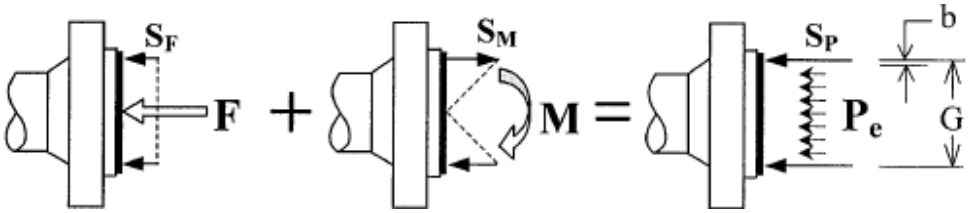
Show

# Flange Leakage Check

START-PROF allows to use following methods of flange leakage check:

**Equivalent pressure / Kellogg Method**




Kellogg aka Equivalent pressure Method is conservative method, where the axial force and bending moment on the flange is converted into equivalent pressure using following equation

$$P_{eq} = P + \frac{4F}{\pi G^2} + \frac{16M}{\pi G^3} < P_{rating}$$

$$M = \sqrt{M_o^2 + M_i^2}$$

F - Axial force on flange

M - Moment on flange

G - Effective gasket diameter

Prating - allowable pressure for flange from rating table (ASME B16.5, EN 1092, GOST codes)

**Code Case 2901 / PVP2013-97814 Method**

The main advantage of this method is that it is less conservative than Kellogg method. This method is published in paper: "Improved Analysis of External Loads on Flanged Joints" PVP2013-97814 by Dr. Warren Brown, 2013.

$$16M_E + 4F_E G \leq \pi G^3\left((\mathrm{P_R} - \mathrm{P_D}) + \mathrm{F_M P_R}\right)$$

And then included into Code Case 2901 at December 11, 2017.

This equation can be represented in the following form:

$$P_{eq} = P + \frac{4F}{\pi G^2} + \frac{16M}{\pi G^3} < (1 + F_M) P_{rating}$$

It is the same as Kellogg method, but allowable pressure is increased times (1+Fm), where Fm factor can be taken from the following table

**Table 1**
**Moment Factor, $F_M$**

| ASME Standard [Note (1)] | Size Range, NPS | Flange Pressure Class 150 | 300 | 600 | 900 | 1500 | 2500 |
|---|---|---|---|---|---|---|---|
| B16.5 | ≤ 12 | 1.2 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| | > 12 and ≤ 24 | 1.2 | 0.5 | 0.5 | 0.3 | 0.3 | ... |
| B16.47, Series A | All | 0.6 | 0.1 | 0.1 | 0.1 | ... | ... |
| B16.47, Series B | < 48 | [Note (2)] | [Note (2)] | 0.13 | 0.13 | ... | ... |
| | ≥ 48 | 0.1 | [Note (3)] | ... | ... | ... | ... |

GENERAL NOTES:
(a) The combinations of size ranges and flange pressure classes for which this table gives no moment factor value are outside the scope o this Case.
(b) The designer should consider reducing the allowable factor if the loading is primarily sustained in nature, and the bolted flange join operates at a temperature where gasket creep/relaxation will be significant [typically above 450°F (232°C) metal temperature].

NOTES:
(1) The acceptable edition of the ASME Standard shall be as shown in Table U-3 for Section VIII, Division 1 construction and Table 1.1 fo Section VIII, Division 2 construction.
(2) The following value for $F_M$ applies:

$$F_M = 0.1 + \frac{(48 - \text{NPS})}{56}$$

(3) $F_M$ =0.1 except NPS 60, Class 300, in which case $F_M$ = 0.03.

**DNV Method**

The idea of DNV method is that flange allowable pressure in Kellogg method can be increased to hydrotest pressure that is 1.5 times the design pressure. But for safety reasons factor 1.3 is used instead of 1.5.

$$MAWP = 1.5\ x\ P_R - P_{eq}$$

The equation can be represented in the following form:

$$P_{eq} = P + \frac{4F}{\pi G^2} + \frac{16M}{\pi G^3} < 1.3P_{rating}$$

**NC 3658.3 Method**

This method is used if flanges, bolts and Gaskets are designed based on as specified in ASME B 16.5a and bolting material have allowable stress value at 100°F(38°C) >=20000 psi (138 MPa) (High Strength Bolting)

Leakage check equation is as following:

OPE loads (SUS)

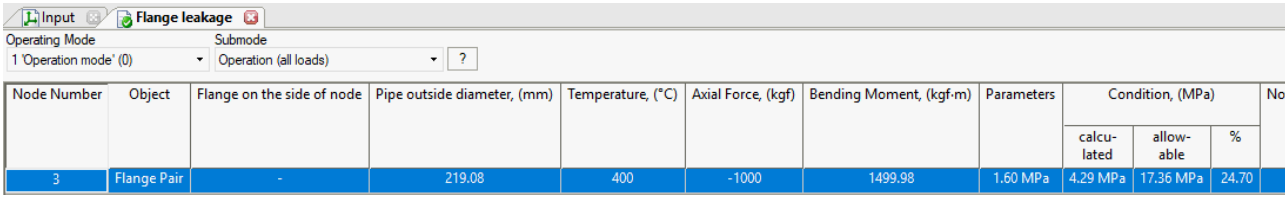
$$S = \frac{248.22 \cdot M_{fs}}{3125 \cdot C \cdot A_b} \leq min\left(S_y; 248.22\ MPa\right)$$

Occasional loads (OCC)

$$S = \frac{248.22 \cdot M_{fd}}{3125 \cdot C \cdot A_b} \leq 2.0 \cdot min\left(S_y; 248.22\ MPa\right)$$

C and Ab values should be specified by user in flange properties. Sy value is taken automatically from database according to design temperature.

## Properties




| Property | Description |
|---|---|
| Axial force | Calculated axial force N acting on the flange (+ for stretch, - for compression) without pressure thrust force. |
| Bending moment | Calculated bending moment M acting on the flange<br>$M = \sqrt{M_x^2 + M_y^2}$,<br>Mx, My - bending moments acting in mutual perpendicular planes, going through the pipe axis |
| Parameters | Design pressure in pipe for Peq methods<br>Bolt Area, Bolt circle diameter, and design pressure for NC 3658.3 |
| Calculated | Equivalent pressure on flange calculated using one of the Peq methods<br>For NC 3658.3:<br>$S = \frac{248.22 \cdot M_{fs}}{3125 \cdot C \cdot A_b}$ |
| Allowable | Allowable pressure on flange calculated using one of the Peq methods<br>For NC 3658.3:<br>$min(S_y; 248.22\ MPa)$ or $2.0 \cdot min(S_y; 248.22\ MPa)$ |

## Menu Access

After analysis: **Output > Flange Leakage**