

Recommended Practice for Subsea Pump Module Systems

API RECOMMENDED PRACTICE 17X
FIRST EDITION, OCTOBER 2021



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. The use of API publications is voluntary. In some cases, third parties or authorities having jurisdiction may choose to incorporate API standards by reference and may mandate compliance.

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.

Classified areas may vary depending on the location, conditions, equipment, and substances involved in any given situation. Users of this Recommended Practice should consult with the appropriate authorities having jurisdiction.

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.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to ensure 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 proper, 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 accordance 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, 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, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001-5571.

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.

The verbal forms used to express the provisions in this document are as follows.

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

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

May: As used in a standard, “may” denotes a course of action permissible within the limits of a standard.

Can: As used in a standard, “can” denotes a statement of possibility or capability.

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, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001. 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, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001.

Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001, standards@api.org.

Currently in preview, click buy full version

Contents

	Page
1 Scope.....	1
2 Normative References	1
3 Terms, Definitions, Acronyms, and Abbreviations	2
3.1 Terms and Definitions	2
3.2 Acronyms and Abbreviations	5
4 System Design Requirements	6
4.1 System Configuration	6
4.2 General Design Requirements	8
4.3 Rotor Dynamic Analysis.....	11
5 Component Design Requirements.....	12
5.1 Pressure Casing	12
5.2 Static Seals	13
5.3 Clearances and Wear	13
5.4 Pump Bearings	13
5.5 Rotor Balancing	14
5.6 Thrust Management.....	14
5.7 Mechanical Shaft Seals	14
5.8 Motor Design	15
5.9 Shaft Couplings	17
5.10 Pump Control Systems	18
5.11 Motor Instrumentation.....	19
5.12 Pump Module Requirements	19
6 Materials	20
6.1 Process Wetted Materials	20
6.2 Pump Module Structure and Piping	21
6.3 Pump and Motor Casing Specifications.....	21
7 Marking and Manufacturing Documentation	22
7.1 Manufacturing Documentation.....	22
7.2 Marking	22
8 Qualification and Testing.....	24
8.1 Qualification Testing.....	24
8.2 Pump Performance Testing.....	27
8.3 Factory Acceptance Testing	30
8.4 Site Receiving Testing.....	32
8.5 System Integration Testing.....	32
9 Transportation and Preservation.....	32
9.1 General	32
9.2 Lifting Arrangements	32
9.3 Preservation.....	32
10 Installation and Intervention.....	34
10.1 General	34
10.2 Retrieval.....	34

Contents

	Page
11 Reliability, Operations and Maintenance.....	34
11.1 Reliability and Maintenance Data	34
11.2 Module Operations and Maintenance.....	35
11.3 Module Retrieval.....	35
Annex A (normative) Pump Design Data Sheets Minimum Requirements.....	36
Annex B (informative) Qualification Testing.....	47
Annex C (informative) Application Specific Testing	53
Annex D (informative) Pump Manufacturing Data Check List and Schedule.....	58
Bibliography.....	67

Figures

1 Subsea Pump System Classification and Designation	7
2 Vibration Limits for GVF <40 % in a Vertical Rotor Dynamic Pump with Hydrodynamic Bearings	28
3 Vibration Limits for GVF >40% in a Vertical Rotor Dynamic Pump with Hydrodynamic Bearings	28
4 Illustration of Recommended Placement for Proximity Probes During Testing.....	29
B.1 Location of Test Points on the Operational Envelope	51
C.1 Location of Test Points on the Operational Envelope	56
D.1 Manufacturer Drawing and Data Requirement List.....	59
D.2 Manufacturer Drawing and Data Requirement List (continued).....	60
D.3 Manufacturer Drawing and Data Requirement List (continued).....	61

