Dry Gas Sealing Systems for Axial, Centrifugal, Rotary Screw Compressors and Expanders

API STANDARD 692
FIRST EDITION, JUNE 2018

REAFFIRMED, DECEMBER 2025



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.

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 patents.

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.

A bullet (•) at the beginning of a subsection or paragraph indicates that either a decision is required or further information is to be provided by the purchaser.

NOTES following a paragraph are informative.

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 and updated quarterly 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

Part 1: General Requirements

1 Scope . . . 1
1.1 General . . . 1
1.2 Part 1-General Requirements . . . 1

2 Normative References . . . 1

3 Terms, Definitions, Acronyms, and Abbreviations . . . 3
3.1 Terms and Definitions . . . 3
3.2 Acronyms and Abbreviations . . . 11

4 General . . . 12
4.1 Unit Responsibility . . . 12
4.2 Nomenclature . . . 12

5 Requirements . . . 12
5.1 Standard Fasteners and Units of Measure . . . 12
5.2 Statutory Requirements . . . 13
5.3 Alternative Designs . . . 13
5.4 Documentation Requirements . . . 13
5.5 Conflicting Requirements . . . 13

6 Basic Design . . . 13
6.1 General . . . 13
6.2 System Design . . . 14
6.3 Seal Gas, Buffer Gas, Secondary Seal Gas, and Separation Gas . . . 15
6.4 Site and Utility Conditions . . . 15
6.5 Gas Conditioning System . . . 16
6.6 Gas Velocities . . . 16
6.7 System Drain Connections . . . 16
6.8 Alarms and Shutdowns . . . 17
6.9 System Analysis Failures Modes . . . 17

7 Special Tools . . . 18

8 Coatings, Insulation, and Heat Tracing . . . 18

9 Inspection, Testing, and Preparation for Shipment . . . 18
9.1 General . . . 18
9.2 Material Inspection . . . 19
9.3 Radiography . . . 19
9.4 Magnetic Particle Inspection . . . 20
9.5 Liquid Penetrant Inspection . . . 20
9.6 Positive Material Identification (PMI) . . . 20
9.7 Testing . . . 20
9.8 Preparation for Shipment . . . 20
9.9 Package Markings . . . 21

10 Vendor's Data . . . 21
10.1 General . . . 21
10.2 Proposals . . . 22
10.3 Contract Data . . . 24

Contents

Page

Annex A (normative) Vent Study . . . 27
Annex B (informative) Phase Maps . . . 28
Annex C (informative) Dry Gas Sealing System Retrofit Checklist . . . 30
Bibliography . . . 32

Figures
B.1 Typical Phase Diagram . . . 29

Tables
1 Minimum Gas Velocities . . . 16
C.1 Dry Gas Sealing System Retrofit Checklist . . . 30

Part 2: Dry Gas Seals

1 Scope . . . 1
2 Normative References . . . 1
3 Terms, Definitions, Acronyms, and Abbreviations . . . 1
4 General . . . 1
5 Requirements . . . 1
6 Basic Design . . . 1
6.1 General . . . 1
6.2 Seal Types . . . 2
6.3 Tandem Seal with Intermediate Labyrinth . . . 2
6.4 Tandem Seal . . . 2
6.5 Double Seal . . . 3
6.6 Single Seal . . . 4
6.7 Separation Seals . . . 5
6.8 Process Side Seals . . . 6
6.9 Seal Requirements . . . 8
6.10 Seal Cartridges . . . 9
6.11 Balance and Overspeed . . . 10
6.12 Labyrinth Seal Clearances . . . 10
6.13 Minimum Speed/Slow Roll/Turning Gear/Ratcheting . . . 11
6.14 Reverse Pressurization . . . 11
6.15 Marking and Rotation Arrows . . . 11
6.16 Materials . . . 11
7 Accessories-Special Tools . . . 12
8 Inspection, Testing, and Preparation for Shipment . . . 12
8.1 General . . . 12
8.2 Inspection . . . 12
8.3 Testing . . . 12
8.4 Preparation for Shipment . . . 12
9 Vendor's Data . . . 13

Contents

Page

9.1 General . . . 13
9.2 Proposals . . . 13
9.3 Contract Data . . . 13

Annex A (informative) Datasheets . . . 15

Annex B (normative) Dry Gas Seal Test Procedures . . . 25

Annex C (informative) Seal Nomeclature . . . 49

Annex D (informative) Dry Gas Seal Selection Guide . . . 54

Annex E (informative) Separation Seals . . . 56

Annex F (informative) Process Side Seal . . . 62

Annex G (informative) Hysteresis Test . . . 67

Annex H (informative) Dry Gas Seal Materials . . . 69

Annex I (normative) Vendor Drawing and Data Requirements (VDDR) . . . 81

Annex J (informative) Inspector's Checklist . . . 88

Annex K (normative) Post-test Dry Gas Seal Visual Inspection . . . 90

Figures

1 Tandem Seal with Intermediate Labyrinth Schematic . . . 3
2 Tandem Seal Schematic . . . 3
3 Double Seal Schematic . . . 4
4 Single Seal Schematic . . . 4
5 Non-contacting Bushing Seal Schematic . . . 5
6 Separation Labyrinth Seal Schematic . . . 5
7 Contacting Bushing Seal Schematic . . . 6
8 Labyrinth Seal Schematic . . . 6
9 Abradable Process Side Seal Schematic . . . 7
10 Non-contacting Bushing Seal Schematic . . . 7
C.1 Tandem Seal with an Intermediate Labyrinth . . . 50
C.2 Tandem Seal . . . 51
C.3 Double Seal . . . 52
C.4 Single Seal . . . 53
E.1 Cross-section Showing a Separation Seal . . . 56
E.2 Separation Seal Non-contacting Bushing Schematic . . . 57
E.3 Showing Separation Seal Non-contacting Bushing Clearance at Cold/Static and Hot/Dynamic Conditions . . . 58
E.4 Separation Seal Labyrinth Schematic . . . 58
E.5 Showing Separation Seal Labyrinth Clearance at Cold/Static and Hot/Dynamic Conditions . . . 59
E.6 Separation Seal Contacting Bushing Schematic . . . 60
E.7 Show Expansions of the Separation Seal Contacting Bushing and Rotating Surface . . . 61
F.1 Cross-section Showing a Process Side Seal . . . 62
F.2 Process Side Seal Standard Labyrinth Schematic . . . 63
F.3 Showing Process Labyrinth Clearance at Cold/Static and Hot/Dynamic Conditions . . . 64
F.4 Process Side Seal Abradable Labyrinth Schematic . . . 64

Contents

Page

F.5 Showing Process Abradable Labyrinth Clearance at Cold/Static and Hot/Dynamic Conditions . . . 65
F.6 Process Side Seal Non-contacting Bushing Schematic . . . 65
F.7 Showing Process Non-contacting Bushing Clearance at Cold/Static and Hot/Dynamic Conditions . . . 66
G.1 Stationary Subassembly Definitions . . . 67
G.2 Typical Hysteresis Test Plot . . . 68
H.1 Histogram Comparing the Elastic Modulus (kN/mm^2) of Selected Face Materials . . . 71
H.2 Histogram Comparing the Strength (N/mm^2) of Selected Face Materials . . . 72
H.3 Histogram Comparing the Fracture Toughness (MPa.m$^{0.5}$) of Selected Face Materials . . . 72
H.4 Histogram Comparing Density (tonnes/m^3) of Selected Face Materials . . . 73
H.5 Histogram Comparing Hardness (HV) of Selected Face Materials . . . 73
H.6 Histogram Comparing Thermal Expansion (m/m/K×10^{-6}) of Selected Face Materials . . . 74
H.7 Histogram Comparing Thermal Conductivity (W/mK) of Selected Face Materials . . . 74
K.1 Stages in Disassembly of a Tandem Seal Arrangement . . . 90
K.2 Stages in Disassembly of a Double Seal Arrangement . . . 91
K.3 Stages in Disassembly of a Single Seal Arrangement . . . 92
K.4 Separation Seals . . . 92
K.5 Steelwork Inspection Sites . . . 96

