Guide material 192.147 Flanges and flange accessories

Foreward

The primary purpose of the GPTC Guide for Gas Transmission and Distribution Piping Systems (Guide) is to provide assistance to the operator in complying with the intent of the Code of Federal Regulations (CFR) in the performance requirements contained in the Transportation of Natural and Other Gas by Pipelines, Title 49 Subchapter D-Pipeline Safety: Part 191- Annual Reports, Incident Reports, and Safety-Related Condition Reports; and Part 192- Minimum Federal Safety Standards (all being typically referred to hereinafter as the "Regulations").

The Guide includes the Minimum Federal Safety Standards together with the design recommendations, material reference, and recommended practices of the GPTC. The function of the GPTC's guide material is to provide "how to" supplementary recommendations related to the Minimum Federal Safety Standards.

The Guide includes the Federal Regulations plus the GPTC's guide material for both Parts 191 and 192. The Guide is published in loose-leaf format. As changes occur to the Regulations and related guide material, replacement or additional sheets will be mailed to Guide purchasers. The subscription service, which is included with the purchase of the Guide, includes changes to the Regulations as issued by DOT/OPS and changes made to the guide material by GPTC. A new edition, incorporating all changes that have been published, is usually issued every three years.

The historical reconstruction of the Regulations is available in AGA X69804, "Historical Collection of Natural Gas Pipeline Safety Regulations." It includes the original version of Parts 191 and 192 and all their amendments through Amdts. 191-15 and 192-93 (reference the document as updated November 1, 2003). The Federal Register preamble to the amendments is included as well. This collection of all earlier amendments has been established as a readily accessible reference to supplement the Guide or to aid research activity. However, considering the electronic availability of amendments, refer to the Federal Register web site for later amendments.

The format of the Guide includes the title of each numbered section of the Regulations and is followed by the effective date of the latest amendment activity or effective date of the original version if no amendment has been issued. The Regulation is followed by a list of amendment numbers for the respective section and the applicable guide material as developed by the Committee.

The GPTC has an established procedure for reviewing requests for interpretations and suggestions for additions and revisions to the Guide. Written requests should be sent to: Secretary, Gas Piping Technology Committee, American Gas Association, 400 N. Capitol Street, N.W., Washington, D.C. 20001.

Requests for interpretations, proposed additions, and revisions to the Regulations should be directed to the Associate Administrator for Pipeline Safety, Office of Pipeline Safety, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 400 7th Street, S.W., Washington, D.C. 20590.

Interpretation

1 FLANGES

1.1 Flange types.

(a) The dimensions and drilling for all line or end flanges should conform to one of the following standards.

ASME B16 Series listed in Appendix A (for iron and steel)
MSS SP-44 Steel Pipe Line Flanges
Flanges cast or forged integral with pipe, fittings or valves in sizes and for the maximum service rating covered by the standards listed above may be used subject to the facing, bolting and gasketing requirements of this paragraph and 1.2, 2.1 and 2.2 below.

(b) Threaded companion flanges that comply with the B16 group of American National Standards, in sizes and for maximum service ratings covered by these standards, may be used.
(c) Lapped flanges in sizes and pressure standards established by ASME B16.5 may be used.
(d) Slip-on welding flanges in sizes and pressure standards established in ASME B16.5 may be used. Slip-on flanges or rectangular section may be substituted for hubbed slip-on flanges provided the thickness is increased as required to produce equivalent strength as determined by calculations made in accordance with Section VIII, Pressure Vessels, of the ASME Boiler and Pressure Vessel Code.

(e) Welding neck flanges in sizes and pressure standards established in ASME B16.5, ASME B16.47, and MSS SP-44 may be used. The bore of the flanges should correspond to the inside diameter of the pipe used. For acceptable welding end treatment see Figure 192.235B in Guide Material Appendix G-192-5.
(f) Flanges made of ductile iron should conform to material and dimensional standards listed in §192.145(a) and should be subject to all service restrictions as outlined for valves in that paragraph. The bolting requirements for ductile iron flanges should be the same as for carbon and low alloy steel flanges as listed in 2.1 below.

1.2 Flange facings.

(a) Cast iron, ductile iron, and steel flanges should have contact faces finished in accordance with MSS SP-6, Finishes for Contact Faces of Pipe Flanges of Connecting-End Flanges of Valves and Fittings.

