

ASME B16.9-2018
(Revision of ASME B16.9-2012)

Factory-Made Wrought Buttwelding Fittings

工厂制锻制对焊管件

AN AMERICAN NATIONAL STANDARD
美国国家标准

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FOREWORD 前言

In 1921, the American Engineering Standards Committee, later the American Standards Association (ASA), organized Sectional Committee B16 to unify and further develop national standards for pipe flanges and fittings (and later, for valves, gaskets, and valve actuators). Cosponsors of the B16 Committee were The American Society of Mechanical Engineers (ASME), the Heating and Piping Contractors National Association [now the Mechanical Contractors Association of America (MCAA)], and the Manufacturers Standardization Society of the Valve and Fittings Industry (MSS). Cosponsors were later designated as cosecretariat organizations. 1921 年, 美国工程标准委员会, 即后来的美国标准协会(ASA), 组织了 B16 分部委员会, 统一和进一步发展了管道法兰和管件(以及后来的阀门、垫片和阀门执行机构)的国家标准。B16 委员会的共同发起人包括美国机械工程师协会(ASME)、全美供热和管道承包商协会(现为美国机械承包商协会(MCAA))以及阀门和配件行业制造商标准化协会(MSS)。这些协同发起者后来被指定为联合秘书组。。

Standardization of welding fittings was initiated in 1937 by a subgroup (designated Subgroup 6) of Subcommittee 3. After consideration of several drafts, a standard was approved by the Committee, cosponsors, and ASA, and published with the designation ASA B16.9-1940. 焊接管件的标准化是 1937 年由 3 小组委员会的一个分组(指定的小组 6)发起的。在审议了若干草案之后, 委员会、共同主办人和 ASA 批准了一项标准, 并将其命名为 ASA B16.9-1940。

Revisions were made in 1950 and 1955 to add sizes up to NPS 24 and to complete coverage of fittings in some sizes. These revisions were approved and published as ASA B16.9-1951 and ASA B16.9-1958. With the subgroup now designated Subcommittee 6 (later Subcommittee F), further revisions were begun to clarify the intent of the Standard, to add angularity tolerances, and to include fittings of different types (long radius reducing elbows and crosses) and smaller sizes (NPS 1 / 4 and NPS 1 / 2). This revision was published as ASA B16.9-1964 after ASA approval. 为了将规格增加到 NPS 24 及完善某些规格管件的范围, 该标准于 1950 年和 1955 年进行了修订。这两次修订被批准。并以 ASA B16.9-1951 和 ASA B16.9-1958 的代号出版。为了明确该标准的意图、增加角度公差、包括不同类型的管件(大半径异径弯头和四通)以及较小规格的管件(NPS 1/4 和 NPS 1/2)。该分组对它进行了进一步修订。该分组现已定名为第 6 分委员会(后来的 F 分委员会)。在经 ASA 批准之后, 该修订版以 ASA B16.9-1964 的代号出版。

After reorganization of ASA, first as the United States of America Standards Institute (USASI), then as the American National Standards Institute (ANSI), with the Sectional Committee being redesignated as an American National Standards Committee, another revision increasing the size range to NPS 48 and revising the text for clarity was approved and published as ANSI B16.9-1971. ASA 重新组建之后, 最初称为美利坚合众国标准学会(USASI)。后改为美国国家标准学会, 与重新定名为美国国家标准委员会的专业委员会一起批准了另一个修订版, 并以 ANSI B16.9-1971 的代号出版。该修订版将规格范围增大到 NPS 48 并对文本进行了修改, 以求更加清楚。

In 1975, Subcommittee F began a major revision to bring the standard up to date with current practice and usage. Common fractions were expressed as decimals (but without intending higher precision) and metric dimensional equivalents were added. Provisions for step-wise change of

radius for NPS 3 / 4 long radius elbows and 180-deg returns were introduced. Following Standards Committee, cosecretariat, and ANSI approval, the revision was published as ANSI B16.9-1978. It was updated by a corrective addendum, B16.9a-1981, issued in February 1982. In 1982, American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. In ASME/ANSI B16.9-1986, the text was revised and inch dimensions were established as the standard. 美国国家标准委员会 B16 于 1982 年改组为 ASME 的一个委员会。依照 ANSI 认可的程序进行工作。在此版中, 对文本进行了修改, 确定了英制尺寸为标准单位。在经标准委员会和 ASME 批准之后。ANSI 于 1986 年 11 月 12 日批准标准为美国国家标准, 以代号 ASME/ANSI B16.9-1986 出版。

In 1991, the Subcommittee reviewed the Standard and made a number of revisions that were included in ASME B16.9- 1993. Dimensions for short pattern lap joints were also added. 1991 年, 小组委员会审查了该标准, 并对 ASME B16.9- 1993 中所包括的标准作了一些修订。还增加了翻边短节的尺寸。

In ASME B16.9-2001, short radius elbows and returns were added, which included all dimensions and tolerances of ASME B16.28-1994. Metric units were provided as an independent but parallel alternative standard to U.S. Customary units. U.S. Customary units were moved into parentheses or separate tables in Mandatory Appendix I. In addition, a Quality System Program appendix was added. 在 ASME B16.9-2001 中增加了短半径弯头和 180° 弯头, 包括 ASME B16.28-1994 的所有尺寸和公差。公制单位作为一种独立的、与美国习惯单位平行的替代标准提供。在强制性附录 i 中, 美国习惯单位被移到括号中或单独的表格中。

In 2003, the Subcommittee reviewed the Standard and made a number of revisions. The scope of the Standard was changed to permit fabricated lap joint stub ends employing circumferential or intersection welds. 小组委员会于 2003 年审核了该标准, 并作出多项修订。标准的范围已经改变, 允许使用周向或纵向焊接方式的制造翻边短节。

In 2006, the Subcommittee reviewed the Standard and made a number of additions and revisions. Segmental elbow requirements were added, as were 3D radius elbow dimensions. Reference documents were updated. 在 2006 年, 小组委员会审核了该标准, 并作出了一些增补和修订。增加了部分弯头要求, 以及 3 倍弯曲半径的弯头尺寸。更新了参考文件。

In 2012, the Subcommittee reviewed the Standard and made numerous revisions to the design proof test in section 9 and updated the references in Mandatory Appendix II. 2012 年, 小组委员会审核了该标准, 并对第 9 条的设计验证性试验作出多项修订, 并更新了强制性附录 II 的参考资料。

This edition adds more specific descriptions of acceptable design methods, revises the requirements for the design proof test, and updates the references. In addition, the U.S. Customary tables in Mandatory Appendix I have been merged with the Metric tables and all tables have been redesignated. Following the approval of the ASME B16 Standards Committee, ANSI approved ASME B16.9-2018 as an American National Standard on September 25, 2018. 本版增加了可接受的设计方法的更具体的描述, 修改了设计验证性试验的要求, 并更新了参

考文献。此外，强制性附录一中的美国习惯表已与公制表合并，所有表已重新指定。经 ASME B16 标准委员会批准，ANSI 于 2018 年 9 月 25 日批准 ASME B16.9-2018 为美国国家标准。

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Standardization of Valves, Flanges, Fittings, and Gaskets

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The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation. 委员会欢迎关于修订本标准的建议。这些建议应尽可能具体, 引述第(s)款、拟议的措词和关于提议理由的详细说明, 包括任何有关文件。

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Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at <http://go.asme.org/InterpretationRequest>. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt. 解释申请

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Edition: Cite the applicable edition of the Standard for which the interpretation is being requested. 版本:引用要求解释的标准的适用版本。

Question: Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. Please provide a condensed and precise question, composed in such a way that a “yes” or “no” reply is acceptable. 问题:将问题表述为对适用于一般理解和使用的特定需求进行解释的请求，而不是对专有设计或情况进行批准的请求。请提供一个简洁而精确的问题，以“是”或“否”的回答是可以接受的。

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Attending Committee Meetings. The B16 Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the B16 Standards Committee. 参加委员会会议。B16 标准委员会定期举行公开会议和/或电话会议。有意出席任何会议及/或电话会议的人士，请联络 B16 标准委员会秘书。

ASME B16.9-2018
SUMMARY OF CHANGES 变更汇总

Following approval by the ASME B16.9 Committee and ASME, and after public review, ASME B16.9-2018 was approved by the American National Standards Institute on September 29, 2018. 经 ASME B16.9 委员会和 ASME 委员会批准, 经过公开评审, ASME B16.9-2018 于 2018 年 9 月 29 日获得美国国家标准协会批准。

In ASME B16.9-2018, the U.S. Customary tables formerly in Mandatory Appendix I have been merged with the Metric tables in the main text; the tables have been redesignated, Mandatory Appendix I deleted, and the cross-references updated accordingly. In addition, this edition includes the following changes identified by a margin note, (18). The Record Number listed below is explained in more detail in the “List of Changes in Record Number Order” following this Summary of Changes. 在 ASME B16.9-2018 中, 原强制附录一中的美国习惯表与正文中的公制表合并; 表已重新指定, 强制删除附录一, 并相应地更新了交叉引用。此外, 本版本还包括由页边空白注(18)确定的下列更改。下面列出的记录编号将在以下更改摘要之后的“记录编号顺序更改列表”中详细解释。

Page	Location	Change (Record Number)
1	1.4	First paragraph editorially revised 第一段编辑修改
1	1.5.1	References to Mandatory Appendix II editorially revised 对强制性附录 II 的引用经过编辑修订
2	2.2	Revised in its entirety (17-1543) 整体修订(17-1543)
3	Section 5	Revised (17-1543) 修订(17-1543)
3	6.2.4	In sub para. (c), “3D” revised to “3D radius”(17-1543) 3D 修订为 3D 弯曲半径
3	Section 9	Revised in its entirety (17-1543) 整体修订(17-1543)
6	Table 5-1	Added (17-1543) 增加 (17-1543)
8	Table 6.1-2	Formerly Tables 2 and I-2; illustration within table revised (17-1543) 原表 2 和 I-2; 表内插图经修订(17-1543)
10	Table 6.1-5	Formerly Tables 5 and I-5; General Note editorially redesignated as Note (1), and Note reference added to the illustration 原表 5 和 I-5; 一般注释在编辑上重新指定为注释 (1), 并将注释引用添加到插图中
11	Table 6.1-6	Formerly Tables 6 and I-6; in title, “3D” revised to “3D Radius,” and in 45-deg elbow entry for NPS 30, “964” mm revised to “946” mm (17-1543) 原表 6 和 I-6; 在标题中, “3D” 修改为 “3D Radius”, 表中 NPS 30 的 45 度弯头, “964” 毫米修改为 “946” 毫米(17-1543)
23	Table 8-1	Formerly Table 12; Note (2) revised (17-1543) 原表 12; 修订注(2)(17-1543)
24	Figure 8-1	Editorially redesignated from Figure 1 从图 1 中编辑地重新指定
28	Mandatory Appendix I	Redesignated from Mandatory Appendix II and updated (17-1543) 由强制性附录 II 重新指定及更新(17-1543)

LIST OF CHANGES IN RECORD NUMBER ORDER 记录编号顺序的更改列表

Record Number

17-1543

Changes

Revised Table 6 title from “3D” to “3D Radius” in the Contents. Revised the Foreword. Revised section 2.2 in its entirety. Revised section 5. Revised “3D” to “3D radius” in section 6.2.4. Revised section 9 in its entirety. Replaced the figure in Tables 2 and I-2. Revised “3D” to “3D Radius” and “964” to “946” in Table 6. Revised the wording of Note (2) in Table 12. Revised “3D” to “3D Radius” in Table I-6. Made multiple revisions in Mandatory Appendix II. 将表 6 标题内容从 “3D” 修改为 “3D Radius”。修订了前言。修订第 2.2 条全文。修改后的第 5 部分。第 6.2.4 节将 “3D” 修改为 “3D radius”。修订第 9 节全文。替换表 2 和 I-2 中的图形。表 6 将 “3D” 修改为 “3D Radius”，将 “964” 修改为 “946”。修订表 12 注(2)的措词。表 I-6 将 “3D” 修改为 “3D Radius”。对强制性附录二进行多次修订。

FACTORY-MADE WROUGHT BUTTWELDING FITTINGS

工厂制造的锻轧制对焊管配件

1 SCOPE 范围

1.1 General 总则

This Standard covers overall dimensions, tolerances, ratings, testing, and markings for factory-made wrought butt welding fittings in sizes NPS 1/2 through NPS 48 (DN 15 through DN 1200). 本标准包括 NPS 1/2 至 NPS 48 (DN15-1200) 的锻轧制工厂制造的对焊管件的总体尺寸、公差、压力额定值、试验及标记。

1.2 Special Fittings 特殊管件

Fittings may be made to special dimensions, sizes, shapes, and tolerances by agreement between the manufacturer and the purchaser. 按制造厂和采购方双方协议, 可制造特殊尺寸、口径、形状和公差的管件。

1.3 Fabricated Fittings 制备的管件

Fabricated laterals and other fittings employing circumferential or intersection welds are considered pipe fabrication and are not within the scope of this Standard. 采用环焊缝或交叉焊缝的制备的分支管件及其他管件均属于管制品, 不属于本标准的范围。

Fabricated lap joint stub ends are exempt from the above restrictions, provided they meet all the requirements of the applicable ASTM material specification listed in [section 5](#). 制备的翻边为以上限制的例外, 如果这类管件满足第 5 节中 ASTM 材料规定的所有其他规定时。

1.4 Relevant Units 单位制

This Standard states values in both SI (Metric) and U.S. Customary units. These systems of units are to be regarded separately as standard. Within the text and tables, the U.S. Customary units are shown in parentheses. 这个标准用 SI(米制)和美国习惯单位制。这些单位制应单独表述在标准。在文本和表格中, 括号中显示了美国常用的单位。

The values stated in each system are not exact equivalents; therefore, it is required that each system of units be used independently of the other. Combining values from the two systems constitutes nonconformance with the Standard. 每个单位制中所述的值并不完全相等;因此, 每个单位制必须独立使用。将来自两个单位制组合在一起构成不符合标准。

The designation for size is NPS for both Metric- and Customary-dimensioned fittings. Fitting pressure rating is associated with the connecting wall thickness of pipe of equivalent size and material. 对于米制和美国惯用单位的管件, 口径的标志是 NPS。管件压力的额定值与相同尺寸和材料的管道的连接壁厚有关。

1.5 References 引用标准

1.5.1 Referenced Standards. Standards and specifications adopted by reference in this Standard are shown in [Mandatory Appendix I](#). It is not considered practical to identify the specific edition of each standard and specification in the individual references. Instead, the specific edition reference is identified in [Mandatory Appendix I](#). A product made in conformance with a prior edition of referenced standards and in all other respects conforming to this Standard will be considered to be in conformance. 引用标准——本标准中引用的标准和技术条件如附录 I 所示。辨认在单独引用时每项标准和技术条件的特定版次被认为是不切实际的。作为替代办法, 在附录 I 中列出了特定版次。按符合于引用到的标准的较早版次制造的产品, 只要在所有其他方面都符合于本标准, 将被认为是符合于本标准。

1.5.2 Codes and Regulations. A fitting used under the jurisdiction of the ASME Boiler and Pressure Vessel Code (BPVC), the ASME Code for Pressure Piping, or a governmental regulation is

subject to any limitation of that code or regulation. This includes any maximum temperature limitation or rule governing the use of a material at low temperature. 法规和条例。在 ASME 锅炉和压力容器规范(BPVC)、ASME 压力管道规范或政府法规管辖下使用的配件受该规范或法规的限制。这包括任何最高温度极限，或控制材料在低温下使用的规则。

1.6 Service Conditions 使用条件

Criteria for selection of fitting types and materials suitable for particular fluid service are not within the scope of this Standard. 适用于特定流体应用场合的管件类型和材料的选择标准不属于本标准的范围。

1.7 Welding 焊接

Installation welding requirements are outside the scope of this Standard. 安装焊接要求超出了本标准的范围。

1.8 Quality Systems 质量体系

Nonmandatory requirements relating to the fitting manufacturer's Quality System Program are described in [Nonmandatory Appendix A](#). 管件制造商的质量体系程序相关的非强制性要求见非强制性附录 A。

1.9 Convention 惯例

For determining conformance with this Standard, the convention for fixing significant digits where limits (maximum and minimum values) are specified shall be as defined in ASTM E29. This requires that an observed or calculated value be rounded off to the nearest unit in the last right-hand digit used for expressing the limit. Decimal values and tolerances do not imply a particular method of measurement. 为了确定与本标准的一致性，习惯上，在要求限定值（最大或最小值）时，确定有效数位的惯例应是按 ASTM E29 的规定进行圆整。这样就要求在表示限定值时，应对测量值或计算值的最右侧紧靠有效位的数进行圆整。小数值和公差并不意味着特殊的测定方法。

1.10 Pressure Rating Designation 压力等级

Class followed by a dimensionless number is the designation for pressure-temperature ratings. Standardized designations for flanges per ASME B16.5 referenced in this Standard are Classes 150, 300, 600, 900, 1500, and 2500. (Class) 后接一个无量纲数的磅级，是压力-温度额定值的标识。在本标准中，依据本标准引用的 ASME B16.5 法兰其标准化标识是 150, 300, 600, 900, 1500, 和 2500 磅级。

2 PRESSURE RATINGS 压力额定值

2.1 Basis of Ratings 额定值基准

The allowable pressure ratings for fittings designed in accordance with this Standard may be calculated as for straight seamless pipe of equivalent material (as shown by comparison of composition and mechanical properties in the respective material specifications) in accordance with the rules established in the applicable sections of ASME B31, Code for Pressure Piping. For the calculation, applicable data for the pipe size, wall thickness, and material that are equivalent to that of the fitting shall be used. Pipe size, wall thickness (or schedule number), and material identity on the fittings are in lieu of pressure rating markings. 按本标准设计的管件的许用压力额定值应根据 ASME B31, 《压力管道规范》适用卷所确定的规则，可按相同材料（按相应材料技术条件的化学成分及力学性能比较）的无缝直管的计算。为了这一计算，应使用与管件相当的管子规格、壁厚及材料的适用数据。管件上的尺寸，壁厚（或壁厚序列号）及材料识别可代替压力额定值标记

2.2 Design of Fittings 管件的设计

2.2.1 Acceptable Design Methods. The design of fittings shall be established by one of the following methods: 可接受的设计方法。管件的设计应采用下列方法之一:

- (a) mathematical analyses contained in nationally recognized pressure vessel or piping codes (e.g., ASME B31.3 para. 304.2 for elbows and para. 304.3 for tees). 国家认可的压力容器或管道规范中包含的数学分析。(如 ASME B31.3 304.2 节用于弯头计算, 304.3 节用于三通计算)。
- (b) proof testing in accordance with [section 9](#) of this Standard. 根据本标准第 9 条进行验证性试验。
- (c) experimental stress analysis, such as described in ASME BPVC, Section VIII, Division 2, Annex 5.F with validation of results. Hydrostatic testing can be used to validate experimental results. 实验性应力分析, 如 ASME BPVC, 第 8 节, 第 2 部分, 附件 5 所述。F 与验证结果。水压试验可用于验证实验结果。
- (d) detailed stress analysis (e.g., finite element method) with results evaluated as described in ASME BPVC, Section VIII, Division 2, Part 5 with validation of results. Strain measurement, photoelastic testing, or hydrostatic testing can be used to validate calculated results. 详细的应力分析(如有限单元法), 评估结果如 ASME BPVC 第 8 节第 2 部分第 5 部分所述, 并对结果进行验证。应变测量、弹性测试或水压试验可用于验证计算结果。

2.2.2 Design Thickness. To meet design or manufacturing requirements, it is expected that some portion of formed fittings may have to be thicker than the pipe wall with which the fitting is intended to be used. The mathematical analyses, if used, may take into account such thicker sections. 设计厚度。为了满足设计或制造的要求, 可以预料, 成型管件某些部分的壁厚可能需要比准备使用该管件的管道壁厚要厚。如有需要, 数学分析可以考虑这些较厚的部分。

2.2.3 Records. Copies of English-language records of the mathematical analysis, the successful proof test, or both shall be made available to the purchaser or regulatory authority upon request. 记录。应买方或监管机构要求, 提供数学分析、成功验证测试或两者的英文记录副本。

3 SIZE 尺寸

NPS, followed by a dimensionless number, is the designation for nominal fitting size. NPS is related to the reference nominal diameter, DN, used in international standards. The relationship is, typically, as follows: NPS 后面跟着一个无量纲数, 是标称拟合尺寸的名称。NPS 与国际标准中使用的参考公称直径 DN 有关。这种关系通常如下:

DN	NPS
15	1/2
20	3/4
25	1
32	1 1/4
40	1 1/2
50	2
65	2 1/2
80	3
100	4

NOTE: For NPS > 4, the equivalence is $DN = 25 \times NPS$. 注: 对于 NPS > 4, $DN = 25 \times NPS$.

4 MARKING 标记

4.1 Standard Marking 标准标记

Each fitting shall be permanently marked to show the following: 每件管件都应永久标记, 以显示

以下内容:

(a) manufacturer's name or trademark 制造商名称或商标

(b) material identification, either the ASTM or ASME grade designation 材料标识, ASTM 或 ASME 等级标识

(c) schedule number¹ or nominal wall thickness in mm 管表号或公称壁厚(毫米)

(d) size — the nominal pipe size (NPS) identification number related to the end connections shall be used 规格—应使用与端部连接的管道公称通径(NPS)标识号

(e) compliance— see para. 4.4 for standard and special fitting marking 符合性—见 4.4 节, 标准和特殊管件标志;

A manufacturer may supplement these mandatory markings with others, including a DN size designation, but confusion with the required marking shall be avoided. 生产厂家可以提供其他的要求标志, 包括 DN 规格标示, 但是要避免标示的混淆。

4.2 Exceptions 例外

Where the size of the fitting does not permit complete marking, the identification marks may be omitted in reverse of the order presented in para. 4.1. 当管件的尺寸不允许进行全部标志时, 可逆上述顺序省略识别标志 (按 4.1 节)。

4.3 Depth of Stamping 钢印深度

Where steel stamps are used, care shall be taken so that the marking is not deep enough or sharp enough to cause cracks or to reduce the wall thickness of the fitting below the minimum allowed. 使用钢印时, 应注意标记的深度和锋利程度, 以免造成裂纹或使管件的壁厚低于允许的最小值

4.4 Compliance 一致性

4.4.1 Standard Fittings. That the fitting was manufactured in conformance with this Standard, including all dimensional requirements, is certified by a prefix "WP" in the material grade designation marking. 标准管件。该管件的制造符合本标准, 包括所有尺寸要求, 在材料等级标识中的前缀 "WP" 标记。

4.4.2 Special Fittings. That the fitting was manufactured in conformance with this Standard, except that dimensional requirements are as agreed between the purchaser and the manufacturer, is certified by a supplementary suffix to the material grade designation marking as follows: 特殊管件。管件的制造符合本标准, 但尺寸要求由买方和制造商共同商定的除外, 由以下材料等级标识的附加后缀认证:

(a) "S58" of ASTM A960 applies for fittings in accordance with ASTM A234, ASTM A403, and ASTM A420. "S58"适用于符合 ASTM A960 的 ASTM A234、ASTM A403 和 ASTM A420 的管件。

(b) "S8" applies for fittings in accordance with ASTM A815. "S8"适用于符合 ASTM A815 的管件。

(c) "SPLD" applies for fittings in accordance with ASTM B361, ASTM B363, and ASTM B366.

"SPLD" 适用于符合 ASTM B361、ASTM B363 和 ASTM B366 的管件。

5 MATERIAL 材料

Wrought fittings covered by this Standard shall be in accordance with ASTM A234, ASTM A403, ASTM A420, ASTM A815, ASTM B361, ASTM B363, ASTM B366, or the corresponding specification listed in ASME BPVC, Section II. The term "wrought" denotes fittings made of pipe, tubing, plate, or forgings. For purposes of determining proof testing requirements of section 9, the materials are grouped by similar properties as shown in Table 5-1. 本标准所涵盖的锻件应符合 ASTM A234、ASTM A403、ASTM A420、ASTM A815、ASTM B361、ASTM B363、ASTM B366 或 ASME BPVC 第二节中列出的相应规范。“锻造”一词是指由管、管、板或锻件制成的管件。为了确定第 9 节的验证测试要求, 材料按类似的属性分组, 如表 5-1 所示

Fittings made from block forgings may only be supplied subject to agreement between the manufacturer and purchaser. Such fittings need not meet the requirements of [section 7](#). 由块状锻件制成的管件只能在制造商和买方同意的情况下提供。这些管件不需要符合第 7 条的要求。

6 FITTING DIMENSIONS 管件尺寸

6.1 General 通则

This Standard provides for a fixed position for the welding ends with reference to either the centerline of the fittings or the overall dimensions. Dimensional requirements for these fittings are in [Tables 6.1-1 through 6.1-11](#). 本标准规定了焊接端相对于连接件中心线或整体尺寸的固定位置。这些配件的尺寸要求见表 6.1-1 至 6.1-11。

6.2 Special Dimensions 特殊尺寸

6.2.1 Fatigue Loading. For applications where fatigue loading is a concern, required minimum dimensions shall be furnished by the purchaser. 疲劳载荷。对于涉及疲劳载荷的应用，买方应提供所需的最小尺寸。

6.2.2 Bore Diameter. Bore diameters away from the ends are not specified. If special flow path requirements are needed, the bore dimensions shall be specified by the purchaser. 内径。没有指定远离端部的内径。如果需要特殊的流道要求，孔的尺寸应由买方指定。

6.2.3 Stub Ends. Service conditions and joint construction often dictate stub end length requirements. Therefore, the purchaser must specify long or short pattern fitting when ordering. [See General Note (b) in [Table 6.1-9](#).] 短管端——使用工况和连接结构常常规定短管端的长度要求。因此，购买方必须在定货时规定长或短型管件[见表 6.1-9 的一般说明(b)]

6.2.4 Segmental Elbows. Factory-made segments of short radius, long radius, and 3D radius elbows may be made to meet customer angle requirements. With the exception of the *B* dimension, factory-made segments of elbows shall meet all other requirements of this Standard. The *B* dimension for segmented elbows can be calculated as follows: 分段弯头。工厂生产的短半径、长半径和三维半径弯头可以满足客户的角度要求。除 *B* 尺寸外，工厂制造的弯头段应满足本标准的所有其他要求。分段弯头的 *B* 尺寸可计算如下：

For segments of 90-deg elbows 对 90 度弧形弯头

$$B_s = A \times \tan(\theta/2)$$

where 式中

A = dimension *A* for appropriate 90-deg elbow being segmented from 特殊 90 度弧形的尺寸按照相当于 90 度弧形的弯头尺寸，根据下表切割

(a) [Table 6.1-1](#) for long radius elbow, mm (in.) 表 6.1-1 长半径弯头，mm(英寸)

(b) [Table 6.1-4](#) for short radius elbow, mm(in.) 表 6.1-4 短半径弯头，mm(英寸)

(c) [Table 6.1-6](#) for 3D radius elbow, mm (in.) 表 6.1-6 为 3D 半径弯头，mm (in)

B_s = center-to-end dimension for segmented elbow 弧形弯头中心至端部尺寸

θ = angle of segmented elbow — 30 deg, 60 deg, 75 deg, etc. 弧形弯头角度—30 度、60 度、75 度，等

When special elbows are intended for field segmenting, the outside or inside diameter tolerance shall be furnished throughout the fitting by agreement between the manufacturer and the purchaser. Any mismatch on the outside or inside diameter needs to be corrected in the field by grinding, back-welding, or bridging of weld to meet the applicable piping code requirements.

Although the elbow intended for field segmenting must meet the requirements of this Standard, once the field-segmented elbow is cut, it is not a B16.9 product. 当特殊弯头被安排在现场切割时，应该根据制造商和买方之间合同提供外径和内径公差。外径和内径的失配，必须通过现场磨削、

补焊或桥焊来达到适用的管道规范的要求。即使弯头是被安排在现场切割时,也必须符合本标准的要求。一旦现场切割的弯头被切下,它就不再是 B16.9 产品了

7 SURFACE CONTOURS 表面轮廓

Where adjacent openings in fittings are not in parallel planes, they shall be joined by a circular arc or radius on the external surfaces. The arc or radius may be terminated in tangents. Except as provided for block forgings (see section 5), the projected profile of external surfaces of fittings shall not have sharp intersections (corners) and/or collapsed arcs. 当管件上相邻的开孔不在平行平面上时,它们应由外表面上的一段圆弧或圆角相连接。圆弧或圆角可能终止于相切处。除由锻坯(见第 5 节)提供的之外,管件外表面的投影轮廓应没有尖利的角和/或倒塌弧度。

8 END PREPARATION 端部制备

Unless otherwise specified, the details of the welding end preparation shall be in accordance with Table 8-1. Transitions from the welding bevel to the outside surface of the fitting and from the root face to the inside surface of the fitting lying within the maximum envelope shown in Figure 8-1 are at the manufacturer's option, except as covered in Note (5) of Figure 8-1 or unless otherwise specifically ordered. 除非另有规定,焊接端准备详见表 8-1。除非如图 8-1 的注释(5)所述或另有特别规定,在如图 8-1 所示的最大包络线的范围内,由焊接坡口到管件的外表面以及由根部钝边到管件的内表面的过渡由制造厂自定。

9 DESIGN PROOF TEST 设计验证性试验 Δ18P

9.1 Required Tests 所要求的试验

Proof tests shall be made as set forth in this Standard when the manufacturer chooses proof testing to qualify the fitting design. The pressure design thickness for critical areas of each type of fitting shall be determined and recorded. The design thickness for other sizes or wall thicknesses covered in para. 9.4 shall require a similar percentage of reinforcement proportional by size or thickness. Critical areas are normally the inner radius of elbows, the crotch of tees and crosses, the knuckle radius of caps, and the large ends of reducers. Proof test shall be based on the computed burst pressure of the fitting and its connecting piping as defined in para. 9.3. 当制造厂选择验证试验方法来对管件的设计进行鉴定时,应按本标准的规定进行验证试验。确定并记录每种类型管件的关键区域的压力设计厚度。第 9.4 节中其它尺寸或壁厚的设计厚度需要根据尺寸和壁厚增加相同比例的补强。关键区域通常是弯头的内弧、三通和四通的肩部、管帽的圆弧部位和异径管的大端。验证试验应基于 9.3 节定义的通过计算获得的管件及其连接管子的爆裂压力。

9.2 Test Assembly 试验组合件

9.2.1 Representative Components. Each fitting type shall be tested, except that testing of certain types of fittings can qualify other fittings as described in Table 9.2.1-1. Fittings from the same material group that have the same basic design configuration and method of manufacture shall be selected from production for testing and shall be identified as to material, grade, and lot, including heat treatment. 代表样品。每种管件类型都应进行测试,按表 9.2.1-1 所述,某些类型的管件可以覆盖表中的管件,免除测试。应从生产中选择具有相同基本设计配置和制造方法的相同材料组的管件进行检测,应确定材料、等级和批次,包括热处理。

(a) Examples of different basic configurations include the following: 不同基本配置的例子包括如下:

(1) elbows of different centerline radius (short versus long versus 3D radius) 不同弯曲半径的弯头(短、长、3D 半径)

(2) tees or crosses formed in full encircling dies versus cold or hot extrusion using a pad die 三通或四通成型时采用全包围模具或用垫板局部冷、热挤压。

(3) concentric versus eccentric shaped reducers 同心或偏心异径管

(4) caps of different configurations 不同类型的管帽

(b) Examples of different methods of manufacture include the following 不同的制造方法的例子包括以下:

(1) mandrel-formed elbows versus elbows welded from two half-shells versus bent pipe 推制成型的弯头或采用哈弗式分片压制焊接的弯头

(2) cold-formed tees or crosses versus extruded tees versus machined from solid forgings 冷成型的三通、四通, 挤压成型的三通或由锻件加工的三通

(3) conical reducers versus bell-shaped (integral tangents) reducers 锥形异径管或钟形异径管(相切)

(4) caps formed by extruding through a draw ring versus ends cut off cold-formed tees versus machined from solids 通过挤压拉伸成型的管帽、切掉冷挤三通顶部得到的管帽或锻件机械加工的管帽

(5) hot forming versus cold forming or using differential heating 热成型, 冷成型或采用局部加热成型

9.2.2 Other Components. Straight seamless or welded pipe whose calculated bursting strength is at least as great as the proof test pressure as calculated in para. 9.3 shall be welded to each end of the fitting to be tested. Pipe sections may have the nominal wall greater than the thickness indicated by the fitting markings. That greater thickness shall not exceed 1.5 times the fitting markings wall. Any internal misalignment greater than 1.5 mm (0.06 in.) shall be reduced by taper boring at a slope not greater than 1:3. Any other unequal wall welding preparation shall be in accordance with ASME B16.25. Length of pipe sections for closures shall be as follows:

9.2.2 其他样品。无缝或焊接直管, 其计算破裂强度至少与 9.3 节计算的试验压力相同, 钢管要焊接到待测管件的两端。钢管的公称壁厚度可能大于管件标记所指示的厚度, 钢管的最大厚度不得超过管件标记壁厚的 1.5 倍。任何大于 1.5 毫米(0.06 英寸)的内部错边应通过锥度镗孔(不大于 1:3 的坡度)来减少。其他不同壁厚的焊接坡口按照 ASME B16.25 执行, 用于封堵的钢管长度计算如下:

(a) Minimum length of pipe shall be one pipe O.D. for NPS 14 (DN 350) and smaller. NPS14 (DN 350)及以下口径, 钢管最小长度=钢管外径。

(b) Minimum length of pipe shall be one-half pipe O.D. for NPS greater than 14 (DN 350). NPS14 (DN 350)以上口径, 钢管最小长度=0.5*钢管外径。

9.3 Test Procedure 测试程序

To qualify a fitting by proof testing, the fitting shall be tested as described herein and shall withstand the minimum calculated pressure for at least 180 s (3 min). 为了通过验证性试验测试使管件合格, 管件应该按照本文所述进行测试, 并且应该承受至少 180 秒(3 分钟)的最小计算压力。

9.3.1 Number of Tests. At least three specimen tests for each fitting, joint size, or configuration are recommended. The test factor, f , is based on the number of specimen tests performed. The test factor, f , described in Table 9.3.1-1, is used in the computed proof test pressure equation. 检测数量。建议对每类管件至少三次试样试验, 推荐按照接头尺寸或结构选择。测试因子 f 是基于所进行的样本测试的数量。试验系数 f 如表 9.3.1-1 所示, 用于计算证明试验压力方程。

NOTE: Tests of geometrically identical fittings of different sizes and wall thicknesses that have overlapping ranges as described in para. 9.4 may be combined to establish the test factor applied to a set of fittings. For example, testing an NPS 2, NPS 8, and NPS 24 of the same basic design configuration and method of

manufacture would qualify for a test factor of 1.0 and would qualify fittings of that type from NPS 1 to NPS 48 and thickness ranges in accordance with para. 9.4.2. 注:不同尺寸和壁厚的几何形状相同的管件的试验,其重叠范围如段 9.4 所述。可以结合段 9.4 以确定适用于一套管件的测试系数。例如,测试具有相同的基本设计配置和制造方法口径为 nps2、nps8 和 nps24 的管件,可以获得 1.0 的测试因子,可以根据第 9.4.2 节确定壁厚覆盖范围,口径覆盖范围从 NPS 1 到 NPS 48

9.3.2 Computed Test Pressure. The minimum proof test pressure shall be at least equal to the value computed by the following equation and rounded to the nearest 0.2MPa (25 psi): 试验压力计算。最小试验压力应至少等于下列公式计算的值,并四舍五入到最接近的 0.2MPa (25 psi):

$$P=2Sf/D$$

where 其中

D = specified outside diameter of pipe 管道的规定外径

f = test factor from Table 9.3.1-1 试验系数见表 9.3.1-1

P = computed minimum proof test pressure for fitting 管件验证性试验的最小计算压力

S = actual tensile strength of the test fitting, determined on a specimen representative of the test fitting, which shall meet the tensile strength requirements of the applicable material of section 5 管件的抗拉强度,实际抗拉强度由管件的试验样品上测量得出,实际抗拉强度要满足第 5 部分材料的相关规定。

t = nominal pipe wall thickness of the pipe that the fitting marking identifies 管件标识的管道公称壁厚

NOTE: Any dimensionally consistent system of units may be used. 注:可采用一致的单位制。

9.3.3 Test Media. The test shall be conducted with water. Trapped air in the assembly shall be purged prior to the start of the test. 试验介质。应采用水压试验,组合件样品中的空气在试验前应排尽。

9.3.4 Application of Test Pressure. A pump with suitable pressure capacity shall be used to uniformly increase the test pressure through yield. Any gauges attached directly to the assembly may be removed and the pressure again uniformly increased at a suitable rate until either failure or the required test pressure has been achieved and held for 180 s. It is acceptable to increase pressure in the test assembly to accommodate reductions in test pressure caused by yielding in the test assembly. 加压要求。加压泵应具有合适的加压能力,使试验压力均匀增加,以达到材料屈服强度。试验组合件上连接的所有仪表应被去除,压力再次均匀地以合适的速度增加,达到爆破压力(样品失效)。或达到要求的测试压力,并保持 180 秒。当试验组合件由于屈服变形而导致的测试压力下降时,可以增加试验组合件的压力。

9.3.5 Recording Pressure–Time Readings. Test pressure versus time readings shall be recorded periodically. This may be achieved through electronic means or instrumentation with appropriate resolution and range that has been calibrated prior to the test. 压力-时间数值记录。测试压力对时间的读数应定期记录。记录可以通过在测试前已校准的具有适当分辨率和范围的电子手段或仪器来实现。

9.3.6 Test Temperature. The temperature(s) of the test fluid and components of the test assembly may not intentionally be increased or decreased if doing so would significantly affect a mechanical property or response of any component of the test assembly while it is under test. 试验温度。如果测试过程中,温度不显著影响试验组合件的机械性能,则试验介质和试验组合件的温度不得故意升高或降低。

9.3.7 Test Results. The test may be terminated if any component (e.g., fitting, pipe segment, fabrication weld) of the test assembly loses containment. The test of the fitting shall be

considered unsuccessful if there is any loss of containment from the tested fitting before or during the time it is to be held at or above the computed pressure. A proof test is successful only when the fitting being tested withstands for at least 180 s a continuous proof test pressure of at least the computed minimum (see para. 9.3.2) without exhibiting loss of containment or evidence of cracking, fissuring, tearing, etc. in the fitting under test. 试验结果。如果试验组合的任何组件(如管件、管段、焊缝)失去密封,则可以终止测试。如果被测试的管件在规定的保压时间前或规定的保压时间中失去密封,无论保压压力等于计算压力或超过计算压力,都将被认为试验失败。只有被测管件无泄漏或开裂、开裂、撕裂等迹象。且被测试的连接件承受至少 180 s 的连续验证测试压力,测试压力的最小值按照第 9.3.2 节计算,验证测试才能成功。

9.4 Applicability of Test Results 测试结果的适用性

It is not necessary to conduct an individual test of fittings with all combinations of sizes, wall thicknesses, and materials. A successful proof test on one representative fitting may qualify others to the extent described in paras. 9.4.1, 9.4.2, and 9.4.3. 不需要对规格、壁厚及材料的所有组合情况进行逐一试验。在一个代表性管件得出的合格的验证试验可代表在 9.4.1、9.4.2、和 9.4.3 范围内的其他管件。

9.4.1 Size Range. One test fitting may be used to qualify similarly proportioned fittings as defined in para. 9.2.1 with a size range from one-half to twice that for the tested fitting. 尺寸范围。一个测试管件可用于符合第 9.2.1 节中定义的类似比例的管件。尺寸范围为测试管件的 0.5 至 2 倍。

9.4.2 Thickness Range. One test fitting may be used to qualify similarly proportioned fittings as defined in para. 9.2.1 with t/D ranges from one-half to three times that for the tested fitting. 壁厚范围。一个测试管件可用于符合第 9.2.1 节中定义的类似比例的管件。 t/D 范围为测试管件的 0.5 至 3 倍。

9.4.3 Material Grades. The pressure-retaining capacity of a fitting of the same basic design configuration and method of manufacture made from material in a material group as listed in Table 5-1 will be directly proportional to the tensile properties of the materials. Therefore, it is necessary to test only a representative fitting to prove the design of a fitting for all materials in a group. 材料等级。由表 5-1 所列材料组中的材料制成的相同基本设计配置和制造方法的管件的保压能力与材料的拉伸性能成正比。因此,只需要对一个具有代表性的管件进行测试,就可以证明一个管件的设计适用于同一组中的所有材料。

9.5 Maintenance of Results 记录保存

The manufacturer shall have a quality control (QC) program that verifies the manufacturing process and material used and ensures that the resulting geometry and design thickness of the fittings or joints manufactured reasonably conform to the geometries tested. The QC program shall control the manufacturing drawings and maintain the QC records showing conformance to these drawings. 制造商应具有质量控制程序,以验证所使用的制造工艺和材料,并确保所制造的配件或接头的几何形状和设计厚度合理,可以满足试验形状的要求。QC 程序也应对制造图纸进行控制,同时保留显示满足这些图纸的 QC 记录。

Tests made in accordance with and at the time of previous editions of this Standard are not intended to be nullified by the changes made in this edition's test procedure and requirements, provided the design criteria for the type tested can be determined. 根据本标准前几版进行的测试不应因本标准测试程序 and 要求的更改而失效,前提是可以确定测试类型的设计标准。

Whenever a significant change is made in the geometry or method of manufacture, the manufacturer shall either retest the new production or show by analysis that the change would not affect the results of prior tests. 当几何形状或制造方法发生重大变化时,制造商应重新测试

新产品或通过分析表明该变化不会影响先前的测试结果。

Examples of changes in geometry that require retests are a change in starting thickness or revised tooling configuration. 需要重新测试的几何形状变化的例子是开始厚度的变化或修改的工具配置。

9.6 Proof Test Report 验证性试验报告

A report of the testing for each joint configuration shall be prepared and shall include 应编制每一种焊接接头配置的试验报告，并应包括

(a) description of the test, including the number of tests and f factor used to establish the target proof test 测试描述，包括测试次数和用于建立目标验证测试的 f 因子

(b) instrumentation and methods of calibration used 所用仪器和校准方法。

(c) material test reports for the assembly's materials (fitting, pipe, and end caps, if used) 试验组合件材料的材料测试报告(如管件、管道和端盖)

(d) actual final test pressures achieved for each test 每次试验的实际最后压力。

(e) length of time at or above the required test pressure (see para. 9.3.4) 在要求的测试压力下或以上的时间长度（详见第 9.3.4 节）

(f) calculations performed 进行的计算

(g) location of rupture, if any, including a sketch or photographs of the assembly 破裂的位置(如有)，包括试验组合件的草图或照片

(h) pressure design thickness required in critical areas 关键区域所需压力设计厚度

(i) certification by the manufacturer and by a licensed Authorized Inspector or other third party having experience in pressure component design and testing 由制造商和具有压力元件设计和测试经验的授权检验员或其他第三方

10 PRODUCTION TESTS 产品试验

Hydrostatic testing of wrought fittings is not required by this Standard. All fittings shall be capable of withstanding, without leakage or impairment of serviceability, a hydrostatic test pressure required by the applicable piping code for seamless pipe of material equivalent to the fitting material, and of the size and wall thickness the fitting marking identifies. 本标准不要求对锻轧钢制管件进行水压试验。所有管件应能经受住由管件标志识别的管件材料和 NPS 规格及壁厚相同的无缝管材，按适用的管道规范所要求的水压试验压力，无泄漏或有损于使用性能。

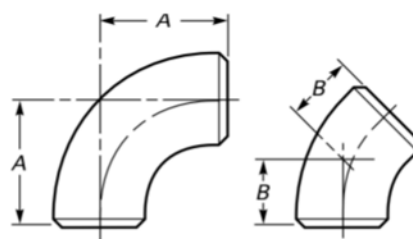
11 TOLERANCES 公差

Tolerances for fittings are shown in Table 11-1 and apply to the nominal dimensions given in Tables 6.1-1 through 6.1-11. Where given in the tables, the minimum and maximum dimensions are based on these tolerances. The listings with decimals do not imply precision measurement, such as use of vernier, micrometer, or electronic readout equipment. 管件的公差见表 11-1，适用于表 6.1-1 至 6.1-11 的公称尺寸。如表中所示，最小和最大尺寸是基于这些公差。带有小数点的列表并不意味着使用游标卡尺、千分尺或电子读出设备等进行精确测量。

Table 5-1 Material Groupings 材料组别

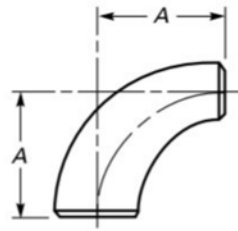
Group No.组别	Material 材料	Standards 标准
1	Carbon and low-alloy steels 碳素钢和低合金钢	ASTM A234/A234M and ASTM A420/A420M
2	Austenitic and duplex stainless steels 奥氏体和双相不锈钢	ASTM A403/A403M and ASTM A815/A815M
3	Nickel alloys 镍合金	ASTM B366/B366M
4	Aluminum alloys 铝合金	ASTM B361
5	Titanium alloys 钛合金	ASTM B363

Table 6.1-1 长半径弯头尺寸



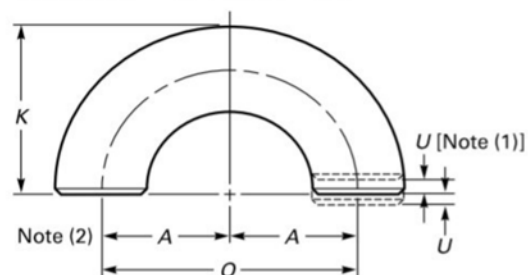
公称直径 (NPS)	坡口处外径 mm (in.)	中心至端部	
		90° 弯头 A	45° 弯头 B
1/2	21.3 (0.84)	38 (1.50)	16 (0.62)
3/4	26.7 (1.05)	38 (1.50)	19 (0.75)
1	33.4 (1.32)	38 (1.50)	22 (0.88)
1 1/4	42.2 (1.66)	48 (1.88)	25 (1.00)
1 1/2	48.3 (1.90)	57 (2.25)	29 (1.12)
2	60.3 (2.38)	76 (3.00)	35 (1.38)
2 1/2	73.0 (2.88)	95 (3.75)	44 (1.75)
3	88.9 (3.50)	114 (4.50)	51 (2.00)
3 1/2	101.6 (4.00)	133 (5.25)	57 (2.25)
4	114.3 (4.50)	152 (6.00)	64 (2.50)
5	141.3 (5.56)	190 (7.50)	79 (3.12)
6	168.3 (6.62)	229 (9.00)	95 (3.75)
8	219.1 (8.62)	305 (12.00)	127 (5.00)
10	273.0 (10.75)	381 (15.00)	159 (6.25)
12	323.8 (12.75)	457 (18.00)	190 (7.50)
14	355.6 (14.00)	533 (21.00)	222 (8.75)
16	406.4 (16.00)	610 (24.00)	254 (10.00)
18	457.0 (18.00)	686 (27.00)	286 (11.25)
20	508.0 (20.00)	762 (30.00)	318 (12.50)
22	559.0 (22.00)	838 (33.00)	343 (13.50)
24	610.0 (24.00)	914 (36.00)	381 (15.00)
26	660.0 (26.00)	991 (39.00)	406 (16.00)
28	711.0 (28.00)	1 067 (42.00)	438 (17.25)
30	762.0 (30.00)	1 143 (45.00)	470 (18.50)
32	813.0 (32.00)	1 219 (48.00)	502 (19.75)
34	864.0 (34.00)	1 295 (51.00)	533 (21.00)
36	914.0 (36.00)	1 372 (54.00)	565 (22.25)
38	965.0 (38.00)	1 448 (57.00)	600 (23.62)
40	1 016.0 (40.00)	1 524 (60.00)	632 (24.88)
42	1 067.0 (42.00)	1 600 (63.00)	660 (26.00)
44	1 118.0 (44.00)	1 676 (66.00)	695 (27.38)
46	1 168.0 (46.00)	1 753 (69.00)	727 (28.62)
48	1 219.0 (48.00)	1 829 (72.00)	759 (29.88)

