

# **Threading and Gauging of Rotary Shouldered Connections**

API SPECIFICATION 7-2  
SECOND EDITION, JANUARY 2017

API MONOGRAM PROGRAM EFFECTIVE DATE: JUNE 6, 2017

ERRATA 1, AUGUST 2017  
ERRATA 2, NOVEMBER 2019  
ADDENDUM 1, MARCH 2020  
(API MONOGRAM PROGRAM EFFECTIVE DATE: OCTOBER 1, 2020)

## 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.

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

Users of this specification 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 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 to comply with authorities having jurisdiction.

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.

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.

*Copyright © 2017 American Petroleum Institute*

[This is a preview. Click here to purchase the full publication.](#)

## 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](mailto:standards@api.org).



## Contents

	Page
<b>1 Scope</b>	<b>1</b>
1.1 Coverage	1
1.2 Application of the API Monogram	
<b>2 Normative References</b>	<b>1</b>
<b>3 Terms, Definitions, Symbols, and Abbreviations</b>	<b>2</b>
3.1 Terms and Definitions	2
3.2 Symbols	5
3.3 Abbreviations	7
<b>4 General Information</b>	<b>7</b>
4.1 General	7
4.2 Purchaser Supplied Information	8
<b>5 Threading</b>	<b>8</b>
5.1 Thread Profile and Dimensions	8
5.2 Bevels for Drill Collars and Tools that Mate Directly with Drill Collars	10
5.3 Low-torque Feature	14
<b>6 Product Optional Features</b>	<b>14</b>
6.1 General	14
6.2 Stress-relief Features	14
6.3 Optional Profile Features	17
6.4 Benchmarks	18
6.5 Surface Treatment	20
6.6 Cold Rolling	20
6.7 Break-in	20
<b>7 Product Gauging</b>	<b>20</b>
7.1 Gauging	20
7.2 Standoff Measurement	21
7.3 Gauge Contact Points	23
7.4 Lead Measurement	23
7.5 Taper Measurement	24
7.6 Thread Height Measurement and Gauges	24
<b>8 Gauges for Rotary Shouldered Connections</b>	<b>24</b>
8.1 Gauge Relationship	24
8.2 Gauge Specifications	25
<b>9 Gauge Calibration</b>	<b>32</b>
9.1 Calibration System	32
9.2 Acceptance Criteria	32
9.3 Gauge Measurement Methods	32
9.4 Gauge Certification	37
<b>Annex A (informative) API Monogram Program Use of the API Monogram by Licensees</b>	<b>38</b>
<b>Annex B (informative) Tables in SI Units</b>	<b>42</b>
<b>Annex C (informative) Tables in USC Units</b>	<b>54</b>
<b>Annex D (informative) USC Units Conversion Table</b>	<b>66</b>
<b>Annex E (informative) Calculations</b>	<b>67</b>
<b>Annex F (informative) Gauging Elements of New Rotary Shouldered Connections</b>	<b>74</b>

## Contents

Page

Annex G (normative) Care and Use of Working Gauges . . . . .	78
Annex H (informative) Care and Use of Master Gauges . . . . .	79
Annex I (informative) Shipment of Reference Master Gauges . . . . .	80
Annex J (informative) Other Rotary Shouldered Connections . . . . .	82
Annex K (informative) Dimensions for Non-preferred Connections in SI Units . . . . .	86
Annex L (informative) Dimensions for Non-preferred Connections in USC Units . . . . .	100
Bibliography . . . . .	114