Tables
1 Perpendicularity Limits . . . 8
H.1 Seal Face Pairing Selection Guidance . . . 75
H.2 Seal Cartridge Materials . . . 76
H.3 Static and Dynamic Sealing Element Material Temperature Limits . . . 78
H.4 Spring Materials . . . 78
H.5 Fastener Materials . . . 79
H.6 Pin Materials . . . 79
H.7 Centering Device Materials . . . 80
H.8 Labyrinth Materials . . . 80
J.1 Inspector's Checklist . . . 88
K.1 Seal Face Damage Examples . . . 93
K.2 Seal Metallic Components . . . 97
K.3 Seal Static and Dynamic Sealing Elements . . . 98
K.4 Seal Centering Elements . . . 100
K.5 Labyrinths and Carbon Rings . . . 100

Part 3: Dry Gas Seal Support Systems

1 Scope . . . 1
2 Normative References . . . 1
3 Terms, Definitions, Acronyms, and Abbreviations . . . 1
4 General . . . 1
5 Requirements . . . 1
5.1 Standard Fasteners and Units of Measure . . . 1
5.2 Statutory Requirements . . . 1
5.3 Alternative Designs . . . 1

Contents

Page

5.4 Documentation Requirements . . . 1

6 Basic Design . . . 1
6.1 General . . . 2
6.2 Accessibility . . . 4
6.3 Tandem Seal-Seal Gas System . . . 4
6.4 Tandem Seal with Intermediate Labyrinth-Secondary Seal Gas System . . . 6
6.5 Tandem Seal-Primary and Secondary Vent Systems . . . 7
6.6 Tandem Seal-Drain System . . . 8
6.7 Double Seal-Seal Gas System . . . 9
6.8 Double Seal-Buffer Gas System . . . 11
6.9 Temperature Monitoring . . . 12
6.10 Double Seal-Vent System . . . 12
6.11 Double Seal-Drain System . . . 13
6.12 Single Seal-Seal Gas System . . . 14
6.13 Separation Gas System . . . 14
6.14 Module A-Alternate Seal Gas Supply . . . 16
6.15 Module B-Gas Conditioning System . . . 16
6.16 Duplex Filter System (Module C) . . . 17

7 Major Components . . . 18
7.1 General . . . 18
7.2 Cooler . . . 18
7.3 Separator . . . 20
7.4 Booster . . . 21
7.5 Heater . . . 23
7.6 Filters . . . 23
7.7 Transfer Valves . . . 24
7.8 Control Valves . . . 25
7.9 Liquid Traps for Cavity Drains . . . 25
7.10 Pressure-relieving Devices . . . 26

8 Materials . . . 26
8.1 General . . . 26
8.2 Low-temperature Service . . . 30

9 Piping and Tubing Systems . . . 30
9.1 General . . . 30
9.2 Threads . . . 32
9.3 Valves . . . 32

10 Recommended Alarms . . . 33

11 Instrumentation, Control, and Electrical Systems . . . 37
11.1 General . . . 37
11.2 Alarm and Shutdown Systems . . . 38
11.3 Instrumentation . . . 39
11.4 Electrical Systems . . . 42

12 Panels and Skids . . . 43
12.1 General . . . 43

13 Dry Gas Seal Support System Inspection and testing . . . 45

Contents

Page

13.1 General . . . 45
13.2 Radiography . . . 46
13.3 Testing . . . 47
13.4 Nameplates . . . 49
13.5 Preparation for Shipment . . . 50