(b) Class 25 and Class 125 cast iron integral or threaded companion flanges may be used with a full-face gasket or with a flat ring gasket extending to the inner edge of the bolt holes. When using a full-face gasket, the bolting may be of alloy steel (ASTM A 193). When using a ring gasket, the bolting should be of carbon steel, without heat treatment other than stress relief, equivalent to ASTM A 307 Grade B.

(c) When bolting together two Class 250 integral or threaded companion cast iron flanges, having 1/16 inch raised faces, the bolting should be of carbon steel, without heat treatment other than stress relief, equivalent to ASTM A 307 Grade B.
(d) Class 150 steel flanges may be bolted to Class 125 cast iron flanges. When such construction is used, the 1/16 inch raised face on the steel flange should be removed. When bolting such flanges together, using a flat ring gasket extending to the inner edge of the bolt holes, the bolting should be of carbon steel, without heat treatment other than stress relief, equivalent to ASTM A 307 Grade B. When bolting such flanges together using a full-face gasket, the bolting may be alloy steel (ASTM A 193).

(e) Class 300 steel flanges may be bolted to Class 250 cast iron flanges. Where such construction is used, the bolting should be of carbon steel, without heat treatment other than stress relief, equivalent to ASTM A 307 Grade B. It is recommended that the raised face on the steel flange be removed. When this is done, bolting should be of carbon steel, without heat treatment other than stress relief, equivalent to ASTM A 307 Grade B.
(f) Forged steel welding neck flanges have an outside diameter and drilling the same as ASME B16.1, but with modified flange thicknesses, hub dimensions, and special facing details, may be used to bolt against flat-faced cast iron flanges, and may operate at the pressure-temperature ratings given in ASME B16.1 Class 125 Cast Iron Pipe Flanges provided:

(1) The minimum flange thickness, T, of the steel flange is not less than that specified for size 6 inch and larger.
(2) Flanges are used with nonmetallic full-face gaskets extending to the periphery of the flange.
(3) The design joint has been proven by test to be suitable for the ratings.

2 FLANGE ACCESSORIES

2.1 Bolting.

(a) For all flange joints other than described under 1.2(c), (d), (e) and (f), the bolting should be made of alloy steel conforming to ASTM A 193, A 320 or A 354, or of heat treated carbon steel conforming to ASTM A 449. However, bolting for American National Standard Class 250 and 300 flanges to be used at temperatures between minus 20 oF and plus 450 oF may be made to ASTM A 307, Grade B.
(b) Alloy steel bolting material conforming to ASTM A 193 or ASTM A 354 should be used for insulating flanges if such bolting is made 1/8 inch undersized.

(c) The materials used for nuts should conform to ASTM A 194 and A 307. A 307 nuts may be used only with A 307 bolting.
(d) All carbon and alloy steel bolts, stud bolts, and their nuts should be threaded in accordance with the following thread series and dimension class as required by ASME B1.1.
(1) Carbon Steel--All carbon steel bolts and stud bolts should have coarse threads, Class 2A dimensions and their nuts, Class 2B dimensions.
(2) Alloy Steel--All alloy steel bolts and stud bolts of 1 inch and smaller nominal diameters should be of the coarse thread series; nominal diameters 1 1/8 inch and larger should be of the 8 thread series. Bolts and stud bolts should have a Class 2A dimension, and their nuts should have a Class 2B dimension.

(e) Bolts should have American National Standard regular square heads or heavy hexagonal heads and should have American National Standard heavy hexagonal nuts conforming to the dimensions of ASME B18.2.1 and B18.2.2.
(f) Nuts cut from bar stock in such a manner that the axis will be parallel to the direction of rolling of the bar may be used in all sizes for joints in which one or both flanges are cast iron, and for joints with steel flanges where the pressure does not exceed 250 p.s.i.g. Such nuts should not be used for joints in which both flanges are steel and the pressure exceeds 250 p.s.i.g. except that, for nut sizes 1/2 inch and smaller, these limitations do not apply.

(g) For all flange joints, the bolts or stud bolts used should extend completely through the nuts.