### Figures

1 Pin Connection (Pin End) . . . . .	9
2 Tapered and Cylindrical Pin Bases . . . . .	9
3 Box Connection (Box End) . . . . .	11
4 Thread Forms V-038R, V-050, V-040 . . . . .	12
5 Product Thread Form V-055 (also V-065 and V-076) . . . . .	13
6 Low-torque Feature for Certain Connections with Large ODs . . . . .	15
7 Box Boreback Feature . . . . .	16
8 Pin Stress-relief Groove . . . . .	16
9 Box Stress-relief Groove . . . . .	17
10 Unthreaded Area of Box Connection . . . . .	18
11 Cylinder Benchmark (Box) . . . . .	19
12 Cylinder Benchmark (Pin) . . . . .	19
13 Stamped Benchmark . . . . .	20
14 Gauging Practice . . . . .	22
15 Standard Lead Template . . . . .	23
16 Thread Height Setting Standard . . . . .	24
17 Gauge Relationships . . . . .	25
18 Gauge Thread Form . . . . .	29
19 Grand, Regional, and Reference Master Thread Gauges . . . . .	30
20 Working Thread Gauges . . . . .	31
21 Torque Hammer . . . . .	33
22 Tolerance Bands for Taper on Gauges . . . . .	35
F.1 External Lead Measurement . . . . .	74
F.2 External Taper Measurement (Pin) . . . . .	75
F.3 Internal Taper Measurement (Box) . . . . .	76
F.4 Thread-height Gauge . . . . .	77
F.5 Thread-height Measurement (Box) . . . . .	77
F.6 Thread-height Measurement (Pin) . . . . .	77
J.1 Thread Form (with 90° Included Angle) . . . . .	84

### Tables

B.1 Product Thread Dimensions for Preferred Connections . . . . .	42
B.2 Product Thread Form Dimensions . . . . .	43
B.3 Bevel Diameters for Preferred Connections When Used on Drill Collars . . . . .	44
B.4 Low-torque Feature . . . . .	46
B.5 Optional Feature Dimensions . . . . .	46
B.6 Stress-relief Groove and Boreback Contour Dimensions for Preferred Connections . . . . .	47
B.7 Compensated Thread Lengths, Thread Heights, and Ball-point Diameters . . . . .	48
B.8 Gauge Thread Form Dimensions . . . . .	48

## Contents

Page

B.9	Gauge Thread Dimensions for Preferred Connections	49
B.10	Gauge External Dimensions for Preferred Connections	50
B.11	Tolerances on Gauge Dimensions for Regional and Grand Master Gauges	51
B.12	Tolerances on Gauge Dimensions for Reference Master Gauges	52
B.13	Tolerances on Gauge Dimensions for Working Gauges	53
C.1	Product Thread Dimensions for Preferred Connections	54
C.2	Product Thread Form Dimensions	55
C.3	Bevel Diameters for Preferred Connections When Used on Drill Collars in USC Units	56
C.4	Low-torque Feature	58
C.5	Optional Feature Dimensions	58
C.6	Stress-relief Groove and Boreback Contour Dimensions for Preferred Connections	59
C.7	Compensated Thread Lengths, Thread Heights, and Ball-point Diameters	60
C.8	Gauge Thread Form Dimensions	60
C.9	Gauge Thread Dimensions for Preferred Connections	61
C.10	Gauge External Dimensions for Preferred Connections	62
C.11	Tolerances on Gauge Dimensions for Regional and Grand Master Gauges	63
C.12	Tolerances on Gauge Dimensions for Reference Master Gauges	64
C.13	Tolerances on Gauge Dimensions for Working Gauges	65
D.1	Conversions Factors for Metric to USC Units	66
E.1	Primary Dimensions for Connection	67
E.2	Primary Dimensions for Thread Form	67
E.3	Auxiliary Design Dimensions	72
J.1	Interchangeable Connections	82
J.2	Equivalences for GOST Connections	82
K.1	Product Dimensions for Non-preferred Connections	86
K.2	Thread Dimensions	88
K.3	Bevel Diameters for Non-preferred Connections When Used on Drill Collars (60° Included Thread Angle)	89
K.4	Low-torque Feature	92
K.5	Optional Feature Dimensions	92
K.6	Stress-relief Grooves and Features Dimensions for Non-preferred Connections	94
K.7	Compensated Thread Lengths, Thread Heights, and Ball-point Diameters	95
K.8	Gauge Thread Form Dimensions for Non-preferred Thread Forms	95
K.9	Gauge Thread Dimensions	96
K.10	Gauge External Dimensions	98
L.1	Product Dimensions for Non-preferred Connections	100
L.2	Thread Dimensions	102
L.3	Bevel Diameters for Non-preferred Connections When Used on Drill Collars (60° Included Thread Angle)	103
L.4	Low-torque Feature	106
L.5	Optional Feature Dimension for Non-preferred Connections	106
L.6	Stress-relief Grooves and Features Dimensions for Non-preferred Connections	108
L.7	Compensated Thread Lengths, Thread Heights, and Ball-point Diameters	109
L.8	Gauge Thread Form Dimensions for Non-preferred Thread Forms	109
L.9	Gauge Thread Dimensions	110
L.10	Gauge External Dimensions	112





## Introduction

This standard is based on API Specification 7, *Specification for Rotary Drill Stem Elements*.