14 Vendor's Data . . . 51
14.1 General . . . 51
14.2 Proposals . . . 51
14.3 Contract Data . . . 51

Annex A (informative) Datasheets . . . 52

Annex B (normative) System Diagrams . . . 64

Annex C (informative) Inspector's Checklist . . . 81

Annex D (informative) Module Comparison . . . 83

Annex E (normative) Vendor Drawing and Data Requirements (VDDR) . . . 86

Annex F (informative) Gas Filter Rating, Testing, and Performance . . . 92

Figures
1 Recommended Separator Sizing for Liquid Knockout . . . 21
B.1 Tandem Seal—Seal Gas Supply . . . 65
B.2 Tandem Seal—Seal Gas Optional Modules . . . 66
B.3 Tandem Seal—Secondary Seal Gas Supply . . . 67
B.4 Tandem Seal—Secondary Seal Gas Optional Modules . . . 68
B.5 Tandem Seal—Vents . . . 69
B.6 Tandem Seal—Vent Options . . . 70
B.7 Tandem Seal—Drains . . . 71
B.8 Tandem Seal—Drain Options . . . 71
B.9 Double Seal—Buffer Gas Supply . . . 72
B.10 Double Seal—Buffer Gas Supply Options . . . 73
B.11 Double Seal—Seal Gas Supply . . . 74
B.12 Double Seal—Seal Gas Supply Options . . . 75
B.13 Double Seal—Vent . . . 76
B.14 Double Seal—Drains . . . 77
B.15 Double Seal—Drain Options . . . 77
B.16 Separation Gas Supply . . . 78
B.17 Separation Gas Supply Options . . . 79
B.18 Gas Conditioning System . . . 80
B.19 Gas Conditioning System—Separator Drain Options . . . 80

Tables
1 Pressure Rating of Dry Gas Seal Systems . . . 2
2 Minimum Materials Requirement—Cooling Water . . . 27
3 Minimum Material Requirements Dry Gas Seal Support Systems . . . 27
4 Minimum Pipe Wall Thicknesses . . . 28
5 Minimum Tubing Wall Thicknesses . . . 28
6 Recommended Alarms for Tandem Seals . . . 34

Contents

Page

7 Recommended Alarms for Tandem Seals with Intermediate Labyrinth 35
8 Recommended Alarms for Double Seals 36
9 Recommended Alarms for Gas Conditioning Unit. 37
C.1 Inspector's Checklist 81
F.1 Relative Size Comparison of Particles of Some Common Materials 93
F.2 Typical Seal Operating Clearances 93
F.3 Element Beta Ratio and Efficiency from Particle Count 94

Part 4: Installation and Commissioning

1 Scope 1
2 Normative References 1
3 Terms, Definitions, Acronyms, and Abbreviations 1
4 General 1
5 Requirements. 1
5.1 Standard Fasteners and Units of Measure. 1
5.2 Statutory Requirements 1
5.3 Alternative Designs. 1
5.4 Documentation Requirements. 1
6 Installation Design. 1
7 Receiving, Inspection, and Storage 2
7.1 General 2
7.2 Receiving and Inspection. 2
7.3 Storage 3
8 Installation and Construction. 4
8.1 General 4
8.2 Dry Gas Seal Installation 4
8.3 Dry Gas Seal Support System Installation. 6
9 Field Commissioning 6
10 Start-up. 7
Annex A (informative) Installation Checklist. 9
Annex B (normative) Cleaning/Flushing of Field Installed Piping 10
Annex C (informative) Commissioning Checklist. 12
Annex D (informative) Start-up Checklist 13

Dry Gas Sealing Systems for Axial, Centrifugal, and Rotary Screw Compressors and Expanders Part 1—General Requirements

1 Scope

1.1 General

This standard covers the minimum dry gas sealing system requirements in association with axial, centrifugal, and rotary screw compressors and expanders for use in the petroleum, chemical, and gas industry services as described in API 617 and API 619.

API 692 does not apply to other types of shaft seals such as clearance seals, restrictive ring seals, or oil seals.

1.2 Part 1—General Requirements

This part of API 692 contains information pertinent to all equipment covered by the other parts of API 692. It shall be used in conjunction with the following parts of API 692 as applicable.

— Part 2—Dry Gas Seals.

— Part 3—Dry Gas Seal Support Systems.

— Part 4—Installation and Commissioning.

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 520, *Sizing, Selection, and Installation of Pressure-relieving Devices—Part I: Sizing and Selection*

API Recommended Practice 520, *Sizing, Selection, and Installation of Pressure-relieving Devices—Part II: Installation*

API Standard 521, *Pressure-relieving and Depressuring Systems*

API Standard 526, *Flanged Steel Pressure-relief Valves*

API Recommended Practice 551, *Process Measurement*

API Recommended Practice 571, *Damage Mechanisms Affecting Fixed Equipment in the Refining Industry*

API Standard 594, *Check Valves: Flanged, Lug, Wafer, and Butt-welding*

API Standard 600, *Steel Gate Valves—Flanged and Butt-welding Ends, Bolted Bonnets*

API Standard 602, *Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries*

API Standard 607, *Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats*