APPENDIX D
GUIDELINES FOR ALLOWABLE GASKET CONTACT SURFACE FLATNESS AND DEFECT DEPTH

D-1 FLANGE FACE FLATNESS TOLERANCES

Existing industry flatness tolerance limits do not include an assessment of the ability of the gasket to tolerate imperfections. The tolerances in Table D-1M/Table D-1 are dependent on the type of gasket employed and are categorized based on the initial axial compression of the gasket to the final assembled load.

The imperfections and flange flatness limits listed in this Appendix are intended as inspection guidance. If exceeded, then engineering judgment should be used to determine whether the particular defect is acceptable. Such determinations should consider factors such as the actual gasket construction, flange flexibility, bolt spacing, joint leakage history, and the risk associated with leakage.

Soft gaskets (see Appendix B) are more tolerant of flange flatness imperfections but are typically more difficult to assemble. Hard gaskets (see Appendix B) have less compression than soft gaskets and, while this can help with improved assembly due to less bolt interaction (cross-talk), it generally means that hard gaskets are more sensitive to flange flatness out-of-tolerance. It is suggested that load-compression test results for the gasket being used be obtained from the gasket manufacturer to determine which of the listed flatness tolerance limits should be employed. Some types of gaskets, such as expanded or microcellular PTFE, elastomers, and flexible graphite, with sufficient initial thickness and applied load, may provide suitable sealing performance to justify the use of larger tolerances.

The highest and lowest measurements around the entire circumference of the gasket seating surface may be recorded and the differences between the two compared to the sum of the radial and circumferential limits stated in Table D-1M/Table D-1. Mating flanges that have only one possible alignment configuration may also be gauged to determine that any waviness of the flange faces is complimentary, such that the seating surfaces follow the same pattern. This is found in multipass exchanger joints and is often caused by thermal distortion. In this case, it is conservative to calculate the overall gaps between the flanges at points around the circumference and use the single-flange tolerances as shown in Table D-1M/Table D-1 to determine acceptability of the gap.

D-2 FLANGE FACE IMPERFECTION TOLERANCES

The tolerances shown in Table D-2M/Table D-2 are separated into two categories, depending on the gasket being employed in the joint (see Appendix B). Care should be taken to ensure the correct tolerances are employed for the gasket being installed. It is important to note that the tolerances apply to the gasket seating surface (area where the gasket seats both initially and finally after assembly).

D-3 RTJ GASKETS

Flanges for RTJ gaskets are typically inspected for flange flatness and seating surface imperfections in a different manner than that for raised-face flanges. The flange flatness and groove dimensions are examined prior to joint disassembly by inspection of the gap between the outer edges of the raised faces. If the gap at any location around the joint circumference is less than 1.5 mm (0.0625 in.), then consideration should be given to repair or remachining of the groove at the next opportunity. This eliminates the risk of the flange faces touching during assembly, which can lead to joint leakage. Once the joint is disassembled, the gasket seating surface (see Figure D-5) should be inspected for damage in accordance with the requirements listed for hard gaskets in Table D-2M/Table D-2.

\[1\] For example: PIP VESV1002, Fabrication Specification for Vessels: ASME Boiler and Pressure Vessel Code Section VIII, Divisions 1 and 2 (March 2012), para. 4.4.3.13; and API 660, 9th ed., Table 5.
APPENDIX D
GUIDELINES FOR ALLOWABLE GASKET CONTACT SURFACE
FLATNESS AND DEFECT DEPTH

D-1 FLANGE FACE FLATNESS TOLERANCES

Existing industry flatness tolerance limits do not include an assessment of the ability of the gasket to tolerate imperfections. The tolerances in Table D-1M/D-1 are dependent on the type of gasket employed and are categorized based on the initial axial compression of the gasket to the final assembled load.

Soft gaskets (see Appendix B) are more tolerant of flange flatness imperfections but are typically more difficult to assemble. Hard gaskets (see Appendix B) have less compression than soft gaskets and, while this can help with improved assembly due to less bolt interaction (cross-talk), it generally means that hard gaskets are more sensitive to flange flatness out-of-tolerance. It is suggested that load-compression test results for the gasket being used be obtained from the gasket manufacturer to determine which of the listed flatness tolerance limits should be employed.

The highest and lowest measurements around the entire circumference of the gasket seating surface may be recorded and the differences between the two compared to the sum of the radial and circumferential limits stated in Table D-1M/D-1. It is acceptable to gauge mating flanges that have only one possible alignment configuration may also be gauged to and determine that any waviness of the flange faces is complimentary, such that the seating surfaces follow the same pattern. This is found in multipass exchanger joints and is often caused by thermal distortion. In this case, it is conservative to calculate the overall gaps between the flanges at points around the circumference and utilize the single-flange tolerances as shown in Table D-1M/D-1 to determine acceptability of the gap.

D-2 FLANGE FACE IMPERFECTION TOLERANCES

The tolerances shown in Table D-2M/D-2 are separated into two categories, depending on the gasket being employed in the joint (see Appendix B). Care should be taken to ensure the correct tolerances are employed for the gasket being installed. It is important to note that the tolerances apply to the gasket seating surface (area where the gasket seats both initially and finally after assembly).

D-3 RTJ GASKETS

Flanges for RTJ gaskets are typically inspected for flange flatness and seating surface imperfections in a different manner than that for raised-face flanges. The flange flatness and groove dimensions are examined prior to joint disassembly by inspection of the gap between the outer edges of the raised faces. If the gap at any location around the joint circumference is less than 1.5 mm (0.0625 in.), then consideration should be given to repair or remachining of the groove at the next opportunity. This eliminates the risk of the flange faces touching during assembly, which can lead to joint leakage. Once the joint is disassembled, the gasket seating surface (see Fig. D-5) should be inspected for damage in accordance with the requirements listed for hard gaskets in Table D-2M/D-2.

---

1 For example: PIP VESV1002, Design and Fabrication Specification for Vessels, ASME Boiler and Pressure Vessel Code Section VIII, Divisions 1 and 2 (March 2012), para. 4.4.3.13; and API 660, 9th ed., Table 52.