

Specification for Casing and Tubing

**API Specification 5CT
Eighth Edition, July 1, 2005**

**ISO 11960:2004, Petroleum and natural gas
industries—Steel pipes for use as casing or tubing
for wells**

EFFECTIVE DATE: JANUARY 1, 2006



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.

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 under local, state, or federal laws.

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.

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.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. Sometimes a one-time extension of up to two years will be added to this review cycle. This publication will no longer be in effect five years after its publication date as an operative API standard or, where an extension has been granted, upon republication. Status of the publication can be ascertained from the API Standards department telephone (202) 682-8000. A catalog of API publications, programs and services is published annually and updated biannually by API, and available through Global Engineering Documents, 15 Inverness Way East, M/S C303B, Englewood, CO 80112-5776.

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 standard or comments and questions concerning the procedures under which this standard was developed should be directed in writing to the Director of the Standards department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005. Requests for permission to reproduce or translate all or any part of the material published herein should be addressed to the Director, Business Services.

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

*These materials are subject to copyright claims of ISO, ANSI and API.
All rights reserved. No part of this work may be reproduced, 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, N.W., Washington, D.C. 20005.*

Copyright © 2005 American Petroleum Institute

API Foreword

This standard is under the jurisdiction of the API Standards Subcommittee on Tubular Goods (API C1/SC5). This API standard is identical with the English version of ISO 11960:2004. ISO 11960 was prepared by Technical Committee ISO/TC 67, Materials, equipment and offshore structures for petroleum and natural gas industries, SC 5, Casing, Tubing, and Drilling Pipe.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of publication.

The bar notations in the margins identify parts of this standard that have been changed from the previous API edition. While efforts have been made to ensure the accuracy of the notations, the user of this standard is responsible for recognizing any differences between this and the previous edition.

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 federal, state, or municipal regulation with which this publication may conflict.

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

Contents

	Page
API Foreword	ii
Foreword	vi
Introduction	vii
1 Scope	1
2 Conformance	2
2.1 Normative references	2
2.2 Units of measurement	2
3 Normative references	2
4 Terms, definitions, symbols and abbreviated terms	4
4.1 Terms and definitions	4
4.2 Symbols and abbreviated terms	8
5 Information to be supplied by the purchaser	9
5.1 Casing	9
5.2 Tubing	11
5.3 Coupling stock and accessories	12
6 Process of manufacture	12
6.1 General	12
6.2 Heat treatment	13
6.3 Straightening	13
6.4 Traceability	14
6.5 Processes requiring validation	15
7 Material requirements	15
7.1 Chemical composition	15
7.2 Tensile properties	15
7.3 Charpy V-notch test — General requirements	16
7.4 Charpy V-notch test — Absorbed energy requirements for coupling stock, coupling blanks and couplings	17
7.5 Charpy V-notch test — Absorbed energy requirements for pipe	18
7.6 Charpy V-notch test — Absorbed energy requirements for casing and tubing accessories	20
7.7 Maximum hardness	21
7.8 Hardness variation — Grades C90, T95 and Q125	21
7.9 Process control — Grades C90, T95 and Q125	21
7.10 Hardenability — Minimum percentage martensite for quenched and tempered products	21
7.11 Grain size — Grades C90 and T95	22
7.12 Surface condition — Grades L80 9Cr and L80 13Cr	22
7.13 Flattening — Electric-welded pipe	22
7.14 Sulfide stress cracking test — Grades C90 and T95	22
8 Dimensions, masses, tolerances, pipe ends and defects	24
8.1 Labels and sizes	24
8.2 Dimensions and masses	24
8.3 Diameter	24
8.4 Wall thickness	25
8.5 Mass	25
8.6 Length	25
8.7 Casing jointers	25
8.8 Height and trim of electric-weld flash	26
8.9 Straightness	26
8.10 Drift requirements	27
8.11 Tolerances on dimensions and masses	27