Table 6.1-2 长半径异径弯头



公称直径 (NPS)	坡口处外径 mm (in.)		中心至端部 A, mm (in.)	公称直径 (NPS)	坡口处外径 mm (in.)		中心至端部 A, mm (in.)
	大端	小端			大端	小端	
2 × 1½	60.3 (2.38)	48.3 (1.90)	76 (3.00)	10 × 8	273.0 (10.75)	219.1 (8.62)	381 (15.00)
2 × 1¼	60.3 (2.38)	42.2 (1.66)	76 (3.00)	10 × 6	273.0 (10.75)	168.3 (6.62)	381 (15.00)
2 × 1	60.3 (2.38)	33.4 (1.32)	76 (3.00)	10 × 5	273.0 (10.75)	141.3 (5.56)	381 (15.00)
2½ × 2	73.0 (2.88)	60.3 (2.38)	95 (3.75)	12 × 10	323.8 (12.75)	273.0 (10.75)	457 (18.00)
2½ × 1½	73.0 (2.88)	48.3 (1.90)	95 (3.75)	12 × 8	323.8 (12.75)	219.1 (8.62)	457 (18.00)
2½ × 1¼	73.0 (2.88)	42.2 (1.66)	95 (3.75)	12 × 6	323.8 (12.75)	168.3 (6.62)	457 (18.00)
3 × 2½	88.9 (3.50)	73.0 (2.88)	114 (4.50)	14 × 12	355.6 (14.00)	323.8 (12.75)	533 (21.00)
3 × 2	88.9 (3.50)	60.3 (2.38)	114 (4.50)	14 × 10	355.6 (14.00)	273.0 (10.75)	533 (21.00)
3 × 1½	88.9 (3.50)	48.3 (1.90)	114 (4.50)	14 × 8	355.6 (14.00)	219.1 (8.62)	533 (21.00)
3½ × 3	101.6 (4.00)	88.9 (3.50)	133 (5.25)	16 × 14	406.4 (16.00)	355.6 (14.00)	610 (24.00)
3½ × 2½	101.6 (4.00)	73.0 (2.88)	133 (5.25)	16 × 12	406.4 (16.00)	323.8 (12.75)	610 (24.00)
3½ × 2	101.6 (4.00)	60.3 (2.38)	133 (5.25)	16 × 10	406.4 (16.00)	273.0 (10.75)	610 (24.00)
4 × 3½	114.3 (4.50)	101.6 (4.00)	152 (6.00)	18 × 16	457.0 (18.00)	406.4 (16.00)	686 (27.00)
4 × 3	114.3 (4.50)	88.9 (3.50)	152 (6.00)	18 × 14	457.0 (18.00)	355.6 (14.00)	686 (27.00)
4 × 2½	114.3 (4.50)	73.0 (2.88)	152 (6.00)	18 × 12	457.0 (18.00)	323.8 (12.75)	686 (27.00)
4 × 2	114.3 (4.50)	60.3 (2.38)	152 (6.00)	18 × 10	457.0 (18.00)	273.0 (10.75)	686 (27.00)
5 × 4	141.3 (5.56)	114.3 (4.50)	190 (7.50)	20 × 18	508.0 (20.00)	457.0 (18.00)	762 (30.00)
5 × 3½	141.3 (5.56)	101.6 (4.00)	190 (7.50)	20 × 16	508.0 (20.00)	406.4 (16.00)	762 (30.00)
5 × 3	141.3 (5.56)	88.9 (3.50)	190 (7.50)	20 × 14	508.0 (20.00)	355.6 (14.00)	762 (30.00)
5 × 2½	141.3 (5.56)	73.0 (2.88)	190 (7.50)	20 × 12	508.0 (20.00)	323.8 (12.75)	762 (30.00)
				20 × 10	508.0 (20.00)	273.0 (10.75)	762 (30.00)
6 × 5	168.3 (6.62)	141.3 (5.56)	229 (9.00)	24 × 22	610.0 (24.00)	559.0 (22.00)	914 (36.00)
6 × 4	168.3 (6.62)	114.3 (4.50)	229 (9.00)	24 × 20	610.0 (24.00)	508.0 (20.00)	914 (36.00)
6 × 3½	168.3 (6.62)	101.6 (4.00)	229 (9.00)	24 × 18	610.0 (24.00)	457.0 (18.00)	914 (36.00)
6 × 3	168.3 (6.62)	88.9 (3.50)	229 (9.00)	24 × 16	610.0 (24.00)	406.4 (16.00)	914 (36.00)
8 × 6	219.1 (8.62)	168.3 (6.62)	305 (12.00)	24 × 14	610.0 (24.00)	355.6 (14.00)	914 (36.00)
8 × 5	219.1 (8.62)	141.3 (5.56)	305 (12.00)	24 × 12	610.0 (24.00)	323.8 (12.75)	914 (36.00)
8 × 4	219.1 (8.62)	114.3 (4.50)	305 (12.00)	...	...	...	...

Table 6.1-3 长半径180° 弯头



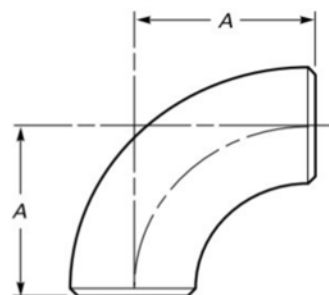
公称直径	坡口处外径	中心至中心	背部至端面
(NPS)	mm (in.)	O, mm (in.)	K, mm (in.)
1/2	21.3 (0.84)	76 (3.00)	48 (1.88)
3/4	26.7 (1.05)	76 (3.00)	51 (2.00)
1	33.4 (1.32)	76 (3.00)	56 (2.19)
1 1/4	42.2 (1.66)	95 (3.75)	70 (2.75)
1 1/2	48.3 (1.90)	114 (4.50)	83 (3.25)
2	60.3 (2.38)	152 (6.00)	106 (4.19)
2 1/2	73.0 (2.88)	190 (7.50)	132 (5.19)
3	88.9 (3.50)	229 (9.00)	159 (6.25)
3 1/2	101.6 (4.00)	267 (10.50)	184 (7.25)
4	114.3 (4.50)	305 (12.00)	210 (8.25)
5	141.3 (5.56)	381 (15.00)	262 (10.31)
6	168.3 (6.62)	457 (18.00)	313 (12.31)
8	219.1 (8.62)	610 (24.00)	414 (16.31)
10	273.0 (10.75)	762 (30.00)	518 (20.38)
12	323.8 (12.75)	914 (36.00)	619 (24.38)
14	355.6 (14.00)	1 067 (42.00)	711 (28.00)
16	406.4 (16.00)	1 219 (48.00)	813 (32.00)
18	457.0 (18.00)	1 372 (54.00)	914 (36.00)
20	508.0 (20.00)	1 524 (60.00)	1 016 (40.00)
22	559.0 (22.00)	1 676 (66.00)	1 118 (44.00)
24	610.0 (24.00)	1 829 (72.00)	1 219 (48.00)

备注:

(1) 端部组对公差按照表11-1执行。

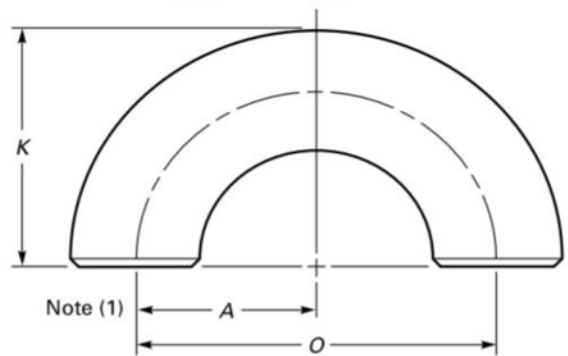
(2) 尺寸A等于尺寸D的1/2。

Table 6.1-4 短半径90° 弯头



公称直径	坡口处外径	中心至端部
(NPS)	mm (in.)	A, mm (in.)
1	33.4 (1.32)	25 (1.00)
1 1/4	42.2 (1.66)	32 (1.25)
1 1/2	48.3 (1.90)	38 (1.50)
2	60.3 (2.38)	51 (2.00)
2 1/2	73.0 (2.88)	64 (2.50)
3	88.9 (3.50)	76 (3.00)
3 1/2	101.6 (4.00)	89 (3.50)
4	114.3 (4.50)	102 (4.00)
5	141.3 (5.56)	127 (5.00)
6	168.3 (6.62)	152 (6.00)
8	219.1 (8.62)	203 (8.00)
10	273.0 (10.75)	254 (10.00)
12	323.8 (12.75)	305 (12.00)
14	355.6 (14.00)	356 (14.00)
16	406.4 (16.00)	406 (16.00)
18	457.0 (18.00)	457 (18.00)
20	508.0 (20.00)	508 (20.00)
22	559.0 (22.00)	559 (22.00)
24	610.0 (24.00)	610 (24.00)

Table 6.1-5 短半径180° 弯头

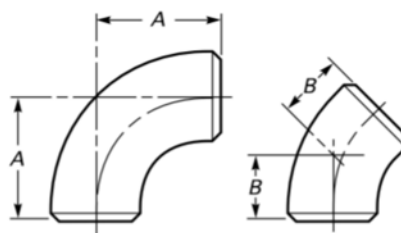


公称直径 (NPS)	坡口处外径 mm (in.)	中心至中心 O, mm (in.)	背部至端面 K, mm (in.)
1	33.4 (1.32)	51 (2.00)	41 (1.62)
1¼	42.2 (1.66)	64 (2.50)	52 (2.06)
1½	48.3 (1.90)	76 (3.00)	62 (2.44)
2	60.3 (2.38)	102 (4.00)	81 (3.19)
2½	73.0 (2.88)	127 (5.00)	100 (3.94)
3	88.9 (3.50)	152 (6.00)	121 (4.75)
3½	101.6 (4.00)	178 (7.00)	140 (5.50)
4	114.3 (4.50)	203 (8.00)	159 (6.25)
5	141.3 (5.56)	254 (10.00)	197 (7.75)
6	168.3 (6.62)	305 (12.00)	237 (9.31)
8	219.1 (8.62)	406 (16.00)	313 (12.31)
10	273.0 (10.75)	508 (20.00)	391 (15.38)
12	323.8 (12.75)	610 (24.00)	467 (18.38)
14	355.6 (14.00)	711 (28.00)	533 (21.00)
16	406.4 (16.00)	813 (32.00)	610 (24.00)
18	457.0 (18.00)	914 (36.00)	686 (27.00)
20	508.0 (20.00)	1 016 (40.00)	762 (30.00)
22	559.0 (22.00)	1 118 (44.00)	838 (33.00)
24	610.0 (24.00)	1 219 (48.00)	914 (36.00)

备注:

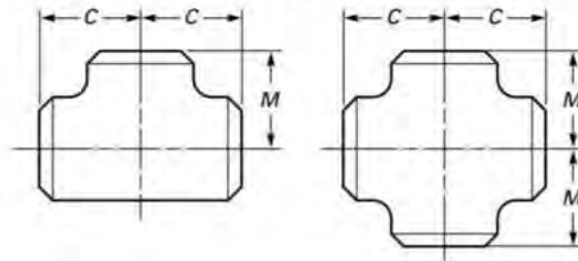
(1) 尺寸A等于尺寸D的1/2.

Table 6.1-6 3D弯曲半径弯头



公称直径 (NPS)	坡口处外径 mm (in.)	中心至端部	
		90° 弯头 A	45° 弯头 B
3/4	26.7 (1.05)	57 (2.25)	24 (0.94)
1	33.4 (1.32)	76 (3.00)	31 (1.25)
1 1/4	42.2 (1.66)	95 (3.75)	39 (1.56)
1 1/2	48.3 (1.90)	114 (4.50)	47 (1.88)
2	60.3 (2.38)	152 (6.00)	63 (2.50)
2 1/2	73.0 (2.88)	190 (7.50)	79 (3.12)
3	88.9 (3.50)	229 (9.00)	95 (3.75)
3 1/2	101.6 (4.00)	267 (10.50)	111 (4.38)
4	114.3 (4.50)	305 (12.00)	127 (5.00)
5	141.3 (5.56)	381 (15.00)	157 (6.19)
6	168.3 (6.62)	457 (18.00)	189 (7.44)
8	219.1 (8.62)	610 (24.00)	252 (9.94)
10	273.0 (10.75)	762 (30.00)	316 (12.44)
12	323.8 (12.75)	914 (36.00)	378 (14.88)
14	355.6 (14.00)	1 067 (42.00)	441 (17.38)
16	406.4 (16.00)	1 219 (48.00)	505 (19.88)
18	457.0 (18.00)	1 372 (54.00)	568 (22.38)
20	508.0 (20.00)	1 524 (60.00)	632 (24.88)
22	559.0 (22.00)	1 676 (66.00)	694 (27.31)
24	610.0 (24.00)	1 829 (72.00)	757 (29.81)
26	660.0 (26.00)	1 981 (78.00)	821 (32.31)
28	711.0 (28.00)	2 134 (84.00)	883 (34.75)
30	762.0 (30.00)	2 286 (90.00)	946 (37.25)
32	813.0 (32.00)	2 438 (96.00)	1 010 (39.75)
34	864.0 (34.00)	2 591 (102.00)	1 073 (42.25)
36	914.0 (36.00)	2 743 (108.00)	1 135 (44.69)
38	965.0 (38.00)	2 896 (114.00)	1 200 (47.25)
40	1 016.0 (40.00)	3 048 (120.00)	1 264 (49.75)
42	1 067.0 (42.00)	3 200 (126.00)	1 326 (52.19)
44	1 118.0 (44.00)	3 353 (132.00)	1 389 (54.69)
46	1 168.0 (46.00)	3 505 (138.00)	1 453 (57.19)
48	1 219.0 (48.00)	3 658 (144.00)	1 516 (59.69)

Table 6.1-7 等径三通和四通尺寸



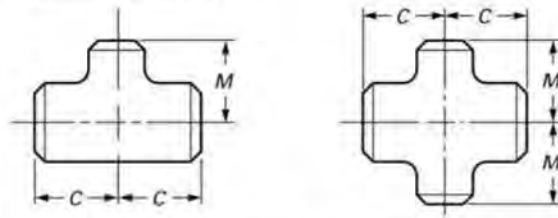
公称直径 (NPS)	坡口处外径 mm (in.)	中心至端部 mm (in.)	
		主管口, C	支口, M [Notes (1) and (2)]
1/2	21.3 (0.84)	25 (1.00)	25 (1.00)
3/4	26.7 (1.05)	29 (1.12)	29 (1.12)
1	33.4 (1.32)	38 (1.50)	38 (1.50)
1 1/4	42.2 (1.66)	48 (1.88)	48 (1.88)
1 1/2	48.3 (1.90)	57 (2.25)	57 (2.25)
2	60.3 (2.38)	64 (2.50)	64 (2.50)
2 1/2	73.0 (2.88)	76 (3.00)	76 (3.00)
3	88.9 (3.50)	86 (3.38)	86 (3.38)
3 1/2	101.6 (4.00)	95 (3.75)	95 (3.75)
4	114.3 (4.50)	105 (4.12)	105 (4.12)
5	141.3 (5.56)	124 (4.88)	124 (4.88)
6	168.3 (6.62)	143 (5.62)	143 (5.62)
8	219.1 (8.62)	178 (7.00)	178 (7.00)
10	273.0 (10.75)	216 (8.50)	216 (8.50)
12	323.8 (12.75)	254 (10.00)	254 (10.00)
14	355.6 (14.00)	279 (11.00)	279 (11.00)
16	406.4 (16.00)	305 (12.00)	305 (12.00)
18	457.0 (18.00)	343 (13.50)	343 (13.50)
20	508.0 (20.00)	381 (15.00)	381 (15.00)
22	559.0 (22.00)	419 (16.50)	419 (16.50)
24	610.0 (24.00)	432 (17.00)	432 (17.00)
26	660.0 (26.00)	495 (19.50)	495 (19.50)
28	711.0 (28.00)	521 (20.50)	521 (20.50)
30	762.0 (30.00)	559 (22.00)	559 (22.00)
32	813.0 (32.00)	597 (23.50)	597 (23.50)
34	864.0 (34.00)	635 (25.00)	635 (25.00)
36	914.0 (36.00)	673 (26.50)	673 (26.50)
38	965.0 (38.00)	711 (28.00)	711 (28.00)
40	1 016.0 (40.00)	749 (29.50)	749 (29.50)
42	1 067.0 (42.00)	762 (30.00)	711 (28.00)
44	1 118.0 (44.00)	813 (32.00)	762 (30.00)
46	1 168.0 (46.00)	851 (33.50)	800 (31.50)
48	1 219.0 (48.00)	889 (35.00)	838 (33.00)

备注:

(1) 对 NPS 26 及以上的管件, 推荐但并不一定要采用支口尺寸 M₁。

(2) 适用于 NPS 24 及以下的四通适用的尺寸。

Table 6.1-8 异径三通和四通尺寸



公称直径 (NPS)	接口处外径		中心至端部	
	主管口	支口	主管口	支口, <i>M</i> [Note (1)]
$\frac{1}{2} \times \frac{1}{2} \times \frac{3}{4}$	21.3 (0.84)	17.3 (0.68)	25 (1.00)	25 (1.00)
$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$	21.3 (0.84)	13.7 (0.54)	25 (1.00)	25 (1.00)
$\frac{3}{4} \times \frac{3}{4} \times \frac{1}{2}$	26.7 (1.05)	21.3 (0.84)	29 (1.12)	29 (1.12)
$\frac{3}{4} \times \frac{3}{4} \times \frac{3}{8}$	26.7 (1.05)	17.3 (0.68)	29 (1.12)	29 (1.12)
$1 \times 1 \times \frac{3}{4}$	33.4 (1.32)	26.7 (1.05)	38 (1.50)	38 (1.50)
$1 \times 1 \times \frac{1}{2}$	33.4 (1.32)	21.3 (0.84)	38 (1.50)	38 (1.50)
$1\frac{1}{4} \times 1\frac{1}{4} \times 1$	42.2 (1.66)	33.4 (1.32)	48 (1.88)	48 (1.88)
$1\frac{1}{4} \times 1\frac{1}{4} \times \frac{3}{4}$	42.2 (1.66)	26.7 (1.05)	48 (1.88)	48 (1.88)
$1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{2}$	42.2 (1.66)	21.3 (0.84)	48 (1.88)	48 (1.88)
$1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{4}$	48.3 (1.90)	42.2 (1.66)	57 (2.25)	57 (2.25)
$1\frac{1}{2} \times 1\frac{1}{2} \times 1$	48.3 (1.90)	33.4 (1.32)	57 (2.25)	57 (2.25)
$1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$	48.3 (1.90)	26.7 (1.05)	57 (2.25)	57 (2.25)
$1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$	48.3 (1.90)	21.3 (0.84)	57 (2.25)	57 (2.25)
$2 \times 2 \times 1\frac{1}{2}$	60.3 (2.38)	48.3 (1.90)	64 (2.50)	60 (2.38)
$2 \times 2 \times 1\frac{1}{4}$	60.3 (2.38)	42.2 (1.66)	64 (2.50)	57 (2.25)
$2 \times 2 \times 1$	60.3 (2.38)	33.4 (1.32)	64 (2.50)	51 (2.00)
$2 \times 2 \times \frac{3}{4}$	60.3 (2.38)	26.7 (1.05)	64 (2.50)	44 (1.75)
$2\frac{1}{2} \times 2\frac{1}{2} \times 2$	73.0 (2.88)	60.3 (2.38)	76 (3.00)	70 (2.75)
$2\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$	73.0 (2.88)	48.3 (1.90)	76 (3.00)	67 (2.62)
$2\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{4}$	73.0 (2.88)	42.2 (1.66)	76 (3.00)	64 (2.50)
$2\frac{1}{2} \times 2\frac{1}{2} \times 1$	73.0 (2.88)	33.4 (1.32)	76 (3.00)	57 (2.25)
$3 \times 3 \times 2\frac{1}{2}$	88.9 (3.50)	73.0 (2.88)	86 (3.38)	83 (3.25)
$3 \times 3 \times 2$	88.9 (3.50)	60.3 (2.38)	86 (3.38)	76 (3.00)
$3 \times 3 \times 1\frac{1}{2}$	88.9 (3.50)	48.3 (1.90)	86 (3.38)	73 (2.88)
$3 \times 3 \times 1\frac{1}{4}$	88.9 (3.50)	42.2 (1.66)	86 (3.38)	70 (2.75)
$3\frac{1}{2} \times 3\frac{1}{2} \times 3$	101.6 (4.00)	88.9 (3.50)	95 (3.75)	92 (3.62)
$3\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$	101.6 (4.00)	73.0 (2.88)	95 (3.75)	89 (3.50)
$3\frac{1}{2} \times 3\frac{1}{2} \times 2$	101.6 (4.00)	60.3 (2.38)	95 (3.75)	83 (3.25)
$3\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{2}$	101.6 (4.00)	48.3 (1.90)	95 (3.75)	79 (3.12)
$4 \times 4 \times 3\frac{1}{2}$	114.3 (4.50)	101.6 (4.00)	105 (4.12)	102 (4.00)
$4 \times 4 \times 3$	114.3 (4.50)	88.9 (3.50)	105 (4.12)	98 (3.88)
$4 \times 4 \times 2\frac{1}{2}$	114.3 (4.50)	73.0 (2.88)	105 (4.12)	95 (3.75)
$4 \times 4 \times 2$	114.3 (4.50)	60.3 (2.38)	105 (4.12)	89 (3.50)
$4 \times 4 \times 1\frac{1}{2}$	114.3 (4.50)	48.3 (1.90)	105 (4.12)	86 (3.38)

Table 6.1-8 异径三通和四通尺寸 (续表)

公称直径 (NPS)	坡口处外径 mm (in.)		中心至端部 mm (in.)	
	主管口	支口	主管口, <i>C</i>	支口, <i>t, M</i> [Note (1)]
5 × 5 × 4	141.3 (5.56)	114.3 (4.50)	124 (4.88)	117 (4.62)
5 × 5 × 3½	141.3 (5.56)	101.6 (4.00)	124 (4.88)	114 (4.50)
5 × 5 × 3	141.3 (5.56)	88.9 (3.50)	124 (4.88)	111 (4.38)
5 × 5 × 2½	141.3 (5.56)	73.0 (2.88)	124 (4.88)	108 (4.25)
5 × 5 × 2	141.3 (5.56)	60.3 (2.38)	124 (4.88)	105 (4.12)
6 × 6 × 5	168.3 (6.62)	141.3 (5.56)	143 (5.62)	137 (5.38)
6 × 6 × 4	168.3 (6.62)	114.3 (4.50)	143 (5.62)	130 (5.12)
6 × 6 × 3½	168.3 (6.62)	101.6 (4.00)	143 (5.62)	127 (5.00)
6 × 6 × 3	168.3 (6.62)	88.9 (3.50)	143 (5.62)	124 (4.88)
6 × 6 × 2½	168.3 (6.62)	73.0 (2.88)	143 (5.62)	121 (4.75)
8 × 8 × 6	219.1 (8.62)	168.3 (6.62)	178 (7.00)	168 (6.62)
8 × 8 × 5	219.1 (8.62)	141.3 (5.56)	178 (7.00)	162 (6.38)
8 × 8 × 4	219.1 (8.62)	114.3 (4.50)	178 (7.00)	156 (6.12)
8 × 8 × 3½	219.1 (8.62)	101.6 (4.00)	178 (7.00)	152 (6.00)
10 × 10 × 8	273.0 (10.75)	219.1 (8.62)	216 (8.50)	203 (8.00)
10 × 10 × 6	273.0 (10.75)	168.3 (6.62)	216 (8.50)	194 (7.62)
10 × 10 × 5	273.0 (10.75)	141.3 (5.56)	216 (8.50)	191 (7.50)
10 × 10 × 4	273.0 (10.75)	114.3 (4.50)	216 (8.50)	184 (7.25)
12 × 12 × 10	323.8 (12.75)	273.0 (10.75)	254 (10.00)	241 (9.50)
12 × 12 × 8	323.8 (12.75)	219.1 (8.62)	254 (10.00)	229 (9.00)
12 × 12 × 6	323.8 (12.75)	168.3 (6.62)	254 (10.00)	219 (8.62)
12 × 12 × 5	323.8 (12.75)	141.3 (5.56)	254 (10.00)	216 (8.50)
14 × 14 × 12	355.6 (14.00)	323.8 (12.75)	279 (11.00)	270 (10.62)
14 × 14 × 10	355.6 (14.00)	273.0 (10.75)	279 (11.00)	257 (10.12)
14 × 14 × 8	355.6 (14.00)	219.1 (8.62)	279 (11.00)	248 (9.75)
14 × 14 × 6	355.6 (14.00)	168.3 (6.62)	279 (11.00)	238 (9.38)
16 × 16 × 14	406.4 (16.00)	355.6 (14.00)	305 (12.00)	305 (12.00)
16 × 16 × 12	406.4 (16.00)	323.8 (12.75)	305 (12.00)	295 (11.62)
16 × 16 × 10	406.4 (16.00)	273.0 (10.75)	305 (12.00)	283 (11.12)
16 × 16 × 8	406.4 (16.00)	219.1 (8.62)	305 (12.00)	273 (10.75)
16 × 16 × 6	406.4 (16.00)	168.3 (6.62)	305 (12.00)	264 (10.38)
18 × 18 × 16	457 (18.00)	406.4 (16.00)	343 (13.50)	330 (13.00)
18 × 18 × 14	457 (18.00)	355.6 (14.00)	343 (13.50)	330 (13.00)
18 × 18 × 12	457 (18.00)	323.8 (12.75)	343 (13.50)	321 (12.62)
18 × 18 × 10	457 (18.00)	273.0 (10.75)	343 (13.50)	308 (12.12)
18 × 18 × 8	457 (18.00)	219.1 (8.62)	343 (13.50)	298 (11.75)
20 × 20 × 18	508 (20.00)	457.0 (18.00)	381 (15.00)	368 (14.50)
20 × 20 × 16	508 (20.00)	406.4 (16.00)	381 (15.00)	356 (14.00)
20 × 20 × 14	508 (20.00)	355.6 (14.00)	381 (15.00)	356 (14.00)

Table 6.1-8 异径三通和四通尺寸 (续表)

公称直径 (NPS)	接口处外径 mm (in.)		中心至端部 mm (in.)	
	主管口	支口	主管口 C	支口 M [Note (1)]
20 × 20 × 12	508 (20.00)	323.8 (12.75)	381 (15.00)	346 (13.62)
20 × 20 × 10	508 (20.00)	273.0 (10.75)	381 (15.00)	333 (13.12)
20 × 20 × 8	508 (20.00)	219.1 (8.62)	381 (15.00)	324 (12.75)
22 × 22 × 20	559 (22.00)	508.0 (20.00)	419 (16.50)	406 (16.00)
22 × 22 × 18	559 (22.00)	457.0 (18.00)	419 (16.50)	394 (15.50)
22 × 22 × 16	559 (22.00)	406.4 (16.00)	419 (16.50)	381 (15.00)
22 × 22 × 14	559 (22.00)	355.6 (14.00)	419 (16.50)	381 (15.00)
22 × 22 × 12	559 (22.00)	323.8 (12.75)	419 (16.50)	371 (14.62)
22 × 22 × 10	559 (22.00)	273.0 (10.75)	419 (16.50)	359 (14.12)
24 × 24 × 22	610 (24.00)	559.0 (22.00)	432 (17.00)	432 (17.00)
24 × 24 × 20	610 (24.00)	508.0 (20.00)	432 (17.00)	432 (17.00)
24 × 24 × 18	610 (24.00)	457.0 (18.00)	432 (17.00)	419 (16.50)
24 × 24 × 16	610 (24.00)	406.4 (16.00)	432 (17.00)	406 (16.00)
24 × 24 × 14	610 (24.00)	355.6 (14.00)	432 (17.00)	406 (16.00)
24 × 24 × 12	610 (24.00)	323.8 (12.75)	432 (17.00)	397 (15.62)
24 × 24 × 10	610 (24.00)	273.0 (10.75)	432 (17.00)	384 (15.12)
26 × 26 × 24	660 (26.00)	610.0 (24.00)	495 (19.50)	483 (19.00)
26 × 26 × 22	660 (26.00)	559.0 (22.00)	495 (19.50)	470 (18.50)
26 × 26 × 20	660 (26.00)	508.0 (20.00)	495 (19.50)	457 (18.00)
26 × 26 × 18	660 (26.00)	457.0 (18.00)	495 (19.50)	444 (17.50)
26 × 26 × 16	660 (26.00)	406.4 (16.00)	495 (19.50)	432 (17.00)
26 × 26 × 14	660 (26.00)	355.6 (14.00)	495 (19.50)	432 (17.00)
26 × 26 × 12	660 (26.00)	323.8 (12.75)	495 (19.50)	422 (16.62)
28 × 28 × 26	711 (28.00)	660.0 (26.00)	521 (20.50)	521 (20.50)
28 × 28 × 24	711 (28.00)	610.0 (24.00)	521 (20.50)	508 (20.00)
28 × 28 × 22	711 (28.00)	559.0 (22.00)	521 (20.50)	495 (19.50)
28 × 28 × 20	711 (28.00)	508.0 (20.00)	521 (20.50)	483 (19.00)
28 × 28 × 18	711 (28.00)	457.0 (18.00)	521 (20.50)	470 (18.50)
28 × 28 × 16	711 (28.00)	406.4 (16.00)	521 (20.50)	457 (18.00)
28 × 28 × 14	711 (28.00)	355.6 (14.00)	521 (20.50)	457 (18.00)
28 × 28 × 12	711 (28.00)	323.8 (12.75)	521 (20.50)	448 (17.62)
30 × 30 × 28	762 (30.00)	711.0 (28.00)	559 (22.00)	546 (21.50)
30 × 30 × 26	762 (30.00)	660.0 (26.00)	559 (22.00)	546 (21.50)
30 × 30 × 24	762 (30.00)	610.0 (24.00)	559 (22.00)	533 (21.00)
30 × 30 × 22	762 (30.00)	559.0 (22.00)	559 (22.00)	521 (20.50)
30 × 30 × 20	762 (30.00)	508.0 (20.00)	559 (22.00)	508 (20.00)
30 × 30 × 18	762 (30.00)	457.0 (18.00)	559 (22.00)	495 (19.50)
30 × 30 × 16	762 (30.00)	406.4 (16.00)	559 (22.00)	483 (19.00)
30 × 30 × 14	762 (30.00)	355.6 (14.00)	559 (22.00)	483 (19.00)

Table 6.1-8 异径三通和四通尺寸 (续表)

公称直径 (NPS)	坡口处外径 mm (in.)		中心至端部 mm (in.)	
	主管口	支口	主管口 C	支口 M [Note (1)]
30 × 30 × 12	762 (30.00)	323.8 (12.75)	559 (22.00)	473 (18.62)
30 × 30 × 10	762 (30.00)	273.0 (10.75)	559 (22.00)	460 (18.12)
32 × 32 × 30	813 (32.00)	762.0 (30.00)	597 (23.50)	584 (23.00)
32 × 32 × 28	813 (32.00)	711.0 (28.00)	597 (23.50)	572 (22.5)
32 × 32 × 26	813 (32.00)	660.0 (26.00)	597 (23.50)	572 (22.50)
32 × 32 × 24	813 (32.00)	610.0 (24.00)	597 (23.50)	559 (22.00)
32 × 32 × 22	813 (32.00)	559.0 (22.00)	597 (23.50)	546 (21.50)
32 × 32 × 20	813 (32.00)	508.0 (20.00)	597 (23.50)	533 (21.00)
32 × 32 × 18	813 (32.00)	457.0 (18.00)	597 (23.50)	521 (20.50)
32 × 32 × 16	813 (32.00)	406.4 (16.00)	597 (23.50)	508 (20.00)
32 × 32 × 14	813 (32.00)	355.6 (14.00)	597 (23.50)	508 (20.00)
34 × 34 × 32	864 (34.00)	813.0 (32.00)	635 (25.00)	622 (24.50)
34 × 34 × 30	864 (34.00)	762.0 (30.00)	635 (25.00)	610 (24.00)
34 × 34 × 28	864 (34.00)	711.0 (28.00)	635 (25.00)	597 (23.50)
34 × 34 × 26	864 (34.00)	660.0 (26.00)	635 (25.00)	597 (23.50)
34 × 34 × 24	864 (34.00)	610.0 (24.00)	635 (25.00)	584 (23.00)
34 × 34 × 22	864 (34.00)	559.0 (22.00)	635 (25.00)	572 (22.50)
34 × 34 × 20	864 (34.00)	508.0 (20.00)	635 (25.00)	559 (22.00)
34 × 34 × 18	864 (34.00)	457.0 (18.00)	635 (25.00)	546 (21.50)
34 × 34 × 16	864 (34.00)	406.4 (16.00)	635 (25.00)	533 (21.00)
36 × 36 × 34	914 (36.00)	864.0 (34.00)	673 (26.50)	660 (26.00)
36 × 36 × 32	914 (36.00)	813.0 (32.00)	673 (26.50)	648 (25.50)
36 × 36 × 30	914 (36.00)	762.0 (30.00)	673 (26.50)	635 (25.00)
36 × 36 × 28	914 (36.00)	711.0 (28.00)	673 (26.50)	622 (24.50)
36 × 36 × 26	914 (36.00)	660.0 (26.00)	673 (26.50)	622 (24.50)
36 × 36 × 24	914 (36.00)	610.0 (24.00)	673 (26.50)	610 (24.00)
36 × 36 × 22	914 (36.00)	559.0 (22.00)	673 (26.50)	597 (23.50)
36 × 36 × 20	914 (36.00)	508.0 (20.00)	673 (26.50)	584 (23.00)
36 × 36 × 18	914 (36.00)	457.0 (18.00)	673 (26.50)	572 (22.50)
36 × 36 × 16	914 (36.00)	406.4 (16.00)	673 (26.50)	559 (22.00)
38 × 38 × 36	965 (38.00)	914.0 (36.00)	711 (28.00)	711 (28.00)
38 × 38 × 34	965 (38.00)	864.0 (34.00)	711 (28.00)	698 (27.50)
38 × 38 × 32	965 (38.00)	813.0 (32.00)	711 (28.00)	686 (27.00)
38 × 38 × 30	965 (38.00)	762.0 (30.00)	711 (28.00)	673 (26.50)
38 × 38 × 28	965 (38.00)	711.0 (28.00)	711 (28.00)	648 (25.50)
38 × 38 × 26	965 (38.00)	660.0 (26.00)	711 (28.00)	648 (25.50)
38 × 38 × 24	965 (38.00)	610.0 (24.00)	711 (28.00)	635 (25.00)
38 × 38 × 22	965 (38.00)	559.0 (22.00)	711 (28.00)	622 (24.50)
38 × 38 × 20	965 (38.00)	508.0 (20.00)	711 (28.00)	610 (24.00)
38 × 38 × 18	965 (38.00)	457.0 (18.00)	711 (28.00)	597 (23.50)

Table 6.1-8 异径三通和四通尺寸 (续表)

公称直径 (NPS)	坡口处外径 mm (in.)		中心至端部 mm (in.)	
	主管口	支口	主管口 C	支口 M [Note (1)]
40 × 40 × 38	1 016 (40.00)	965.0 (38.00)	749 (29.50)	749 (29.50)
40 × 40 × 36	1 016 (40.00)	914.0 (36.00)	749 (29.50)	737 (29.00)
40 × 40 × 34	1 016 (40.00)	864.0 (34.00)	749 (29.50)	724 (28.50)
40 × 40 × 32	1 016 (40.00)	813.0 (32.00)	749 (29.50)	711 (28.00)
40 × 40 × 30	1 016 (40.00)	762.0 (30.00)	749 (29.50)	698 (27.50)
40 × 40 × 28	1 016 (40.00)	711.0 (28.00)	749 (29.50)	673 (26.50)
40 × 40 × 26	1 016 (40.00)	660.0 (26.00)	749 (29.50)	673 (26.50)
40 × 40 × 24	1 016 (40.00)	610.0 (24.00)	749 (29.50)	660 (26.00)
40 × 40 × 22	1 016 (40.00)	559.0 (22.00)	749 (29.50)	648 (25.50)
40 × 40 × 20	1 016 (40.00)	508.0 (20.00)	749 (29.50)	635 (25.00)
40 × 40 × 18	1 016 (40.00)	457.0 (18.00)	749 (29.50)	622 (24.50)
42 × 42 × 40	1 067 (42.00)	1 016.0 (40.00)	762 (30.00)	711 (28.00)
42 × 42 × 38	1 067 (42.00)	965.0 (38.00)	762 (30.00)	711 (28.00)
42 × 42 × 36	1 067 (42.00)	914.0 (36.00)	762 (30.00)	711 (28.00)
42 × 42 × 34	1 067 (42.00)	864.0 (34.00)	762 (30.00)	711 (28.00)
42 × 42 × 32	1 067 (42.00)	813.0 (32.00)	762 (30.00)	711 (28.00)
42 × 42 × 30	1 067 (42.00)	762.0 (30.00)	762 (30.00)	711 (28.00)
42 × 42 × 28	1 067 (42.00)	711.0 (28.00)	762 (30.00)	698 (27.50)
42 × 42 × 26	1 067 (42.00)	660.0 (26.00)	762 (30.00)	698 (27.50)
42 × 42 × 24	1 067 (42.00)	610.0 (24.00)	762 (30.00)	660 (26.00)
42 × 42 × 22	1 067 (42.00)	559.0 (22.00)	762 (30.00)	660 (26.00)
42 × 42 × 20	1 067 (42.00)	508.0 (20.00)	762 (30.00)	660 (26.00)
42 × 42 × 18	1 067 (42.00)	457.0 (18.00)	762 (30.00)	648 (25.50)
42 × 42 × 16	1 067 (42.00)	406.4 (16.00)	762 (30.00)	635 (25.00)
44 × 44 × 42	1 118 (44.00)	1 067.0 (42.00)	813 (32.00)	762 (30.00)
44 × 44 × 40	1 118 (44.00)	1 016.0 (40.00)	813 (32.00)	749 (29.50)
44 × 44 × 38	1 118 (44.00)	965.0 (38.00)	813 (32.00)	737 (29.00)
44 × 44 × 36	1 118 (44.00)	914.0 (36.00)	813 (32.00)	724 (28.50)
44 × 44 × 34	1 118 (44.00)	864.0 (34.00)	813 (32.00)	724 (28.50)
44 × 44 × 32	1 118 (44.00)	813.0 (32.00)	813 (32.00)	711 (28.00)
44 × 44 × 30	1 118 (44.00)	762.0 (30.00)	813 (32.00)	711 (28.00)
44 × 44 × 28	1 118 (44.00)	711.0 (28.00)	813 (32.00)	698 (27.50)
44 × 44 × 26	1 118 (44.00)	660.0 (26.00)	813 (32.00)	698 (27.50)
44 × 44 × 24	1 118 (44.00)	610.0 (24.00)	813 (32.00)	698 (27.50)
44 × 44 × 22	1 118 (44.00)	559.0 (22.00)	813 (32.00)	686 (27.00)
44 × 44 × 20	1 118 (44.00)	508.0 (20.00)	813 (32.00)	686 (27.00)
46 × 46 × 44	1 168 (46.00)	1 118.0 (44.00)	851 (33.50)	800 (31.50)
46 × 46 × 42	1 168 (46.00)	1 067.0 (42.00)	851 (33.50)	787 (31.00)
46 × 46 × 40	1 168 (46.00)	1 016.0 (40.00)	851 (33.50)	775 (30.50)
46 × 46 × 38	1 168 (46.00)	965.0 (38.00)	851 (33.50)	762 (30.00)

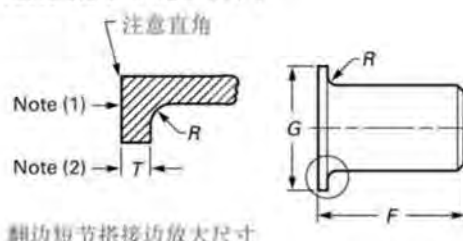
Table 6.1-8 异径三通和四通尺寸 (续表)

公称直径 (NPS)	坡口处外径 mm (in.)		中心至端部 mm (in.)	
	主管口	支口	主管口, <i>C</i>	支口, <i>M</i> [Note (1)]
46 × 46 × 36	1 168 (46.00)	914.0 (36.00)	851 (33.50)	762 (30.00)
46 × 46 × 34	1 168 (46.00)	864.0 (34.00)	851 (33.50)	749 (29.50)
46 × 46 × 32	1 168 (46.00)	813.0 (32.00)	851 (33.50)	749 (29.50)
46 × 46 × 30	1 168 (46.00)	762.0 (30.00)	851 (33.50)	737 (29.00)
46 × 46 × 28	1 168 (46.00)	711.0 (28.00)	851 (33.50)	737 (29.00)
46 × 46 × 26	1 168 (46.00)	660.0 (26.00)	851 (33.50)	737 (29.00)
46 × 46 × 24	1 168 (46.00)	610.0 (24.00)	851 (33.50)	724 (28.50)
46 × 46 × 22	1 168 (46.00)	559.0 (22.00)	851 (33.50)	724 (28.50)
48 × 48 × 46	1 219 (48.00)	1 168.0 (46.00)	889 (35.00)	838 (33.00)
48 × 48 × 44	1 219 (48.00)	1 118.0 (44.00)	889 (35.00)	838 (33.00)
48 × 48 × 42	1 219 (48.00)	1 067.0 (42.00)	889 (35.00)	813 (32.00)
48 × 48 × 40	1 219 (48.00)	1 016.0 (40.00)	889 (35.00)	813 (32.00)
48 × 48 × 38	1 219 (48.00)	965.0 (38.00)	889 (35.00)	813 (32.00)
48 × 48 × 36	1 219 (48.00)	914.0 (36.00)	889 (35.00)	787 (31.00)
48 × 48 × 34	1 219 (48.00)	864.0 (34.00)	889 (35.00)	787 (31.00)
48 × 48 × 32	1 219 (48.00)	813.0 (32.00)	889 (35.00)	787 (31.00)
48 × 48 × 30	1 219 (48.00)	762.0 (30.00)	889 (35.00)	762 (30.00)
48 × 48 × 28	1 219 (48.00)	711.0 (28.00)	889 (35.00)	762 (30.00)
48 × 48 × 26	1 219 (48.00)	660.0 (26.00)	889 (35.00)	762 (30.00)
48 × 48 × 24	1 219 (48.00)	610.0 (24.00)	889 (35.00)	737 (29.00)
48 × 48 × 22	1 219 (48.00)	559.0 (22.00)	889 (35.00)	737 (29.00)

备注:

(1) 对 NPS 14及以上的管件, 推荐但并不一定要采用支口尺寸 *M*;

Table 6.1-9 翻边短节尺寸



翻边短节搭接边放大尺寸

公称直径 (NPS)	筒部外径 of Barrel, mm (in.)		长型短节总长度 Length, F, mm (in.)	短型短节总长度 Length, F, mm (in.)	圆角半径R Fillet, R, mm (in.)	搭接边直径 Lap, G, mm (in.)
	Max.	Min.	[Notes (3), (4)]	[Notes (3), (4)]	[Note (5)]	[Note (6)]
1/2	22.8 (0.896)	20.5 (0.809)	76 (3.00)	51 (2.00)	3 (0.12)	35 (1.38)
3/4	28.1 (1.106)	25.9 (1.019)	76 (3.00)	51 (2.00)	3 (0.12)	43 (1.69)
1	35.0 (1.376)	32.6 (1.284)	102 (4.00)	51 (2.00)	3 (0.12)	51 (2.00)
1 1/4	43.6 (1.716)	41.4 (1.629)	102 (4.00)	51 (2.00)	5 (0.19)	64 (2.50)
1 1/2	49.9 (1.965)	47.5 (1.869)	102 (4.00)	51 (2.00)	6 (0.25)	73 (2.88)
2	62.4 (2.456)	59.5 (2.344)	152 (6.00)	64 (2.50)	8 (0.31)	92 (3.62)
2 1/2	75.3 (2.966)	72.2 (2.844)	152 (6.00)	64 (2.50)	8 (0.31)	105 (4.12)
3	91.3 (3.596)	88.1 (3.469)	152 (6.00)	64 (2.50)	10 (0.38)	127 (5.00)
3 1/2	104.0 (4.096)	100.8 (3.969)	152 (6.00)	76 (3.00)	10 (0.38)	140 (5.50)
4	116.7 (4.593)	113.5 (4.469)	152 (6.00)	76 (3.00)	11 (0.44)	157 (6.19)
5	144.3 (5.683)	140.5 (5.532)	203 (8.00)	76 (3.00)	11 (0.44)	186 (7.31)
6	171.3 (6.743)	167.5 (6.594)	203 (8.00)	89 (3.50)	13 (0.50)	216 (8.50)
8	222.1 (8.743)	218.3 (8.594)	203 (8.00)	102 (4.00)	13 (0.50)	270 (10.62)
10	277.2 (10.913)	272.3 (10.719)	254 (10.00)	127 (5.00)	13 (0.50)	324 (12.75)
12	328.0 (12.913)	323.1 (12.719)	254 (10.00)	152 (6.00)	13 (0.50)	381 (15.00)
14	359.9 (14.170)	354.8 (13.969)	305 (12.00)	152 (6.00)	13 (0.50)	413 (16.25)
16	411.0 (16.180)	405.6 (15.969)	305 (12.00)	152 (6.00)	13 (0.50)	470 (18.50)
18	462.0 (18.190)	456.0 (17.969)	305 (12.00)	152 (6.00)	13 (0.50)	533 (21.00)
20	514.0 (20.240)	507.0 (19.969)	305 (12.00)	152 (6.00)	13 (0.50)	584 (23.00)
22	565.0 (22.240)	558.0 (21.969)	305 (12.00)	152 (6.00)	13 (0.50)	641 (25.25)
24	616.0 (24.240)	609.0 (23.969)	305 (12.00)	152 (6.00)	13 (0.50)	692 (27.25)

通注:

(a) 公差见表 11-1;

(b) 使用条件和连接结构常常规定接管长度要求, 因此在订货时, 采购方应指定长短型。

注:

(1) 垫片表面加工应按 ASME B16.5 对凸面法兰的规定;

(2) 搭接边厚度 T 应不小于公称管子壁厚。见表11-1 最大公差;

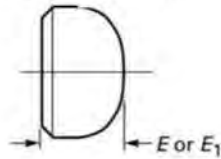
(3) 当短型接管端部用 300 磅级和 600 磅级的较大法兰及用于大于等于 900 磅级的大部分规格法兰时, 和当长型接管端部用 1500 磅级和 2500 磅级的较大法兰时, 为了避免法兰覆盖焊缝, 可能需要增加连管的长度。增加量由制造商与采购方协商;

(4) 当采用榫槽面和凹凸面等特殊端面时, 必须增加搭接边的厚度, 增加厚度应在基本长度 F 之外 (不包括在基本长度内);

(5) 这些尺寸应与 ASME B16.5 《管道法兰和法兰管件》中搭接法兰的规定半径相等;

(6) 本尺寸与 ASME B16.5 中所示的标准机加工面一致。搭接的背面应进行机加工, 使其安装表面一致。当采用环接面时选用 ASME B16.5 中给定的尺寸 K 值。

Table 6.1-10 管帽尺寸



公称直径 (NPS)	坡口处外径 mm (in.)	长度 E, mm (in.) [Note (1)]	长度E时最小壁厚 for Length, E, mm (in.)	长度 E ₁ , mm (in.) [Note (2)]
1/2	21.3 (0.84)	25 (1.00)	4.57 (0.18)	25 (1.00)
3/4	26.7 (1.05)	25 (1.00)	3.81 (0.15)	25 (1.00)
1	33.4 (1.32)	38 (1.50)	4.57 (0.18)	38 (1.50)
1 1/4	42.2 (1.66)	38 (1.50)	4.83 (0.19)	38 (1.50)
1 1/2	48.3 (1.90)	38 (1.50)	5.08 (0.20)	38 (1.50)
2	60.3 (2.38)	38 (1.50)	5.59 (0.22)	44 (1.75)
2 1/2	73.0 (2.88)	38 (1.50)	7.11 (0.28)	51 (2.00)
3	88.9 (3.50)	51 (2.00)	7.62 (0.30)	64 (2.50)
3 1/2	101.6 (4.00)	64 (2.50)	8.13 (0.32)	76 (3.00)
4	114.3 (4.50)	64 (2.50)	8.64 (0.34)	76 (3.00)
5	141.3 (5.56)	76 (3.00)	9.65 (0.38)	89 (3.50)
6	168.3 (6.62)	89 (3.50)	10.92 (0.43)	102 (4.00)
8	219.1 (8.62)	102 (4.00)	12.70 (0.50)	127 (5.00)
10	273.0 (10.75)	127 (5.00)	12.70 (0.50)	152 (6.00)
12	323.8 (12.75)	152 (6.00)	12.70 (0.50)	178 (7.00)
14	355.6 (14.00)	165 (6.50)	12.70 (0.50)	191 (7.50)
16	406.4 (16.00)	178 (7.00)	12.70 (0.50)	203 (8.00)
18	457.0 (18.00)	203 (8.00)	12.70 (0.50)	229 (9.00)
20	508.0 (20.00)	229 (9.00)	12.70 (0.50)	254 (10.00)
22	559.0 (22.00)	254 (10.00)	12.70 (0.50)	254 (10.00)
24	610.0 (24.00)	267 (10.50)	12.70 (0.50)	305 (12.00)
26	660.0 (26.00)	267 (10.50)	...	...
28	711.0 (28.00)	267 (10.50)	...	...
30	762.0 (30.00)	267 (10.50)	...	...
32	813.0 (32.00)	267 (10.50)	...	...
34	864.0 (34.00)	267 (10.50)	...	...
36	914.0 (36.00)	267 (10.50)	...	...
38	965.0 (38.00)	305 (12.00)	...	...
40	1 016.0 (40.00)	305 (12.00)	...	...
42	1 067.0 (42.00)	305 (12.00)	...	...
44	1 118.0 (44.00)	343 (13.50)	...	...
46	1 168.0 (46.00)	343 (13.50)	...	...
48	1 219.0 (48.00)	343 (13.50)	...	...