Tables

1 Pump Classification Type Identification	8
2 Pump Module Interfaces.....	11
3 Insulation Thermal Class used for Subsea Motors	16
4 Bolting Requirement	21
5 Classification by Installation Depth	22
6 Classification by Sea Water Temperature	23
7 Classification by Process Fluid Temperature	23
8 Casing Rated Pressure Class.....	23
9 Pre-concept Configuration Changes.....	25
10 Scope of Test Object.....	26
A.1 Design Basis (Input) Datasheet	36
A.2 Production Datasheet	38
A.3 Umbilical Requirements (Input and Output) Datasheet	40
A.4 Control Requirements (Input and Output) Datasheet	41
A.5 Pump Data Datasheet	41
A.6 Barrier Fluid System Datasheet.....	42
A.7 Pump Rating and Material Details Datasheet.....	42

Contents

	Page
A.8 Motor Design Datasheet	43
A.9 Equivalent Rated Operating Point (Input and Output) Datasheet	44
A.10 Test Data Collection Requirement Datasheet	45
B.1 Suggested Start-up and Shutdown Test Process for Qualification Testing	48
B.2 Suggested Start-up and Shut-down Test Order for Qualification Testing	49
B.3 Test Points and Their Locations on Operational Envelope	50
B.4 Suggested Extended Performance Test Process for Qualification Testing	51
C.1 Suggested Start-up and Shut-down Test Process for Application Specific Testing	53
C.2 Suggested Start-up and Shut-down Test Order for Application Specific Testing	54
C.3 Suggested Datapoint Distribution for Collecting GVF Related Reliability Data	56
C.4 Suggested Extended Performance Test Process for Application Specific Testing	57
D.1 Details and Comments to Figure D.1, Figure D.2, and Figure D.3	61

Currently in preview, click buy full version

Introduction

API RP 17X. relies on the principles of API Std 610 and API Std 676. The intent of this recommended practice (RP) is to provide requirements, recommendations and guidance for the specification, design, construction, transportation, installation, maintenance, operation of subsea pumps. It is intended to be applied in conjunction with the API 17 suite of documents. This RP is not intended to inhibit a manufacturer from offering innovative solutions for pumping or engineering solutions for the individual applications.

Currently in preview, click buy full version

Currently in preview, click buy full version

Recommended Practice for Subsea Pump Module Systems

1 Scope

This RP provides guidance for the design, manufacture, installation, and operation of subsea pumps, including rotary displacement and rotor dynamic types for single phase, and multi-phase services. The RP applies to all subsea pump modules placed at or above the mud line.

API RP 17X describes subsea pump modules that are either directly designed or “marinized” for use in an offshore/marine environment. Potential applications include:

- Offshore use near subsea wells to boost production and enhance oil recovery (EOR) from partially depleted oil fields, or:
- To boost flowline pressures to flow at higher rates or greater distances or when flowing subsea wells up to a surface facility.

The design of such system solutions requires additional equipment to power, control and otherwise operate the pumps. These are not within the scope of this document and can be found in API Std 17F, API Std 17G, API 17Z, and other relevant standards for these and associated equipment on the host facility or site.

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, except that new editions may be used on issue and shall become mandatory upon the effective date specified by the publisher or six months from the date of the revision (where no effective date is specified).

API Specification 6A, *Specification for Wellhead and Tree Equipment*

API Recommended Practice 17A, *Design and Operation of Subsea Production Systems—General Requirements and Recommendations*

API Specification 17D, *Design and Operation of Subsea Production Systems—Subsea Wellhead and Tree Equipment, Second Edition, May 2011, Addendum 1, September 2015*

API Standard 17F, *Standard for Subsea Production Control Systems*

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

API Recommended Practice 17P, *Design and Operation of Subsea Production Systems—Subsea Structures and Manifolds*

API Recommended Practice 17V, *Recommended Practice for Analysis, Design, Installation, and Testing of Safety Systems for Subsea Applications*

API Specification 20E, *Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries*

API Specification 20F, *Corrosion-resistant Bolting for Use in the Petroleum and Natural Gas Industries*

API Standard 541, *Form-wound Squirrel Cage Induction Motors—375 kW (500 Horsepower) and Larger*

API Standard 546, *Brushless Synchronous Machines— 500kVA and Larger*