# ConFlat (CF) Flanges

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# Overview:

A vacuum flange is a flange at the end of a tube used to connect vacuum chambers, tubing and vacuum pumps to each other.

Vacuum flanges are used for scientific and industrial applications to allow various pieces of equipment to interact via physical connections and for vacuum maintenance, monitoring, and manipulation from outside a vacuum's chamber.

Several vacuum flange standards exist, and the same flange types are called by different names by different manufacturers and standards organizations.

However, a system introduced under the trademark ConFlat has found almost universal acceptance for flanged joints. The term "ConFlat" is a registered trademark of Varian, Inc., so "CF" is commonly used by other flange manufacturers.

Both flanges that make the seal are identical. They contain a circular knife edge that penetrates into a flat copper gasket shaped as a simple washer to achieve an ultrahigh vacuum seal.

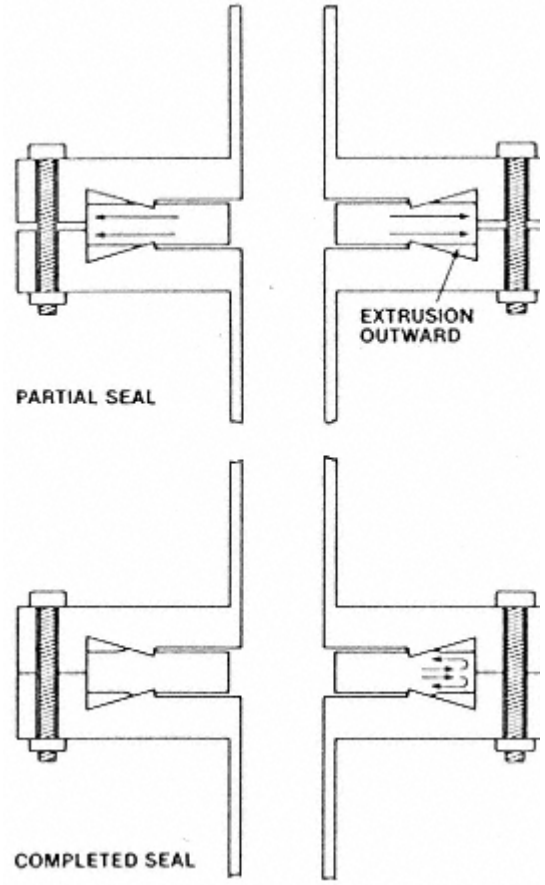
There are two basic design requirements for the construction of all-metal seals.

Due to the particular geometry of the knife edge, the copper gasket is pushed outward in the radial direction as the flange bolts are tightened.

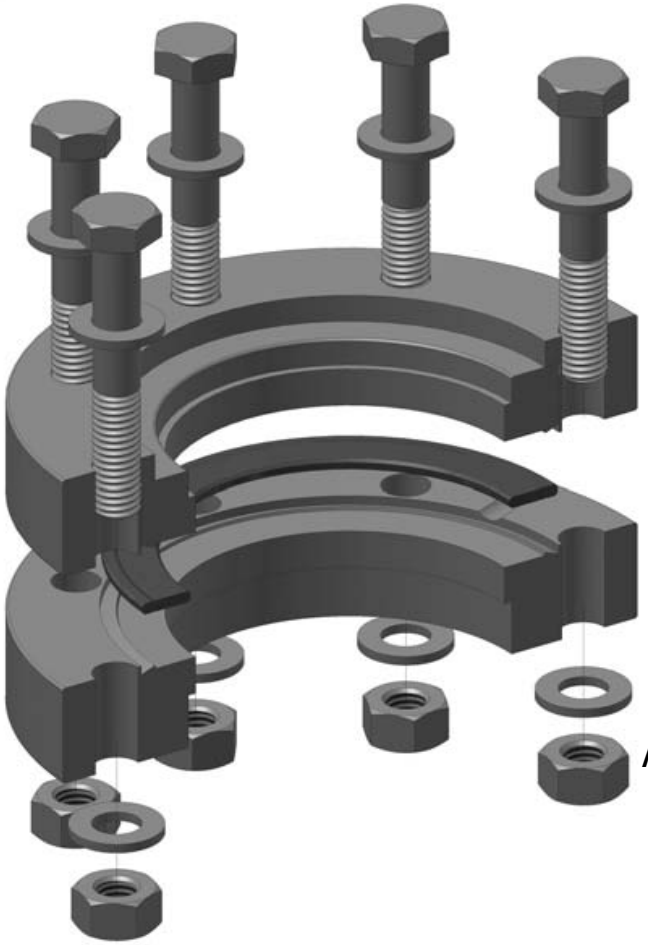
The CF seal operates from 760 Torr (1013 mbar) to < 1 x 10-13 Torr (<1.3 x $10^{-13}$ mbar), and within the temperature range -196° C to 450° C.

Regular nuts and bolts are not suitable for CF flange applications. Various high-tensile strength nut/bolt combinations made from low magnetic permeability, are used.

## Design:



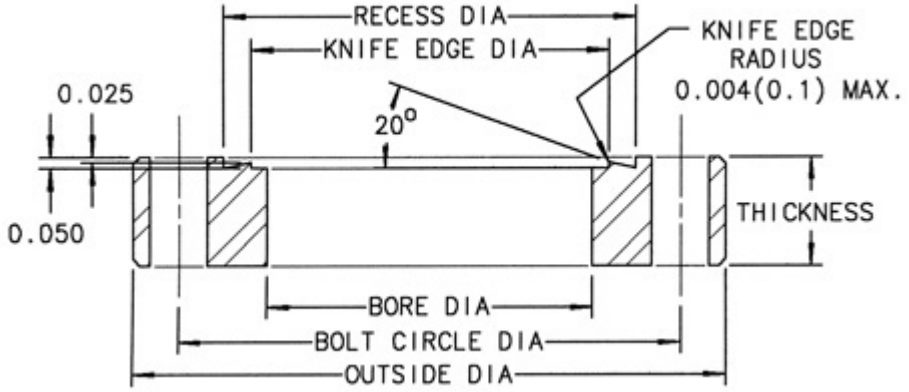

Design and action of ConFlat flanges.



Principle construction of a CF flange

A CF pipe and flange with copper gasket.

## Dimensions of CF Flanges




| Nominal diameter | AD (mm (inch)) | Thickness (mm) | AD CU gasket (mm) | Bolt circle (mm) | Number of holes |
|---|---|---|---|---|---|
| DN10 | 25.4 (1″) | 6 | 13.4 | 18 | 6 x M3 |
| DN16 | 34 (1.33″) | 8 | 21 | 27 | 6 x M4 |
| DN25 | 54 (2.12″) | 12 | 33 | 41 | 4 x M4 |
| DN40 | 70 (2.75″) | 13 | 48 | 59 | 6 x M6 |
| DN50 | 86 (3.38″) | 16 | 61 | 72 | 6 x M6 |
| DN63 | 114 (4.5″) | 17 | 82 | 92 | 8 x M8 |
| DN75 | 117 (4.62″) | 18 | 92 | 102 | 10 x M8 |
| DN100 | 154 (6″) | 20 | 120 | 130 | 16 x M8 |
| DN125 | 171 (6.75″) | 21 | 142 | 152 | 18 x M8 |
| DN160 | 203 (8″) | 22 | 171 | 181 | 20 x M8 |
| DN200 | 254 (10″) | 25 | 222 | 232 | 24 x M8 |
| DN250 | 305 (12″) | 25 | 272.7 | 284 | 32 x M8 |
| DN250 "imperial" | 305 (12″) | 27 | 270 | 283 | 32 x M10 |

In North America, flange sizes are given by flange outer diameter in inches while in Europe and Asia, sizes are given by tube inner diameter in millimeters.

## Types:

CF flanges are offered in four distinct versions or combinations:

Fixed flange: once welded to a fitting, it has its bolt-hole orientation fixed with respect to that fitting.

Rotatable flange: when welded to a fitting, it enables the bolt-hole ring to rotate.

Through-hole flange: indicates a mating flange pair accepts bolts that go through both flanges and is secured by nuts or plate nuts.

Tapped flange: connected to a through-hole flange using only bolts.

## Gaskets:

The gasket material sealing two flanges determines the joint's maximum temperature and, to an extent, the base pressure of the vacuum volume.

The normal gaskets for stainless steel CF flanges are punched from 1/4-hard, high-purity, oxygen-free (OFHC) copper stock, chemically cleaned and finished to be scratch- and burr-free. For systems requiring frequent high-temperature bakeouts, silver-plated copper gaskets are recommended.

Aluminum CF flanges must use aluminum gaskets — never copper. However, aluminum gaskets can be used on stainless steel CF flanges if baking is restricted to 200° C.

Thank You