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Steel Pipeline Flanges

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
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An MSS Standard Practice is intended as a basis for common practice by the manufacturer, the user, and the general public. The existence of an MSS Standard Practice does not in itself preclude the manufacture, sale, or use of products not conforming to the Standard Practice. Mandatory conformance is established only by reference in a code, specification, sales contract or public law, as applicable.

Substantive changes in this 1996 edition are "flagged" by parallel bars as shown on the margins of this paragraph. The specific detail of the change may be determined by comparing the material flagged with that in the previous edition.

Non-toleranced dimensions in this Standard Practice are nominal, and unless otherwise specified, shall be considered "for reference only".

Originally Approved July 1952

FOREWORD

The Manufacturers Standardization Society originally developed the Standard Practice in response to the continued requests for steel pipe flanges for pipeline use, particularly in sizes larger than those covered by ANSI Standard B16.5 on Steel Pipe Flanges and Flanged Fittings. The line pipe is uniquely characterized by high-strength, cold worked, thin-wall of the carbon steel grade, which necessitates special considerations for the welding end of the flanges.

The size and pressure class range was originally NPS 26 through NPS 36 in pressure classes customarily designated in ANSI Standard B16.5 as 300, 400, 600, and 900 lb. The 1970 edition deleted the slip-on flanges for lack of demand, and added a 150 lb. class and coverage for sizes NPS 12 through NPS 24. Additional coverage was also necessitated by the advent of the use of line pipe of grades having minimum specified yield strength higher than the 52,000 psi maximum contemplated at the time of initial development, and therefore still thinner walls.

In some instances, this advent widened the differential between the tensile properties of the flange steel versus that of the mating pipe steel. This, in turn necessitated greater flexibility in the selection of hub dimensions, so that various combinations of material-strength and flange-dimensions could be utilized to supply the flanges. Section 5 on Flange Design was introduced at this point, and is one of the key features of this standard. The 1972 edition included the coverage of blind flanges in all pressure classes and clarification of text requirements for better understanding and usage under the more diverse conditions.

The 1975 edition expanded the size range above size NPS 36. The drilling templates for the Class 150 flanges of the NPS 38 and larger sizes continued the previous philosophy of adopting the drilling template of the Class 125 of ANSI Standard B16.1. However, the drilling templates of the Class 300 flanges of the NPS 38 and larger sizes did not continue the adoption of the Class 250 of ANSI Standard B16.1 drilling templates, nor did the NPS 38 and larger sizes of Classes 400, 600, and 900 continue the extrapolation of ANSI B16.5 drilling templates; instead, these drilling templates were necessarily designed more compactly because of the increased loads. While these flanges are designated by the customary ANSI Standard Class 150, 300, 400, 600, and 900, their use is almost entirely confined to cross country transmission pipelines at atmospheric temperatures. The flanges have been designed primarily for use at their cold ratings which conform to the ANSI Standard B16.5 ratings of 100F, and are intended primarily for attachment to relatively thin-wall, high-strength cold worked pipe, and high-strength butt-welding fittings in pipeline service at temperatures of 450F and lower. However, flanges forged of other materials are capable of pressure temperature ratings as specified in Paragraph 2.2.

The 1980 edition was created to bring the document into closer editorial alignment with ANSI B16.5. However, out of recognition of the successful experience of the pipeline industry, room temperature ratings were extended to 250F. De-rating above 250F was accelerated such that the 450F ratings are the same as B16.5. Users are cautioned that when these flanges are bolted to valves and used at temperatures between 100F and 450F, the rating of the valve will not be as high as the flange.

The 1990 revision of this SP was required to update the reference standards list and delete the metric equivalents.

The 1991 revision of this SP was required to add blind flange machining guidance, flat face requirements and precautionary notes as well as update of referenced standards.

The 1996 revision adds a table with permissible imperfections in flange facing finish and clarifies annex A design criteria. There were several errata, or corrections made to references to other standards. Dimensional tolerances have been changed where necessary to conform with ASME B16.5 and B16.47.

CONTENTS

1. SCOPE

1.1 General — This standard covers pressure-temperature ratings, materials, dimensions, tolerances (by reference to ASME/ANSI B16.5), marking and testing. The welding neck type flanges shall be forged steel, and the blind flanges may be made of either forged steel or from steel plates.

1.1.1 Dimensional requirements for sizes NPS 10 and smaller are provided by reference to ASME/ANSI B16.5. When such flanges meet all other stipulations of this standard, they shall be considered as complying therewith.

1.2 References

1.2.1 Referenced Standards — Standards and specifications adopted by reference in this standard are shown in Annex C, for convenience of identifying edition number, date and source of supply.

A flange 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 even though the edition reference may be changed in a subsequent revision of this Standard Practice.

1.2.2 Codes and Regulations — A flange used under the jurisdiction of the ASME Boiler and Pressure Vessel Code, the ANSI Code for Pressure Piping, or Governmental Regulations, is subject to any limitation of that code or regulation. This includes any maximum temperature limitation for a material, or rule governing the use of a material at a low temperature.

2. PRESSURE-TEMPERATURE RATINGS

2.1 General Flanges covered by this standard shall be designated as one of the following: Class 150, 300, 400, 600 and 900. Ratings in Table 3 are in U.S. customary units.

2.2 Rating for Other Materials and Temperatures above 450 F — NPS 26 and larger flanges forged of steels covered in ASME/ANSI B16.5 whose bores are no larger than those which may be calculated for pipe complying with parallel ASTM pipe specifications, and which comply with all requirements (except dimensions) of American National Standard B16.5 are capable of being utilized at the pressure-temperature ratings given in that standard.

3. MATERIALS

3.1 The steel used in the manufacture of these flanges shall be selected by the manufacturer to meet the following requirements.

3.1.1 All materials used for flanges shall be killed steel.

3.1.2 The steel used shall be suitable for field welding to other flanges, fittings, or pipe manufactured under ASTM specifications A 105, A 53, A 106, A 350, A 381, A 694, A 707, or API Standard 5L.

3.1.3 The steel used shall have a maximum carbon content of 0.35 and a carbon equivalent computed by the following equation:

$$\text{C.E.} = \text{C} + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + \text{V}}{5} + \frac{\text{Ni} + \text{Cu}}{15}$$

that should not exceed 0.48%, based on ladle analysis. If the carbon equivalent factor exceeds 0.48%, the acceptance of the flanges shall be based on agreement between purchaser and manufacturer.

3.1.3.1 The choice and use of alloying elements, combined with the elements within the limits prescribed in paragraph 3.1.3 to give the required tensile properties prescribed in paragraphs 3.1.4 shall be made by the flange manufacturer and included and reported in the ladle analysis to identify the type of steel.

3.1.4 The steel used shall have tensile properties conforming to the requirements prescribed in Table 1 and capable of meeting the requirements of section 4 and the flange manufacturer's design conditions as given in Annex A.