2.2 Gaskets.

(a) Material for gaskets should be capable of withstanding the maximum pressure and maintaining its physical and chemical properties at any temperature to which it might reasonably be subjected in service.
(b) Gaskets used under pressure and at temperatures above 250 oF should be of noncombustible
material. Metallic gaskets should not be used with Class 150 standard or lower-rated flanges.
(c) Full-face gaskets should be used with all bronze flanges, and may be used with Class 25 or Class 125 cast iron flanges. Flat ring gaskets with outside diameter extending to the inside of the bolt holes may be used with cast iron flanges, with raised face steel flanges, or with lapped steel flanges.

(d) In order to secure higher unit compression on the gasket, metallic gaskets of a width less than the full male face of the flange may be used with raised face, lapped, or large male and female facings. The width of the gasket for small male and female or for tongue and groove joints should be equal to the width of the male face or tongue.
(e) Rings for ring joints should be of dimensions established in ASME B16.20. The material for these rings should be suitable for the service conditions encountered and should be softer than the flanges.

(f) The insulating material should be suitable for the temperature, moisture, and other conditions where it will be used.

2.3 Insulating kits.

(a) Insulating kits are available to provide electrical isolation at flanged connections. Insulating kits typically contain a gasket, washers, and sleeves for the bolts.
(b) Insulating kits should be specified to be compatible with both the gas stream and the external environment (e.g., temperature, pressure, gas quality or composition, moisture).
(c) Assembly.

(1) Carefully inspect the insulating kit components for rough edges, cracks, delaminations, or other defects that could contribute to crushing, cracking, or loss of seal under load.
(2) Ensure proper flange alignment and follow the manufacturer's assembly instructions, including torque values that may vary from non-insulating flange assemblies.
(3) Prior to coating or painting flanged connections, verify that desired insulating properties have been attained.

(4) Coating or painting materials should be nonconductive.

(d) Post assembly.

(1) Where possible, include the assembled insulating flange in pressure testing or perform an instrumented leak test prior to coating or painting.
(2) If the assembly is to be buried, consider providing a test station with test leads and bonding wires for future test capability. See §§192.469 and 192.471.
(3) Consider providing for ground fault, lightning protection, or temporary bonding. See §192.467.

3 FLANGE INSTALLATION AND MAINTENANCE

Proper installation and maintenance of flanged joints are critical for maintaining safe operation of pipeline facilities.

3.1 Flange preparation.

(a) The sealing surfaces of the flanges should be clean and smooth.
(b) To seal properly, the sealing faces should be installed parallel to each other.

3.2 Bolting methods.

Methods for tightening flange bolts may include the use of torque wrenches or the use of hydraulic stud tensioners.

(a) Bolt torque values.

(1) The proper bolt torque values are based on gasket material, flange size, flange type, flangerating, bolt size, bolt material, and thread lubricant. When available, the gasket manufacturer's recommended torque values should be followed.
(2) The minimum torque value represents the amount of force required to provide proper compression of the gasket to prevent leakage.
(3) The maximum torque value represents a torque limit to prevent gasket crushing, bolt yielding, flange deformation, or flange cracking.

(4) Thread lubrication significantly influences the amount of torque actually applied to the flange assembly. All flange bolts should be lubricated, and lubrication can be accomplished by using pre-coated bolts or by the field application of thread lubricants.

(b) Bolt torque procedure.

Bolt torque should be applied evenly across the flange and is normally applied in several steps. Bolt torque should be applied using manual or hydraulic torque wrenches. The following method provides an example of applying torque. The number of steps may vary based on recommendations of the gasket manufacturer and operator requirements. Except for the final step, use a star or crisscross pattern to tighten the bolts.

(1) Install and hand tighten all bolts and nuts.
(2) Tighten all bolts to 30% of the final torque value.
(3) Tighten all bolts to 60% of the final torque value.
(4) Tighten all bolts to 100% of the final torque value.
(5) Follow a circular pattern and ensure that all bolts are tightened to 100% of the final torque value.

(c) Hydraulic tensioning.

Hydraulic tensioning involves stretching the bolt to achieve a desired elongation as the nut is tightened onto the flange bolt. Advantages of hydraulic tensioning include the elimination of friction factor errors and more uniform gasket loading. The disadvantages of hydraulic tensioning include the need for longer studs, specialized equipment, and additional workspace.