8.12	Pipe ends.....	28
8.13	Defects.....	30
8.14	Coupling make-up and thread protection.....	30
9	Couplings.....	31
9.1	General requirements.....	31
9.2	Alternative grades or heat treatments.....	31
9.3	Process of manufacture — Groups 1, 2 and 3.....	32
9.4	Process of manufacture — Grade Q125.....	32
9.5	Mechanical properties.....	32
9.6	Dimensions and tolerances.....	32
9.7	Regular couplings.....	32
9.8	Special-clearance couplings — Groups 1, 2 and 3.....	33
9.9	Combination couplings.....	33
9.10	Reducing couplings — Groups 1, 2 and 3.....	33
9.11	Seal-ring couplings.....	33
9.12	Special-bevel tubing couplings — Groups 1, 2 and 3.....	33
9.13	Threading.....	33
9.14	Surface inspection.....	34
9.15	Measurement of imperfections.....	35
9.16	Repair and removal of imperfections and defects.....	35
9.17	Thread surface treatment — Grade Q125.....	35
9.18	Couplings and coupling blank protection — Grades C90, T95 and Q125.....	35
10	Inspection and testing.....	35
10.1	Test equipment.....	35
10.2	Lot definition for testing of mechanical properties.....	35
10.3	Testing of chemical composition.....	36
10.4	Tensile tests.....	37
10.5	Flattening test.....	39
10.6	Hardness test.....	40
10.7	Impact test.....	44
10.8	Grain size determination — Grades C90 and T95.....	46
10.9	Hardenability — Grades C90 and T95.....	46
10.10	Sulfide stress-cracking test — Grades C90 and T95.....	46
10.11	Metallographic evaluation — EW Grades P110 and Q125.....	46
10.12	Hydrostatic tests.....	46
10.13	Dimensional testing.....	48
10.14	Visual inspection.....	51
10.15	Non-destructive examination (NDE).....	51
11	Marking.....	58
11.1	General.....	58
11.2	Stamp marking requirements.....	59
11.3	Stencil marking requirements.....	60
11.4	Colour identification.....	60
11.5	Thread and end-finish marking — All groups.....	61
11.6	Pipe-threader marking requirements — All groups.....	61
12	Coating and protection.....	62
12.1	Coatings — All groups.....	62
12.2	Thread protectors.....	62
13	Documents.....	63
13.1	Electronic media — All groups.....	63
13.2	Certification — Groups 1, 2 and 3.....	63
13.3	Certification requirements — Grade Q125.....	63
13.4	Retention of records.....	63
14	Minimum facility requirements for various categories of manufacturer.....	64
14.1	Pipe mill.....	64
14.2	Processor.....	64
14.3	Pipe threader.....	64

14.4	Coupling, pup-joint or accessory manufacturer	64
Annex A	(normative) Supplementary requirements	66
Annex B	(normative) Purchaser inspection	80
Annex C	(normative) Tables in SI units	81
Annex D	(normative) Figures in SI (USC) units	154
Annex E	(normative) Tables in USC units	184
Annex F	(informative) Marking instructions for API licensees	258
Annex G	(informative) Procedures used to convert from USC units to SI units	263
Annex H	(normative) Product Specification Levels	276
Annex I	(normative) Requirements for thread protector design validation	283
Annex J	(informative) Summary of Product Specification Level (PSL) requirements	287
Bibliography	291

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11960 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 5, *Casing, tubing and drill pipe*.

This third edition cancels and replaces the second edition (ISO 11960:2001), which has been technically revised. It also incorporates the Technical Corrigendum ISO 11960:2001/Cor.1:2002.

It is the intent of TC 67 that the second and third editions of ISO 11960 both be applicable, at the option of the purchaser (as defined in 4.1.35), for a period of six months from the first day of the calendar quarter immediately following the date of publication of this third edition, after which period the second edition will no longer be applicable.

Introduction

This International Standard is based on API 5CT (Specification for Casing and Tubing).

Users of this International Standard should be aware that further or differing requirements may be needed for individual applications. This International 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 International Standard and provide details.

This International Standard includes requirements of various nature. These are identified by the use of certain verbal forms:

- SHALL is used to indicate that a provision is MANDATORY;
- SHOULD is used to indicate that a provision is not mandatory, but RECOMMENDED as good practice;
- MAY is used to indicate that a provision is OPTIONAL.

Petroleum and natural gas industries — Steel pipes for use as casing or tubing for wells

1 Scope

1.1 This International Standard specifies the technical delivery conditions for steel pipes (casing, tubing, plain-end casing liners and pup joints), coupling stock and accessories and establishes requirements for three Product Specification Levels (PSL-1, PSL-2, PSL-3). The requirements for PSL-1 are the basis of this International Standard. The requirements that define different levels of standard technical requirements for PSL-2 and PSL-3, for all Grades except H-40 and L-80 9Cr, are contained in Annex H.

For pipes covered by this International Standard, the sizes, masses and wall thicknesses as well as grades and applicable end-finishes are listed in Tables C.1 to C.3 and Tables E.1 to E.3.

By agreement between the purchaser and manufacturer, this International Standard can also be applied to other plain-end pipe sizes and wall thicknesses.

This International Standard is applicable to the following connections in accordance with API Spec 5B:

- short round thread casing (STC);
- long round thread casing (LC);
- buttress thread casing (BC);
- extreme-line casing (XC);
- non-upset tubing (NU);
- external upset tubing (EU);
- integral joint tubing (IJ).

For such connections, this International Standard specifies the technical delivery conditions for couplings and thread protection. Supplementary requirements that may optionally be agreed for enhanced leak resistance connections are given in Annex A.11 (SR22).

This International Standard can also be applied to tubulars with connections not covered by ISO/API standards.

1.2 The four groups of products to which this International Standard is applicable include the following grades of pipe:

- Group 1: All casing and tubing in Grades H, J, K and N;
- Group 2: All casing and tubing in Grades C, L, M and T;
- Group 3: All casing and tubing in Grade P;
- Group 4: All casing in Grade Q.