Openhole Isolation Equipment

API SPECIFICATION 19OH
FIRST EDITION, JANUARY 2018

EFFECTIVE DATE: JULY 2018

REAFFIRMED, DECEMBER 2024



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 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 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.

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, Washington, DC 20001.

Copyright © 2018 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.

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, 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, Washington, DC 20001.

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

Contents

Page

1 Scope . . . 1
2 Normative References . . . 1
3 Terms and Definitions . . . 2
4 Abbreviations and Symbols . . . 5
5 Functional Requirements . . . 6
5.1 General . . . 6
5.2 Type Description . . . 6
5.3 Well Parameters . . . 6
5.4 Operational Parameters . . . 7
5.5 Environmental Compatibility . . . 7
5.6 Design Validation . . . 8
5.7 Quality Control . . . 8
5.8 Optional Testing . . . 8
6 Technical Specification . . . 8
6.1 General . . . 8
6.2 Technical Characteristics . . . 8
6.3 Design Requirements . . . 8
6.4 Materials . . . 9
6.5 Design Ratings . . . 11
6.6 Design Verification . . . 11
6.7 Design Validation Requirements . . . 11
6.8 Design Changes . . . 12
6.9 Design Scaling . . . 13
6.10 Design Report . . . 13
7 Supplier/Manufacturer Requirements . . . 13
7.1 General . . . 13
7.2 Documentation and Data Control . . . 13
7.3 Material Requirements . . . 15
7.4 Heat Treating . . . 17
7.5 Quality Requirements . . . 18
7.6 Traceability . . . 18
7.7 Component Dimensional Inspection . . . 18
7.8 Welds . . . 20
7.9 Hardness Inspection of Components . . . 20
7.10 NDE of Components . . . 20
7.11 Shear Device Verification . . . 22
7.12 Functional Testing (Factory Acceptance Testing) . . . 22
7.13 Calibration Systems . . . 22
7.14 Visual Inspections . . . 23
7.15 Coatings and Overlays . . . 23
7.16 Bonding Evaluations . . . 23
8 Repair/Redress/Remanufacture Requirements . . . 23
9 Shipping, Handling, and Storage . . . 23

Contents

Page

Annex A (informative) API Monogram Program—Use of the API Monogram by Licensees 24

Annex B (normative) Validation Requirements for Inflatable, Expandable, Openhole Mechanical Packers, and Bridge Plugs 28

Annex C (normative) Validation Test Requirements for Swellable Packers 31

Annex D (informative) Additional Validation Test Requirements for Swellable Packers 36

Bibliography 37

Figures

C.1 Pressure Rating Vs Hole Size 34
C.2 Pressure Rating vs Length 34
C.3 Combined Performance Interpolation of Swell Percentage and Length 35

Tables
1 Design Validation Grade Hierarchy 12
2 Quality Grade Requirements Summary 19
3 Sampling Plan Unit Counts 21

Introduction

This Specification has been developed by users/purchasers and suppliers/manufacturers of openhole isolation equipment intended for use in the petroleum and natural gas industry worldwide. This Specification is intended to give requirements and information to both parties in the selection, manufacture, testing, and use of openhole isolation equipment. Further, this Specification addresses supplier/manufacturer requirements that set the minimum requirements with which suppliers/manufacturers shall comply to claim conformity with this Specification.

This Specification has been structured to allow for grades of increased requirements both in quality control and design validation. These variations allow the user/purchaser to select the grade required for a specific application for openhole isolation equipment.

The quality grades provide the user/purchaser the choice of requirements to meet a specific preference or application. Additional quality requirements may be specified by the user/purchaser as supplemental requirements.

Standard design validation grades provide the user/purchaser the choice of requirements to meet a specific preference or application. Design validation grade V3 OH is the minimum grade and represents equipment where the validation method has been defined by the supplier/manufacturer. The complexity and severity of the validation testing typically increases as the grade number decreases.

Users of this Specification should be aware that requirements above those outlined in this Specification may be needed for individual applications. This Specification is not intended to inhibit a supplier/manufacturer from offering, or the user/purchaser from accepting, alternative equipment or engineering solutions. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the supplier/manufacturer should identify any variations from this Specification.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process. This Specification was initiated utilizing information provided by the Advanced Well Equipment Standards Group RP 3362.

Openhole Isolation Equipment

1 Scope

This Specification covers requirements and guidelines for openhole isolation equipment and bridge plugs as defined herein. Openhole isolation equipment includes swellable packers, inflatable packers, expandable packers, and openhole packers that are designed for use in the petroleum and natural gas industries. This Specification provides requirements for design verification, design validation, manufacturing, quality, shipping, handling and storage, and related supporting topics.

Included within this Specification are four Annexes, of them, B and C are normative, and A and D are informative.

Requirements for the end connections to the well conduit are not included in this Specification. Also not covered are downhole anchoring devices (see API 11D1); cup style packers; and requirements for the application, installation, and use of openhole isolation equipment. Equipment and technology that are covered by other API specifications and standards are exempted from this specification, such as:

— production packers,

— liner hanger systems,

— service tools,

— test tool packers.

Repairs, remanufacturing, and redress are excluded from this Specification.

2 Normative References

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Spec 5CRA, *Specification for Corrosion Resistant Alloy Seamless Tubes for Use as Casing, Tubing and Coupling Stock*

API Specification 5CT, *Specification for Casing and Tubing*

API Spec Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

ASNT RP SNT-TC-1A [1], *Non-Destructive Testing*

ASTM D412 [2], *Standard Test Methods for Vulcanized and Thermoplastic Elastomers—Tension*

ASTM D429, *Standard Test Methods for Rubber Property—Adhesion to Rigid Substrates*

ASTM D638, *Standard Test Method of Tensile Properties of Plastics*

ASTM D1414, *Standard Test Methods for Rubber O-Rings*

[1] American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, New York, 10036.
[2] American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohoken, PA 19427-2959.