通注:

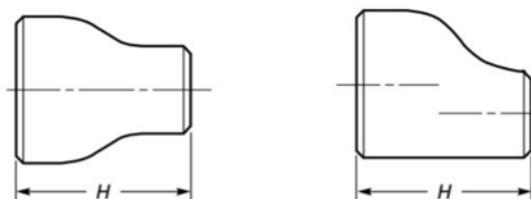
这些管帽的形状应为椭圆形, 并应符合 ASME《锅炉及压力容器规范》中给定的形状要求。

注:

(1) 长度 E 适用于厚度不超过“长度 E 时极限壁厚”栏中所列之值的场合;

(2) 对于 NPS 24 及以下的管帽, 长度 E₁ 适用于厚度大于“极限壁厚”栏中所列之值的场合; 对于 NPS 26 及以上的管盖, 长度 E₁ 应由制造厂和采购双方协商。

Table 6.1-11 异径管尺寸



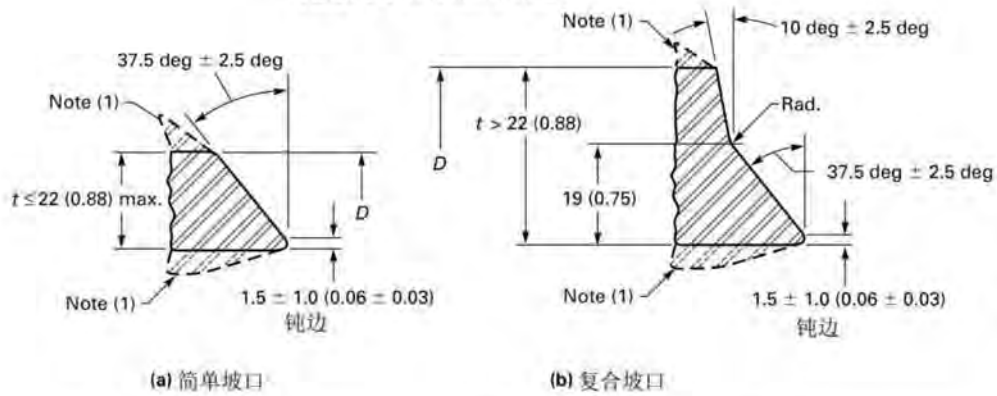
公称直径 (NPS)	坡口处外径 at Bevel, mm (in.)		端对端尺寸 H, mm (in.)	公称直径 (NPS)	坡口处外径 at Bevel, mm (in.)		端对端尺寸 H, mm (in.)
	大端	小端			大端	小端	
$\frac{3}{4} \times \frac{1}{2}$	26.7 (1.05)	21.3 (0.84)	38 (1.50)	5×4	141.3 (5.56)	114.3 (4.50)	127 (5.00)
$\frac{3}{4} \times \frac{3}{8}$	26.7 (1.05)	17.3 (0.68)	38 (1.50)	$5 \times 3\frac{1}{2}$	141.3 (5.56)	101.6 (4.00)	127 (5.00)
$1 \times \frac{3}{4}$	33.4 (1.32)	26.7 (1.05)	51 (2.00)	5×3	141.3 (5.56)	88.9 (3.50)	127 (5.00)
$1 \times \frac{1}{2}$	33.4 (1.32)	21.3 (0.84)	51 (2.00)	$5 \times 2\frac{1}{2}$	141.3 (5.56)	73.0 (2.88)	127 (5.00)
$1\frac{1}{4} \times 1$	42.2 (1.66)	33.4 (1.32)	51 (2.00)	5×2	141.3 (5.56)	60.3 (2.38)	127 (5.00)
$1\frac{1}{4} \times \frac{3}{4}$	42.2 (1.66)	26.7 (1.05)	51 (2.00)	6×5	168.3 (6.62)	141.3 (5.56)	140 (5.50)
$1\frac{1}{4} \times \frac{1}{2}$	42.2 (1.66)	21.3 (0.84)	51 (2.00)	6×4	168.3 (6.62)	114.3 (4.50)	140 (5.50)
$1\frac{1}{2} \times 1\frac{1}{4}$	48.3 (1.90)	42.2 (1.66)	64 (2.50)	$6 \times 3\frac{1}{2}$	168.3 (6.62)	101.6 (4.00)	140 (5.50)
$1\frac{1}{2} \times 1$	48.3 (1.90)	33.4 (1.32)	64 (2.50)	6×3	168.3 (6.62)	88.9 (3.50)	140 (5.50)
$1\frac{1}{2} \times \frac{3}{4}$	48.3 (1.90)	26.7 (1.05)	64 (2.50)	$6 \times 2\frac{1}{2}$	168.3 (6.62)	73.0 (2.88)	140 (5.50)
$1\frac{1}{2} \times \frac{1}{2}$	48.3 (1.90)	21.3 (0.84)	64 (2.50)	8×6	219.1 (8.62)	168.3 (6.62)	152 (6.00)
$2 \times 1\frac{1}{2}$	60.3 (2.38)	48.3 (1.90)	76 (3.00)	8×5	219.1 (8.62)	141.3 (5.56)	152 (6.00)
$2 \times 1\frac{1}{4}$	60.3 (2.38)	42.2 (1.66)	76 (3.00)	8×4	219.1 (8.62)	114.3 (4.50)	152 (6.00)
2×1	60.3 (2.38)	33.4 (1.32)	76 (3.00)	$8 \times 3\frac{1}{2}$	219.1 (8.62)	101.6 (4.00)	152 (6.00)
$2 \times \frac{3}{4}$	60.3 (2.38)	26.7 (1.05)	76 (3.00)	10×8	273.0 (10.75)	219.1 (8.62)	178 (7.00)
$2\frac{1}{2} \times 2$	73.0 (2.88)	60.3 (2.38)	89 (3.50)	10×6	273.0 (10.75)	168.3 (6.62)	178 (7.00)
$2\frac{1}{2} \times 1\frac{1}{2}$	73.0 (2.88)	48.3 (1.90)	89 (3.50)	10×5	273.0 (10.75)	141.3 (5.56)	178 (7.00)
$2\frac{1}{2} \times 1\frac{1}{4}$	73.0 (2.88)	42.2 (1.66)	89 (3.50)	10×4	273.0 (10.75)	114.3 (4.50)	178 (7.00)
$2\frac{1}{2} \times 1$	73.0 (2.88)	33.4 (1.32)	89 (3.50)	12×10	323.8 (12.75)	273.0 (10.75)	203 (8.00)
$3 \times 2\frac{1}{2}$	88.9 (3.50)	73.0 (2.88)	89 (3.50)	12×8	323.8 (12.75)	219.1 (8.62)	203 (8.00)
3×2	88.9 (3.50)	60.3 (2.38)	89 (3.50)	12×6	323.8 (12.75)	168.3 (6.62)	203 (8.00)
$3 \times 1\frac{1}{2}$	88.9 (3.50)	48.3 (1.90)	89 (3.50)	12×5	323.8 (12.75)	141.3 (5.56)	203 (8.00)
$3 \times 1\frac{1}{4}$	88.9 (3.50)	42.2 (1.66)	89 (3.50)	14×12	355.6 (14.00)	323.8 (12.75)	330 (13.00)
$3\frac{1}{2} \times 3$	101.6 (4.00)	88.9 (3.50)	102 (4.00)	14×10	355.6 (14.00)	273.0 (10.75)	330 (13.00)
$3\frac{1}{2} \times 2\frac{1}{2}$	101.6 (4.00)	73.0 (2.88)	102 (4.00)	14×8	355.6 (14.00)	219.1 (8.62)	330 (13.00)
$3\frac{1}{2} \times 2$	101.6 (4.00)	60.3 (2.38)	102 (4.00)	14×6	355.6 (14.00)	168.3 (6.62)	330 (13.00)
$3\frac{1}{2} \times 1\frac{1}{2}$	101.6 (4.00)	48.3 (1.90)	102 (4.00)	16×14	406.4 (16.00)	355.6 (14.00)	356 (14.00)
$3\frac{1}{2} \times 1\frac{1}{4}$	101.6 (4.00)	42.2 (1.66)	102 (4.00)	16×12	406.4 (16.00)	323.8 (12.75)	356 (14.00)
$4 \times 3\frac{1}{2}$	114.3 (4.50)	101.6 (4.00)	102 (4.00)	16×10	406.4 (16.00)	273.0 (10.75)	356 (14.00)
4×3	114.3 (4.50)	88.9 (3.50)	102 (4.00)	16×8	406.4 (16.00)	219.1 (8.62)	356 (14.00)
$4 \times 2\frac{1}{2}$	114.3 (4.50)	73.0 (2.88)	102 (4.00)	18×16	457 (18.00)	406.4 (16.00)	381 (15.00)
4×2	114.3 (4.50)	60.3 (2.38)	102 (4.00)	18×14	457 (18.00)	355.6 (14.00)	381 (15.00)
$4 \times 1\frac{1}{2}$	114.3 (4.50)	48.3 (1.90)	102 (4.00)				

Table 6.1-11 异径管尺寸 (续表)

公称直径 (NPS)	坡口处外径 at Bevel, mm (in.)		端对端尺寸 H, mm (in.)	公称直径 (NPS)	坡口处外径 at Bevel, mm (in.)		端对端尺寸 H, mm (in.)
	大端	小端			大端	小端	
18 × 12	457 (18.00)	323.8 (12.75)	381 (15.00)	36 × 34	914 (36.00)	864 (34.00)	610 (24.00)
18 × 10	457 (18.00)	273.0 (10.75)	381 (15.00)	36 × 32	914 (36.00)	813 (32.00)	610 (24.00)
20 × 18	508 (20.00)	457.0 (18.00)	508 (20.00)	36 × 30	914 (36.00)	762 (30.00)	610 (24.00)
20 × 16	508 (20.00)	406.4 (16.00)	508 (20.00)	36 × 26	914 (36.00)	660 (26.00)	610 (24.00)
20 × 14	508 (20.00)	355.6 (14.00)	508 (20.00)	36 × 24	914 (36.00)	610 (24.00)	610 (24.00)
20 × 12	508 (20.00)	323.8 (12.75)	508 (20.00)	38 × 36	965 (38.00)	914 (36.00)	610 (24.00)
22 × 20	559 (22.00)	508.0 (20.00)	508 (20.00)	38 × 34	965 (38.00)	864 (34.00)	610 (24.00)
22 × 18	559 (22.00)	457.0 (18.00)	508 (20.00)	38 × 32	965 (38.00)	813 (32.00)	610 (24.00)
22 × 16	559 (22.00)	406.4 (16.00)	508 (20.00)	38 × 30	965 (38.00)	762 (30.00)	610 (24.00)
22 × 14	559 (22.00)	355.4 (14.00)	508 (20.00)	38 × 28	965 (38.00)	711 (28.00)	610 (24.00)
24 × 22	610 (24.00)	559.0 (22.00)	508 (20.00)	38 × 26	965 (38.00)	660 (26.00)	610 (24.00)
24 × 20	610 (24.00)	508.0 (20.00)	508 (20.00)	40 × 38	1 016 (40.00)	965 (38.00)	610 (24.00)
24 × 18	610 (24.00)	457.0 (18.00)	508 (20.00)	40 × 36	1 016 (40.00)	914 (36.00)	610 (24.00)
24 × 16	610 (24.00)	406.4 (16.00)	508 (20.00)	40 × 34	1 016 (40.00)	864 (34.00)	610 (24.00)
26 × 24	660 (26.00)	610.0 (24.00)	610 (24.00)	40 × 32	1 016 (40.00)	813 (32.00)	610 (24.00)
26 × 22	660 (26.00)	559.0 (22.00)	610 (24.00)	40 × 30	1 016 (40.00)	762 (30.00)	610 (24.00)
26 × 20	660 (26.00)	508.0 (20.00)	610 (24.00)	42 × 40	1 067 (42.00)	1 016 (40.00)	610 (24.00)
26 × 18	660 (26.00)	457.0 (18.00)	610 (24.00)	42 × 38	1 067 (42.00)	965 (38.00)	610 (24.00)
28 × 26	711 (28.00)	660.0 (26.00)	610 (24.00)	42 × 36	1 067 (42.00)	914 (36.00)	610 (24.00)
28 × 24	711 (28.00)	610.0 (24.00)	610 (24.00)	42 × 34	1 067 (42.00)	864 (34.00)	610 (24.00)
28 × 20	711 (28.00)	508.0 (20.00)	610 (24.00)	42 × 32	1 067 (42.00)	813 (32.00)	610 (24.00)
28 × 18	711 (28.00)	457.0 (18.00)	610 (24.00)	42 × 30	1 067 (42.00)	762 (30.00)	610 (24.00)
30 × 28	762 (30.00)	711.0 (28.00)	610 (24.00)	44 × 42	1 118 (44.00)	1 067 (42.00)	610 (24.00)
30 × 26	762 (30.00)	660.0 (26.00)	610 (24.00)	44 × 40	1 118 (44.00)	1 016 (40.00)	610 (24.00)
30 × 24	762 (30.00)	610.0 (24.00)	610 (24.00)	44 × 38	1 118 (44.00)	965 (38.00)	610 (24.00)
30 × 20	762 (30.00)	508.0 (20.00)	610 (24.00)	44 × 36	1 118 (44.00)	914 (36.00)	610 (24.00)
32 × 30	813 (32.00)	762.0 (30.00)	610 (24.00)	46 × 44	1 168 (46.00)	1 118 (44.00)	711 (28.00)
32 × 28	813 (32.00)	711.0 (28.00)	610 (24.00)	46 × 42	1 168 (46.00)	1 067 (42.00)	711 (28.00)
32 × 26	813 (32.00)	660.0 (26.00)	610 (24.00)	46 × 40	1 168 (46.00)	1 016 (40.00)	711 (28.00)
32 × 24	813 (32.00)	610.0 (24.00)	610 (24.00)	46 × 38	1 168 (46.00)	965 (38.00)	711 (28.00)
34 × 32	864 (34.00)	813.0 (32.00)	610 (24.00)	48 × 46	1 219 (48.00)	1 168 (46.00)	711 (28.00)
34 × 30	864 (34.00)	762.0 (30.00)	610 (24.00)	48 × 44	1 219 (48.00)	1 118 (44.00)	711 (28.00)
34 × 26	864 (34.00)	660.0 (26.00)	610 (24.00)	48 × 42	1 219 (48.00)	1 067 (42.00)	711 (28.00)
34 × 24	864 (34.00)	610.0 (24.00)	610 (24.00)	48 × 40	1 219 (48.00)	1 016 (40.00)	711 (28.00)

通注：尽管图示中显示的是钟形异径管，但是允许采用锥形异径管。

Table 8-1 焊接坡口和钝边



公称壁厚 t	端部准备
Less than x [Note (2)] < x [注(2)]	Cut square or slightly chamfer; at manufacturer's option (not illustrated) 直角或轻微倒角, 由制造商定 (没有标示)
x to 22 (0.88), inclusive [Note (2)] $x \sim 22$ (0.88)	Plain bevel as in illustration (a) above 简单坡口, 如简图(a)所示
More than 22 (0.88) >22(0.88)	Compound bevel as in illustration (b) above 复合坡口, 如简图(b)所示

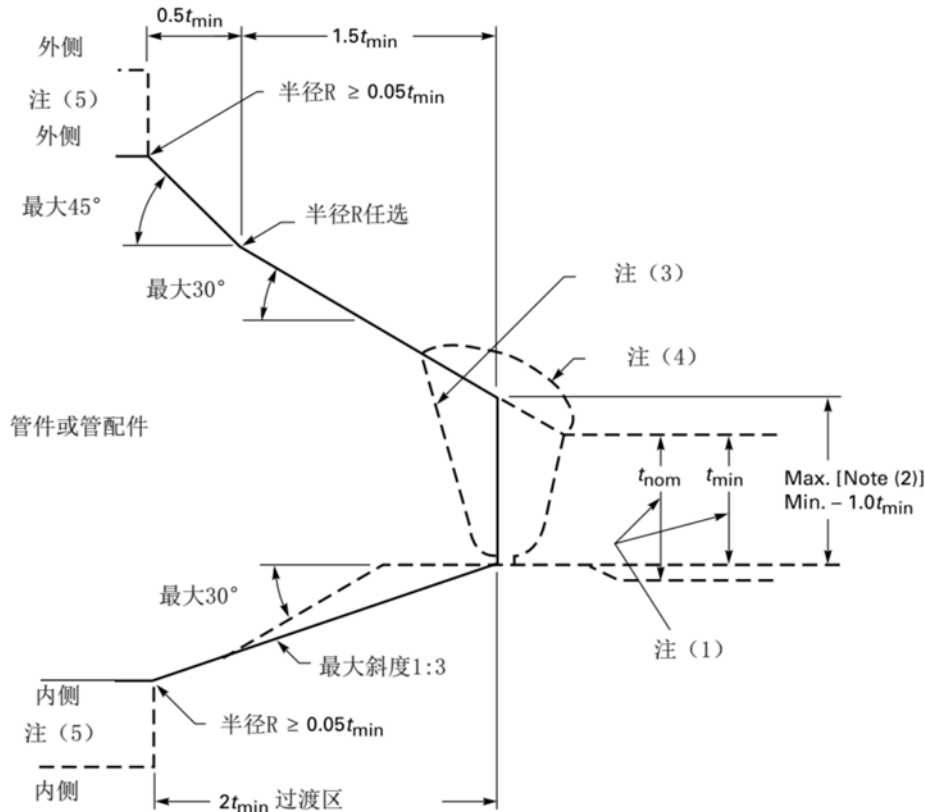
GENERAL NOTE: In the illustrations, dimensions in parentheses are in inches; other dimensions are in millimeters. 通注: 括号中的尺寸单位为英寸; 其他尺寸单位为 mm。

NOTES: 注:

(1) See section 8 and Figure 8-1 for transition contours. 过渡轮廓线参阅第 8 节及图 8-1。

(2) $x = 5$ mm (0.19 in.) for carbon steel or ferritic alloy steel and 3 mm (0.12 in.) for austenitic steel or nonferrous alloys. 对碳素钢或铁素体合金钢 $x=5$ (0.19), 对奥氏体合金钢 $x=3$ (0.12)

S



NOTES 注:

(1) The value of t_{min} is whichever of the following is applicable: t_{min} 的值是下列中可适用的值之一:

(a) the minimum ordered wall thickness of the pipe, to include pipe that is purchased to a nominal wall thickness with an undertolerance other than 12.5%. 管道的最小订购壁厚, 包括购买到的低于公称壁厚的管道, 但公差不得超过标称壁厚 12.5%

(b) 0.875 times the nominal wall thickness of pipe ordered to a pipe schedule wall thickness that has an undetolerance of 12.5% 0.875 乘以管道公称壁厚, 该管道公称壁厚的公差为 12.5%

(2) The maximum thickness at the end of the component is as follows:管件端部最大厚度为:

(a) the greater of $[t_{\min} + 4 \text{ mm (0.16 in.)}]$ or $1.15t_{\min}$ when ordered on a minimum wall basis 在最小壁厚的基础上订购的 $[t_{\min} + 4 \text{ mm(0.16 英寸)}]$ 或 $1.15t_{\min}$ 中较大的壁厚

(b) the greater of $[t_{\min} + 4 \text{ mm (0.16 in.)}]$ or $1.10t_{\text{nom}}$ when ordered on a nominal wall basis 在公称壁厚的基础上订购的 $[t_{\min} + 4 \text{ 毫米(0.16 英寸)}]$ 或 $1.10t_{\text{nom}}$ 中较大的壁厚

(3) Weld bevel shown is for illustration only. 焊接坡口仅供参考。

(4) The weld reinforcement permitted by applicable code may lie outside the maximum envelope 适用规范允许的焊接补强可能位于最大外包络线之外。

(5) Where transitions using maximum slope do not intersect the inside or outside surfaces within the transition region, as shown by the phantom outline, maximum slopes shall be used. Alternatively, radii lying within the envelope may be used. 在所用最大斜度的过渡段不与内表面或外表面相交时，如虚线轮廓所示，应采用图示的最大斜度或换用圆角。

Table 9.2.1-1 Testing Coverage 试验覆盖

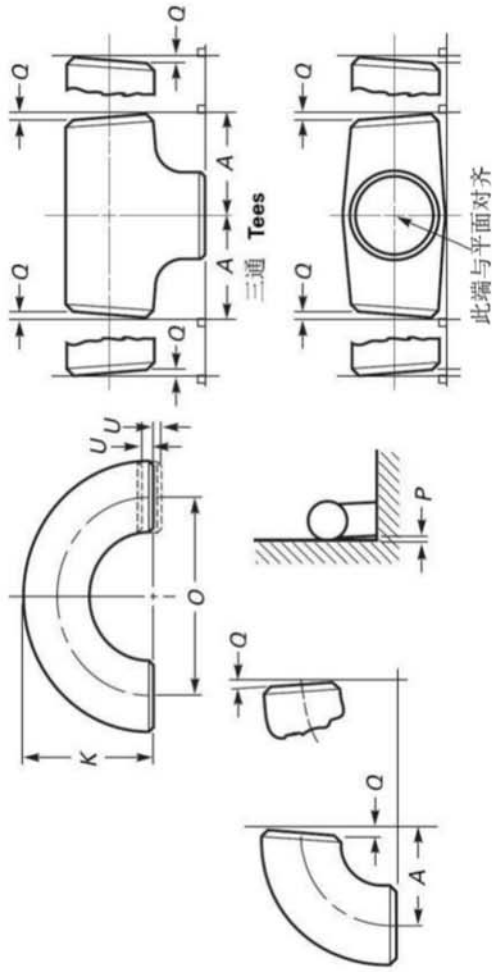
Type of Fitting Tested [Note (1)] 测试的管件类型[注(1)]	Qualifies the Following If the Same Design Thickness Is Used 如果采用相同的设计厚度，则可以按以下进行覆盖
Short radius elbow [Note (2)] 短半径弯头[注(2)]	Short radius, long radius, reducing long radius, or 3D radius elbow 短半径弯头，长半径弯头或 3 倍弯曲半径弯头
Long radius elbow [Note (2)] 长半径弯头[注(2)]	Long radius, reducing long radius, or 3D radius elbow 长半径弯头，缩径弯头或 3 倍弯曲半径弯头
3D radius elbow [Note (2)] 3 倍弯曲半径弯头[注(2)]	3D radius elbow 3 倍弯曲半径弯头
Straight tee 等径三通	Straight or reducing tees of any reduction 等径三通或异径三通（支口任意变径级别）
Reducing tee 异径三通	Reducing tees with the same or more reduction in outlet size 异径三通（支口变径级别相同或支口缩径级别增大）
Straight cross 等径四通	Straight or reducing crosses of any reduction 等径四通或异径四通（支口任意变径级别）
Reducing cross 异径四通	Reducing crosses with the same or more reduction in outlet size 异径四通（支口变径级别相同或支口缩径级别增大）
Cap 管帽	Caps of the same configuration 相同类型的管帽
Eccentric reducer [Note (3)] 偏心异径管[注(3)]	Eccentric or concentric reducers with the same or lesser included transition angle 偏心异径管或同心异径管（相同的过渡角或较小的过渡角）
Concentric reducer [Note (3)] 同心异径管[注(3)]	Concentric reducers with the same or lesser included transition angle [Note (4)] 同心异径管（相同的过渡角或较小的过渡角）[注(4)]
Lap joint stub ends 翻边	Lap joint stub ends are exempt from proof 翻边不需要进行验证性试验

NOTES 注:

- (1) Paragraph 9.4 applies to as-tested and qualified fittings. 第 9.4 段适用于经测试合格的配件。
- (2) A test of any angle elbow covered in Tables 6.1-1 through 6.1-6 will qualify any other angle. A factory-made segment elbow that has a proof test on a geometrically similar 45-deg or 90-deg elbow need not be tested separately. 表 6.1-1 至 6.1-6 中所涉及的任何角度弯头进行测试，可以覆盖其他角度。工厂生产的弯管，如果在几何上相似的 45 度或 90 度弯管进行了验证试验，则不需要单独再进行试验。
- (3) Straight conical (no tangent) and bell-shaped reducers are considered different design configurations and require separate testing. 直锥型异径管(无切线)和钟形异径管被认为是不同的设计配置，需要单独测试。
- (4) "Transition angle" is defined as the angle of the conical section and is calculated as the $[\arctan (\text{difference of diameters}/\text{twice the length})]$ for concentric reducers or $[\arctan (\text{difference of diameters}/\text{length})]$ for eccentric reducers. "过渡角"定义为圆锥截面的角度，计算为同心异径管的 $[\arctan (\text{直径差}/\text{长度的两倍})]$ 或偏心异径管的 $[\arctan (\text{直径差}/\text{长度})]$ 。

Table 9.3.1-1 Test Factor, *f*, Determination 试验因子 *f*，测定

Number of Tests Performed, or Number of Geometrically Similar Fittings Tested 试验次数，或几何相似的管件试验次数	Test Factor, <i>f</i> 试验因子 <i>f</i>
One 一次	1.10
Two 两次	1.05
Three or more 三次及以上	1.0



所有管件[注 (1) 和 (2)]			中心至端部尺寸		异径管和指 接管端总长 F, H	管盖总长 E	180 度弯头			
公称管径 (NPS)	DN	坡口处外径 [注 (3) 和 (4)] D	端部内径 [注 (3) 和 (5)]	90 度和 45 度长和短半径 弯头和三通 A, B, C, M			3D 半径弯头, A, B	中心至 中心尺寸 O	背部至 端面尺寸 K	端部错边 U
1/2 ~ 2½	15-65	+1.6, -0.8	0.8	2	2	3	3	6	6	1
3 ~ 3½	80-90	1.6	1.6	2	2	3	3	6	6	1
4	100	1.6	1.6	2	2	3	3	6	6	1
5 ~ 8	125-200	+2.4, -1.6	1.6	2	2	3	6	6	6	1
10 ~ 18	250-450	+4.0, -3.2	3.2	2	2	3	6	10	6	2
20 ~ 24	500-600	+6.4, -4.8	4.8	2	2	3	6	10	6	2
26 ~ 30	650-750	+6.4, -4.8	4.8	3	3	6	10	...	...	...
32 ~ 48	800-1 200	+6.4, -4.8	4.8	5	5	6	10	...	...	...

公称管径 (NPS)	DN	搭接接管端部注 (6) I			公称管径 (NPS)	DN	角度公差	
		搭接边外径 G	搭接圆角半径 R	搭接边厚度			偏离角 Q	偏离平面 P
1/2 ~ 2½	15-65	+0, -1	+0, -1	+1.6, -0	1/2 to 4	15-100	1	2
3 ~ 3½	80-90	+0, -1	+0, -1	+1.6, -0	5 to 8	125-200	2	4
4	100	+0, -1	+0, -2	+1.6, -0	10 to 12	250-300	3	5
5 ~ 8	125-200	+0, -1	+0, -2	+1.6, -0	14 to 16	350-400	3	6
10 ~ 18	250-450	+0, -2	+0, -2	+3.2, -0	18 to 24	450-600	4	10
20 ~ 24	500-600	+0, -2	+0, -2	+3.2, -0	26 to 30	650-750	5	10
26 ~ 30	650-750	...	...	...	32 to 42	800-1 050	5	13
32 ~ 48	800-1 200	...	...	...	44 to 48	1 100-1 200	5	19

GENERAL NOTE: Tolerances are equal plus and minus except as noted 通注：公差除注释外为正负偏差。

注：

- (1) The inside diameter and the nominal wall thicknesses at ends are to be specified by the purchaser 端部内径和公称壁厚由采购方指定；
- (2) A minimum wall thickness of 87.5% applies unless the purchaser specifies a different wall thickness tolerance. See Figure 8-1, Note (1)(a)除非采购方规定不同的壁厚公差，否则，使用 87.5%作为最小壁厚。见图 8-1，注（1）（a）；
- (3) Out-of-round is the sum of absolute values of plus and minus tolerances 圆度为正偏差和负偏差绝对值之和；
- (4) This tolerance may not apply in localized areas of formed fittings where increased wall thickness is required to meet design requirements of para. 2.2。在成型管件的局部，当需要增加壁厚以满足 2.2 条的设计要求时，该项公差不可以使用。
- (5) Unless otherwise specified by the purchaser, these tolerances apply to the nominal inside diameter, which equals the difference between the nominal outside diameter and twice the nominal wall thickness.除非采购方另有要求，这些公差适用于公称内径等于公称外径减两倍公称壁厚的场合；
- (6) See Table 6.1-9 for limiting dimensions of outside diameter of barrel.见表 6.1-9 筒体外径尺寸限定。

MANDATORY APPENDIX I REFERENCES 强制性附录 I 参考资料

The following is a list of standards and specifications referenced in this Standard. Unless otherwise specified, the latest edition of ASME publications shall apply. 以下是本标准中引用的标准和规范列表。除另有规定外，适用最新版的 ASME 出版物。

ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric/Inch Standard

ASME B16.25, Buttwelding Ends

ASME B31, Code for Pressure Piping

ASME B31.3, Process Piping

ASME B36.10M, Welded and Seamless Wrought Steel Pipe

ASME B36.19M, Stainless Steel Pipe

ASME Boiler and Pressure Vessel Code

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

ASTM A234/A234M-17, Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A403/A403M-16, Specification for Wrought Austenitic Stainless Steel Piping Fittings

ASTM A420/A420M-16, Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service

ASTM A815/A815M-14e1, Specification for Wrought Ferritic, Ferritic/Austenitic and Martensitic Stainless Steel Piping Fittings

ASTM A960/A960M-16a, Specification for Common Requirements for Wrought Steel Piping Fittings

ASTM B361-16, Specification for Factory-Made Wrought Aluminum and Aluminum-Alloy Welding Fittings

ASTM B363-14, Specification for Seamless and Welded Unalloyed Titanium and Titanium Alloy Welding Fittings

ASTM B366/B366M-17, Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings

ASTM E29-13, Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

ISO 6708:1995, Pipework components — Definition and selection of DN (nominal size)

ISO 9000:2015, Quality management systems — Fundamentals and vocabulary¹

ISO 9001:2015, Quality management systems — Requirements¹

ISO 9004:2009, Managing for the sustained success of an organization — A quality management approach¹

Publisher: International Organization for Standardization (ISO), Central

Secretariat, Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland

(www.iso.org)

NONMANDATORY APPENDIX A QUALITY SYSTEM PROGRAM 非强制性 附录 A 质量体系计划

The products manufactured in accordance with this Standard shall be produced under a Quality System Program following the principles of an appropriate standard from the ISO 9000 series.¹ A determination of the need for registration and/or certification of the product manufacturer's quality system by an independent organization shall be the responsibility of the manufacturer. The detailed documentation demonstrating program compliance shall be available to the purchaser at the manufacturer's facility. A written summary description of the program used by the product manufacturer shall be available to the purchaser upon request. The "product manufacturer" is defined as the entity whose name or trademark appears on the product in accordance with the marking or identification requirements of this Standard. 按照本标准生产的产品应按照质量体系程序生产，并遵循 iso9000 系列标准的原则。产品生产厂家所需要的由第三方组织确定的质量体系注册/或证书是生产厂商的义务。购买方应在生产厂能看到标志符合大纲的详细文件。依据要求用户应能看到生产厂商使用的对大纲的书面的描述。产品制造厂被定义为一个机构，其名称或商标按本标准的标记或识别要求标在产品上。