 6
4.3	Jumper Configurations 11
4.4	Drill Center Layout Guidance 11
4.5	Requirements During Installation (that Influence Jumper Selection) 13
4.6	ROV/ROT Aspects 13
4.7	Multibore Connection Systems 13
5	Connection Equipment 14
5.1	General 14
5.2	Functional Requirements 14
5.3	Design Requirements 15
5.4	Design Verification Requirements 17
5.5	Design Validation 19
5.6	Factory Acceptance Testing of Connectors 23
5.7	Connector Documentation 24
5.8	Pressure Caps 29
5.9	Debris Caps 30
5.10	Tooling 30
6	Jumper Components 31
6.1	General 31
6.2	Pipe 31
6.3	Forgings and Elbows 31
6.4	VIV Suppression 31
6.5	Cathodic Protection 31
6.6	Instrumentation 32
6.7	Thermal Insulation 32
7	Jumper Design 32
7.1	General 32
7.2	Primary Design Requirements for Rigid Jumpers and Spools 33
7.3	Design Analysis Deliverables 35
7.4	Load Cases 35
7.5	Analysis Methodology 37
7.6	Design Considerations for Flexible Pipe Jumpers 37
7.7	Piggability 38

Contents

	Page
8 Jumper Metrology	38
8.1 General	38
8.2 Offshore Survey	38
8.3 Offshore Deployment	38
8.4 Onshore Survey	39
8.5 Post-fabrication Survey	40
9 Fabrication and Testing Considerations for Rigid Jumpers	40
9.1 Applicable Welding Codes	40
9.2 Welding and Pipe Fit-up Consideration	40
9.3 Jumper Assembly	40
9.4 Onshore Fabrication Site Tooling and Requirements	41
9.5 Insulation Considerations	42
9.6 Factory Acceptance Testing	42
9.7 Fabrication Data Books	44
9.8 Transportation and Storage	44
10 Jumper Installation and Recovery	45
10.1 General Installation and Recovery System Requirements	45
10.2 Installation and Recovery Equipment	45
10.3 Operations Manuals	46
10.4 Jumper Loadout	47
10.5 Preinstallation and Recovery Activities	49
10.6 Jumper Installation	50
10.7 Jumper Recovery	51
10.8 Hazards	51
Bibliography	52
Figures	
1 Examples of Connector Types	7
2 Typical Jumper Configurations	12
3 Bending Capacity Chart Example	27
4 Torsion Capacity Chart Example	27
Table	
1 Example Jumper Load Cases	36

Recommended Practice for Flowline Connectors and Jumpers

1 Scope

This recommended practice (RP) addresses specific requirements and recommendations for subsea flowline connectors and jumpers within the frameworks set forth by recognized and accepted industry specifications and standards. As such, it does not supersede or eliminate any requirement imposed by any other industry specification.

This RP covers subsea flowline connectors and jumpers used for pressure containment in both subsea production of oil and gas, and subsea injection services. Equipment within the scope of this document is listed below.

— Equipment used to make the following subsea connections are included:

- pipeline end terminations to manifolds,
- pipeline end terminations to trees,
- pipeline end terminations to riser bases,
- manifolds to trees,
- pipeline inline sleds to other subsea structures.

— The following connection components and systems are included:

- jumper assemblies,
- monobore connectors systems,
- multibore connectors systems,
- pressure and flooding caps,
- connector actuation tools.

The following components and their applications are outside the scope of this RP:

- subsea structures,
- hydraulic, electrical, and fiber optic flying leads,
- umbilicals,
- pig launcher/receiver equipment,
- specialized ROV and other tooling.

Equipment for use in high-pressure high-temperature (HPHT) environments is beyond the scope of this document (see API 17TR8 for guidance on subsea HPHT applications).

2 Normative References

The following referenced documents are indispensable for the application of this document. 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 2A-WSD, *Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design*

API Recommended Practice 2X, *Ultrasonic and Magnetic Examination of Offshore Structural Fabrication and Guidelines for Qualification of Technicians*

API Specification 6A, *Specification for Wellhead and Christmas Tree Equipment 20th Edition, 2010*

API Standard 6X, *Design Calculations for Pressure-containing Equipment 1st Edition, 2014*

API Specification 17A, *Design and Operation of Subsea Production Systems-General Requirements and Recommendations, 4th Edition, 2006*

API Recommended Practice 17B, *Recommended Practice for Flexible Pipe*

API Specification 17D, *Design and Operation of Subsea Production Systems-Subsea Wellhead and Tree Equipment, 2nd Edition, 2012*

API Recommended Practice 17H, *Remotely Operated Tools and Interfaces on Subsea Production Systems*

API Specification 17J, *Specification for Unbonded Flexible Pipe*

API Specification 17K, *Specification for Bonded Flexible Pipe*

ASME *Boiler and Pressure Vessel Code* ¹, Section VIII Division 2: *Alternative Rules for Construction of Pressure Vessels*

ASME *Boiler and Pressure Vessel Code*, Section VIII Division 3: *Alternative Rules for Construction of High Pressure Vessels*

ASME B31.3, *Process Piping*

ASME B31.4, *Pipeline Transportation Systems for Liquids and Slurries*

ASME B31.8, *Gas Transmission and Distribution Piping Systems*

AWS D1.1/D1.1M ², *Structural Welding Code—Steel*

DNV ³, *Rules for the Classification of Mobile Units*, Part 3, Chapter 1, Section 10

ISO 15590-1 ⁴, *Induction bends, fittings and flanges for pipeline transportation systems—Part 1: Induction bends*

¹ ASME International, 2 Park Avenue, New York, New York 10016-5990, www.asme.org.

² American Welding Society, 8669 NW 36 Street, #130, Miami, Florida 33166-6672, www.aws.org.

³ Det Norske Veritas, Veritasveien 1, 1322, Hovik, Oslo, Norway, www.dnv.com.

⁴ International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.