The function of this part of this standard is to define the connections design and the gauging required for rotary drill stem elements. It also defines the testing required to verify compliance with these requirements. As rotary drill stem elements are very mobile, moving from rig to rig, design control is an important element required to ensure the interchangeability and performance of product manufactured by different sources.

Users of this standard should be aware that further or differing requirements may be needed for individual applications. This standard is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this standard and provide details.

# Threading and Gauging of Rotary Shouldered Connections

## 1 Scope

### 1.1 Coverage

This standard specifies the following requirements on rotary shouldered connections for use in petroleum and natural gas industries: dimensional requirements on threads and thread gauges, stipulations on gauging practice and gauge specifications, as well as instruments and methods for inspection of thread connections. These connections are intended primarily for use in drill-string components.

Other supplementary specifications can be agreed between interested parties for special tolerance requirements, qualification, testing, inspection, and finishing. This standard applies both to newly manufactured connections and connections that are recut after service. It should be realized that recut connections are subject to additional inspection and testing—the user is referred to API 7G-2 for such information.

This standard is applicable to preferred rotary shouldered connection designs. These are traceable to an internationally supported system of gauges and calibration that can be described as number (NC) style, regular (REG) style, or full-hole (FH) style.

### 1.2 Application of the API Monogram

If the product (gauge) is manufactured at a facility licensed by API and, it is intended to be supplied bearing the API Monogram, the requirements of Annex A apply.

## 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 Specification 5DP, *Specification for Drill Pipe*

API Specification 7-1, *Specification for Rotary Drill Stem Elements*

ISO 1302<sup>1</sup>, *Geometrical Product Specifications (GPS)—Indication of surface texture in technical product documentation*

ISO 10424-1, *Petroleum and natural gas industries—Rotary drilling equipment—Part 1: Rotary drill stem elements*

ISO 11961, *Petroleum and natural gas industries—Steel drill pipe*

ISO/IEC<sup>2</sup> 17025, *General requirements for the competence of testing and calibration laboratories*

---

<sup>1</sup> International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland, [www.iso.org](http://www.iso.org).

<sup>2</sup> International Electrotechnical Commission, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, [www.iec.ch](http://www.iec.ch).

## 3 Terms, Definitions, Symbols, and Abbreviations

### 3.1 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1.1

##### **bevel diameter**

Outside diameter of the contact face of the rotary shouldered connection.

#### 3.1.2

##### **blunt start**

A thread with removal of the incomplete thread at the starting end.

NOTE May also be referred to as Higbee or other similar name.

#### 3.1.3

##### **box connection**

##### **box end**

Threaded connection on oil country tubular goods with internal (female) threads.

#### 3.1.4

##### **box thread**

Internal (female) threads of a rotary shouldered connection.

#### 3.1.5

##### **break-in**

Procedure applied to newly manufactured threads to assure correct mating.

#### 3.1.6

##### **calibration system**

Documented system of gauge calibration and control.

#### 3.1.7

##### **cold rolling**

##### **(cold working)**

Plastic deformation of the surface of the connection at a temperature low enough to induce strain hardening.

#### 3.1.8

##### **first perfect thread**

Thread furthest from the sealing face on a pin, or closest to the sealing face on a box, where both the crest and the root are fully formed.

#### 3.1.9

##### **full depth thread**

Thread in which the thread root lies on the minor cone of an external thread or lies on the major cone of an internal thread.

#### 3.1.10

##### **full-hole (FH) style**

Type and size of rotary shouldered connection, covered by this standard, having thread form of V-040 or V-050.

NOTE The number relates to a historical drill pipe size.