

**ASME B16.47-2006**  
(Revision of ASME B16.47-1996)

# **Large Diameter Steel Flanges**

**NPS 26 Through NPS 60**  
**Metric/Inch Standard**

**AN AMERICAN NATIONAL STANDARD**



**The American Society of  
Mechanical Engineers**

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Three Park Avenue • New York, NY 10016

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## FOREWORD

In November 1980, a task force was appointed within Subcommittee C of the American National Standards (ANSI) B16 Committee to develop a standard for pipe flanges in size NPS 26 through NPS 48. Every attempt was made to standardize those dimensions that existed within the industry for the materials covered by ANSI B16.5.

Prompted by suggestions received from committee members, the task force was authorized to increase the size range to NPS 60. The first draft was developed in December 1982 to include Class 75 through Class 1500 for the size range NPS 26 through NPS 60. Flange dimensions were based on the Manufacturers Standardization Society Standard Practice (MSS SP) 44 flanges, except for Class 75 flanges that are ANSI/API 605 flanges.

At the request of the American Petroleum Institute (API), flange dimensions in accordance with the API Standard 605, were included in the subsequent drafts. Class 1500 flanges were deleted due to a lack of interest in using large size flanges in that pressure-temperature rating.

The API-605 flanges for Class 150 and 300 and for sizes NPS 36 and smaller for classes higher than Class 300 are not compatible with the MSS SP-44 flanges. Thus, the MSS SP-44 flanges are designated as Series A flanges and the API-605 flanges are designated as Series B flanges in this Standard. Materials covered in this Standard are as in ANSI B16.5, except nickel base alloys are excluded. Pressure-temperature ratings are in accordance with ANSI B16.5.

In 1982, American National Standards Committee B16 was reorganized as the American Society of Mechanical Engineers (ASME) B16 Committee operating under procedures accredited by ANSI. Following approval by the Standards Committee and ASME, approval as an American National Standard was given by ANSI on June 12, 1990.

The 1996 Edition allowed flanges marked with more than one material grade or specification, revised flange face finish requirements, revised pressure-temperature ratings for several material groups, added permissible flange facing imperfections, added blind flanges for Series B flanges, and included several other revisions. Following approval by the Standards Committee and ASME, Boiler and Pressure Vessel Committee, ANSI approved the previous edition as an American National Standard on October 3, 1996 with the new designation ASME B16.47-1996.

This 2006 Edition is presented in metric units, as primary units, with U.S. Customary units in either parenthetical or separate terms. Mandatory Appendix I has been provided after the main text for convenience to cover ratings and dimensions in U.S. Customary units. Inch dimension bolt holes were retained for flanges manufactured to metric dimensions to avoid fit up problems. Development of metric dimensions was done to reflect the intended precision of the dimension rather than by numerical conversion. For some materials pressure-temperature ratings have been revised to reflect variations to material strength properties (tensile and yield) listed in the ASME Boiler and Pressure Vessel Code, Section II. Some materials have been assigned to different rating tables in order to minimize changes to ratings for commonly used materials.

All requests for interpretation or suggestions for revisions should be sent to the Administrative Secretary, B16, The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990. As an alternative, inquiries may be submitted via e-mail to: SecretaryB16@asme.org.

ASME B16.47-2006 was approved by the American National Standards Institute on November 6, 2006.

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As an alternative, inquiries may be submitted via e-mail to: SecretaryB16@asme.org.

**Proposing Revisions.** Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

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.

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The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject: Cite the applicable paragraph number(s) and the topic of the inquiry.  
Edition: Cite the applicable edition of the Standard for which the interpretation is being requested.  
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. The inquirer may also include any plans or drawings which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

**Attending Committee Meetings.** The B16 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B16 Standards Committee.

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# LARGE DIAMETER STEEL FLANGES

## NPS 26 THROUGH NPS 60 METRIC/INCH STANDARD

### 1 SCOPE

#### 1.1 General

This Standard covers pressure–temperature ratings, materials, dimensions, tolerances, marking, and testing for pipe flanges in sizes NPS 26 through NPS 60. Included here are flanges with rating class designations 75, 150, 300, 400, 600, and 900 with requirements given in both SI (metric) and U.S. Customary units, with diameter of bolts and flange bolt holes expressed in inch units.

This Standard is limited to

- (a) flanges made from cast or forged materials
- (b) blind flanges made from cast, forged, or plate materials (see Tables 1 and 2)

Also, included in this Standard are requirements and recommendations regarding flange bolting, flange gaskets, and flange joints.

#### 1.2 Flange Series

This Standard provides two series of flange dimensions. Series A specifies flange dimensions for general use flanges. Series B specifies flange dimensions for compact flanges that, in most cases, have smaller bolt circle diameters than Series A flanges. The two series of flanges are, in general, not interchangeable. The user should recognize that some flanges, valves, equipment bolted between flanges, and flanged equipment may be compatible with only one series of these flanges.

#### 1.3 References

Codes, standards, and specifications, containing provisions to the extent referenced herein, constitute requirements of this Standard. These reference documents are listed in Mandatory Appendix III.

#### 1.4 Date of Purchase, Manufacture, or Installation

The pressure–temperature ratings in this Standard are applicable upon its publication to all flanges within its scope that otherwise meet its requirement. For unused flanges maintained in inventory, the manufacturer of the flange may certify conformance to this Edition, provided that it can be demonstrated that all requirements of this Edition have been met. Where such components were installed in accordance with the pressure–temperature

ratings of an earlier edition of this Standard, those ratings are applicable, except as may be governed by the applicable code or regulation.

