

GP 03-16-01	Flanged Joints, Gaskets, and Bolting	October 2008
-------------	--------------------------------------	--------------

Flanged Joints, Gaskets, and Bolting

GP 03-16-01

Scope

- 1) [I] This Global Practice (GP) covers the design of flanged joints for piping, and the selection of flanges, flange facings, gaskets and bolting for piping, and equipment flanged nozzles and manways.
- 2) [I] Orifice flanges, valve bonnets, and elastomeric o-ring gaskets are outside the Scope of this Practice.

Refining/Chemicals, Downstream Imperial Oil	For Company Use Only	Version 3.1.0
Page 1 of 19	©ExxonMobil Development Company	
Copyright Waiver ExxonMobil Development Company and ExxonMobil Pipeline Company hereby license the use of ExxonMobil Engineering Practices System (EMEPS) Global Practices (GPs) for use by any ExxonMobil division, subsidiary, or more-than-50%-owned affiliate. The GPs may be downloaded and modified as necessary for project and affiliate use. Written permission from ExxonMobil Development Company or ExxonMobil Pipeline Company is not required. However, any modified GPs must be renumbered to a project-specific or affiliate-specific number to distinguish them from the GPs on the EMEPS web site. ExxonMobil operated joint ventures may utilize GPs to create project-specific or location-specific specifications. It is the responsibility of individual affiliate or joint venture to ensure that the use of GPs and their derivatives is limited to joint venture related business and not disclosed or used outside the JV without appropriate EM management approval.		



Documents

Document Sharing Hub

GP 03-16-01	Flanged Joints, Gaskets, and Bolting	October 2008
-------------	--------------------------------------	--------------

Table of Contents

Table of Tables	3
1. Required References	4
1.1. Global Practices–ExxonMobil Engineering Practices	4
1.2. API–American Petroleum Institute.....	4
1.3. ASME–American Society of Mechanical Engineers	4
1.4. ASTM–American Society for Testing and Materials	5
2. Definitions.....	5
3. Flanged Joints.....	5
4. Flanges.....	6
5. Gaskets	8
6. Bolting.....	10
Appendix: Acceptable Metric Equivalents for Temperatures.....	15
Record of Change	16
Attachment: Purpose Code Definitions.....	19

RFCH, DIOL	For Company Use Only	Version 3.1.0
Page 2 of 19	©ExxonMobil Development Company	 Documents Document Sharing Hub

GP 03-16-01	Flanged Joints, Gaskets, and Bolting	October 2008
-------------	--------------------------------------	--------------

Table of Tables

Table 1: Flange Standards.....	7
Table 2: Bolting Requirements	10
Table 3: Flange Facings and Gaskets	12

RFCH, DIOL	For Company Use Only	Version 3.1.0
Page 3 of 19	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 03-16-01	Flanged Joints, Gaskets, and Bolting	October 2008
-------------	--------------------------------------	--------------

1. Required References

This Section lists the Practices, codes, standards, specifications, and publications that shall be used with this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 03-10-01	Piping Selection and Design Criteria
GP 03-16-03	Leak Bands and Heat/Weather Shields for Flanges and Flangeless Valves
GP 18-07-01	Welding Procedures
GP 18-10-01	Additional Requirements for Materials

1.2. API–American Petroleum Institute

API RP 941	Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants
----------------------------	---

1.3. ASME–American Society of Mechanical Engineers

Unless specific references to the ASME Code are listed, an IHS link to the Introduction is provided to facilitate access to relevant parts of the Code.

ASME B16.1	Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250)
ASME B16.20	Metallic Gaskets for Pipe Flanges Ring-Joint, Spiral-Wound, and Jacketed
ASME B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.47	Large Diameter Steel Flanges NPS 26 Through NPS 60 Metric/Inch Standard
ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.3	Process Piping
ASME SEC VIII D1	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 1

RFCH, DIOL	For Company Use Only	Version 3.1.0
Page 4 of 19	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 03-16-01	Flanged Joints, Gaskets, and Bolting	October 2008
-------------	--------------------------------------	--------------

1.4. ASTM—American Society for Testing and Materials

ASTM A 193/A 193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A 194/A 194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A 320/A 320M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service
ASTM F 436	Standard Specification for Hardened Steel Washers

2. Definitions

- 1) **[I]** Hydrogen Service, as used herein, is to be consistent with the definition provided in [GP 18-10-01](#). Equipment is in hydrogen service when the design temperature is greater than the CS curve in [API RP 941](#) for the given hydrogen partial pressure.
- 2) **[I]** Combustible liquids—High flash liquids [flash points 100°F (38°C) or higher] when handled at temperatures 15°F (8°C) below their flash point or lower.
- 3) **[I]** Flammable liquids—Low flash liquids [flash point below 100°F (38°C)]; and high flash liquids [flash point 100°F (38°C) or higher] when handled at temperatures above or within 15°F (8°C) of their flash point.
- 4) **[I]** Flammable materials—Flammable liquids; hydrocarbon vapors; and other vapors such as hydrogen and carbon disulfide that are readily ignitable when released to atmosphere.

3. Flanged Joints

- 1) **[R]** The selection of flanged facings and gaskets shall be per Table 3.
- 2) **[S] [A] [R]** Electrically insulated flanged joints require approval by the Owner's Engineer. Insulating flanged joints are required for:
 - a) Isolation of all lines heated by electric impedance heating systems.
 - b) Protection of marine terminal loading stations to electrically isolate on-board (tanker or barge) piping from the pier piping under any of the following circumstances:
 - i) At cathodically protected marine terminals
 - ii) Where loading arms or electrically bonded oil cargo hoses are used
 - iii) For loading and unloading products classified as flammable liquids
- 3) **[*] [R]** When specified, hot service thermal insulation of flanges is permitted where all of the conditions in the following table are met:

RFCH, DIOL	For Company Use Only	Version 3.1.0
Page 5 of 19	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 03-16-01	Flanged Joints, Gaskets, and Bolting	October 2008
-------------	--------------------------------------	--------------

Maximum Fluid Operating Temperature	550°F (290°C) ⁽¹⁾⁽²⁾
Maximum Design Pressure	600 psig (4140 kPa) ⁽²⁾
Flange Material	Carbon Steel, or Low Alloy Steel (to 5% Cr) ⁽³⁾
Bolting Material	Grade B7 or B16 per Section 6, Item ⁽¹⁾
Service Restrictions	Not for hydrogen service, highly corrosive fluids such as concentrated acids, or toxic materials such as phenol or hydrogen sulfide
Notes:	
(1)	For temperatures below 300°F (149°C), consideration shall be given to the possibility of corrosion under the insulation.
(2)	Steam service flanges may be insulated to a maximum fluid operating temperature of 750°F (400°C) and a maximum design pressure of 650 psig (4480 kPa).
(3)	For hydrocarbon services, the flange periphery shall, in addition, be fitted with a leak band.

- 4) When weather and heat shields are provided on flanges, they shall be per [GP 03-16-03](#).
- 5) [S] [A] [R] For any flammable material or combustible liquid service where the piping system is lined with plastic or low melting point [below 700°F (370°C)] material, flanged joints shall be designed to prevent leakage when exposed to heat sufficient to destroy or melt the lining material (lapped over flange faces). External insulation of the flanges may be considered for this purpose subject to the Owner's Engineer approval and the requirements of Section 3, Item 4 above.
- 6) [S] [R] For wafer or lug type valve installations in piping systems with a design temperature greater than 400°F (200°C), flanges and bolting material shall be selected to have the same nominal coefficient of thermal expansion as the body material of the valve.
- 7) [R] Steel flanges mating to flat-faced cast iron flanges shall be flat faced. Full-faced gaskets shall be used.
- 8) [S] [A] [R] Proprietary flanged piping connectors, quick opening closures, or clamps shall not be used without prior approval by the Owner's Engineer. Equipment that is provided with an approved quick opening closure shall incorporate the following additional design features:
 - a) A vent valve that is located such that vent operation will be outside of the opening path of the quick opening closure or its potential failure path.
 - b) A pressure gauge, easily visible from the location of the quick opening closure and vent valve.

4. Flanges

- 1) [A] [R] Flanges shall be in accordance with the Standards given in Table 1 and the additional requirements of this Practice and [GP 03-10-01](#). Flanges of materials other than those listed or flanges with special dimensions for mating to equipment shall be per [ASME B31.3](#) or [ASME SEC VIII D1](#) as applicable, and shall be approved by the Owner's Engineer.

RFCH, DIOL	For Company Use Only	Version 3.1.0
Page 6 of 19	©ExxonMobil Development Company	