#### 1.5 User Accountability

This Standard cites responsibilities that are to be assumed by the flange user in the areas of, for example

- (a) application
- (b) installation
- (c) system pressure testing
- (d) operation
- (e) material selection

#### 1.6 Quality Systems

Requirements relating to the product manufacturer's Quality System Program are described in Mandatory Appendix II.

#### 1.7 Relevant Units

This Standard states values in both SI (metric) and U.S. Customary units. As an exception, diameter of bolts and flange bolt holes are expressed in inch units only. These systems of units are to be regarded separately as standard. Within the text, the U.S. Customary units are shown in parentheses or in separate tables. 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. Except for diameter of bolts and flange bolt holes, combining values from the two systems constitutes nonconformance with the Standard.

#### 1.8 Service Conditions

Criteria for selection of materials suitable for particular fluid service are not within the scope of this Standard.

#### 1.9 Convention

For the purpose of determining conformance with this Standard, the convention for fixing significant digits where limits, maximum and minimum values are specified, shall be rounded as defined in ASTM Practice E 29. This requires that an observed or calculated value shall 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.

## 1.10 Denotation

**1.10.1 Pressure Rating Designation.** Class, followed by a dimensionless number, is the designation for pressure–temperature ratings (i.e., class 75, class 150, class 300, class 400, class 600, class 900).

**1.10.2 Size.** NPS, followed by a dimensionless number, is the designation for nominal flange size. NPS is related to the reference nominal diameter, DN, used in international and other standards. For the sizes covered in this Standard, the relationship is:  $DN = 25 \times NPS$ .

## 2 PRESSURE–TEMPERATURE RATINGS

### 2.1 General

Pressure–temperature ratings are maximum allowable working gage pressures, in bar units, at the temperatures in degrees Celsius shown in Tables 3 through 27 for the applicable material and class designation. Tables I-1 through I-25 of Mandatory Appendix I lists pressure–temperature ratings using psi units for pressure at the temperature in degrees Fahrenheit. For intermediate temperatures, linear interpolation is permitted. Interpolation between class designations is not permitted.

### 2.2 Flanged Joints

A flanged joint is composed of separate and independent, although interrelated, components: the flanges, the gasket, and the bolting, which are assembled by another influence, the assembler. Proper controls must be exercised in the selection and application for all of these elements to attain a joint that has acceptable leak tightness. Assembly and tightening techniques, such as controlled bolt tightening, are described in ASME PCC-1.

### 2.3 Ratings of Flanged Joints

**2.3.1 Basis.** Pressure–temperature ratings apply to flanged joints that conform to the limitations on bolting in para. 5.3 and on gaskets in para. 5.4, and which are made up in accordance with good practice for alignment and assembly (see para. 2.2). Use of these ratings for flanged joints not conforming to these limitations is the responsibility of the user.

**2.3.2 Mixed Flanged Joints.** If the two flanges in a flanged joint do not have the same pressure–temperature rating, the rating of the joint at any temperature is the lower of the two flange ratings at that temperature.

### 2.4 Rating Temperature

The temperature shown for a corresponding pressure rating is the temperature of the pressure containing shell of the component. In general, this temperature is the same as that of the contained fluid. Use of a pressure rating corresponding to a temperature other than that

of the contained fluid is the responsibility of the user, subject to the requirements of applicable codes and regulations. For any temperature below  $-29^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$ ) the rating shall be no greater than the rating shown for  $-29^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$ ). See also para. 2.5.3.

## 2.5 Temperature Considerations

**2.5.1 General.** Use of flanges at either high or low temperatures shall take into consideration the risk of joint leakage due to forces and moments developed in the connected piping or equipment. Provisions in paras. 2.5.2 and 2.5.3 are included as advisory with the aim of lessening these risks.

**2.5.2 High Temperature.** Application at temperatures in the creep range will result in decreasing bolt loads as relaxation of flanges, bolts, and gaskets takes place. Flanged joints subjected to thermal gradients may likewise be subject to decreasing bolt loads. Decreased bolt loads diminish the capacity of the flanged joint to sustain loads effectively without leakage. At temperatures above  $200^{\circ}\text{C}$  ( $400^{\circ}\text{F}$ ) for Classes 75 and 150, and above  $400^{\circ}\text{C}$  ( $750^{\circ}\text{F}$ ) for other class designations, flanged joints may develop leakage problems unless care is taken to avoid imposing severe external loads and/or severe thermal gradients.

**2.5.3 Low Temperature.** Some of the materials listed in Tables 1 and 2, notably some carbon steels, may undergo a decrease in ductility when used at low temperatures to such an extent as to be unable to safely resist shock loading, sudden changes of stress, or high stress concentration. Some codes or regulations may require impact testing for applications even where temperatures are higher than  $-29^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$ ). When such requirements apply, it is the responsibility of the user to ensure these requirements are communicated to the manufacturer prior to the time of purchase.

## 2.6 System Pressure Testing

Flanged joints may be subjected to system pressure tests at a pressure of 1.5 times the  $38^{\circ}\text{C}$  ( $100^{\circ}\text{F}$ ) rating rounded off to the next higher 1 bar (25 psi) increment. Testing at any higher pressure is the responsibility of the user, taking into account the requirements of the applicable code or regulation.

## 2.7 Welding Neck Flanges

**2.7.1 Maximum Bore Size.** Ratings for welding neck flanges covered by this Standard are based upon their hubs at the welding end having a thickness at least equal to that calculated for pipe having a 276 MPa (40,000 psi) specified minimum yield strength. In order to assure adequate flange hub thickness for flange sizes NPS 26 and larger, the bore of a welding neck flange, dimension  $B$  as shown in Figs. 1 and 2, shall not exceed  $B_{\text{max}}$  determined as follows: