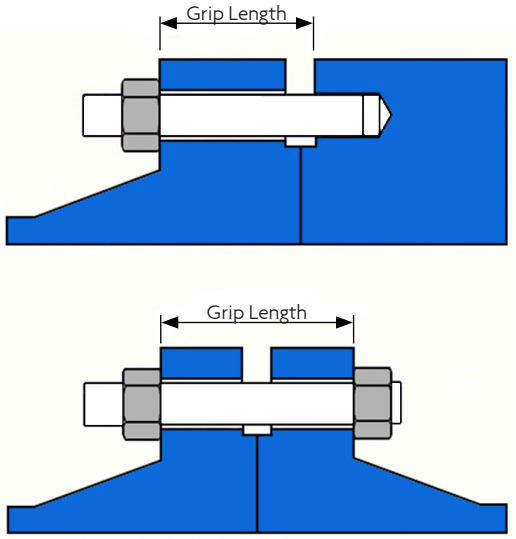
Oil Pressure Calculation

The formula widely used in the bolt tensioning industry to calculate the Oil Pressure to be used with a bolt tensioning tool is given below along with definitions of the terms used :-

Bolt Load
Residual Bolt Load required when the tensioning operation is complete

Tensioning Force
The load that will be applied by the bolt tensioner during the tensioning operation

Load Transfer Factor
The ratio of Tensioning Force to Bolt Load



$$\text{Load Transfer Factor} = \frac{\text{Tensioning Force}}{\text{Bolt Load}} = 1.01 + \frac{\text{Bolt Diameter}}{\text{Grip Length}}$$

If the Load Transfer Factor calculates to less than 1.10 then use 1.10

Tensioning Force = Bolt Load x Load Transfer Factor

Always check that the tensioning force will not exceed 95% of the yield strength of the bolt material. If it does, the grip length of the bolt must be increased. Contact Boltight for advice on this.

$$\text{Oil Pressure (bar)} = \frac{10 \times \text{Tensioning Force (Newtons)}}{\text{Tool Pressure Area (mm}^2\text{)}}$$

Check that the oil pressure calculated does not exceed the maximum working pressure of the bolt tensioning tool. Users who require highly accurate residual bolt stresses should perform a bolt extension measurement before and after tensioning. In this way residual bolt stresses can be calculated from the actual bolt extensions measured.

IMPORTANT - The chart and formula should only be used as a guide. The actual residual load can be affected by many factors including but are not limited to, damage to bolt and nut threads, squareness of the nut washer face to the nut threads, squareness of the joint faces, condition of the joint face under the nut, and the use of washers. Users who require very accurate and known residual bolt loads should use measurements to determine the actual residual load achieved. For example. Bolt length measurement before and after tensioning, then calculate the residual load from the measured bolt extension. Boltight Limited accepts no responsibility for the actual residual loads achieved.

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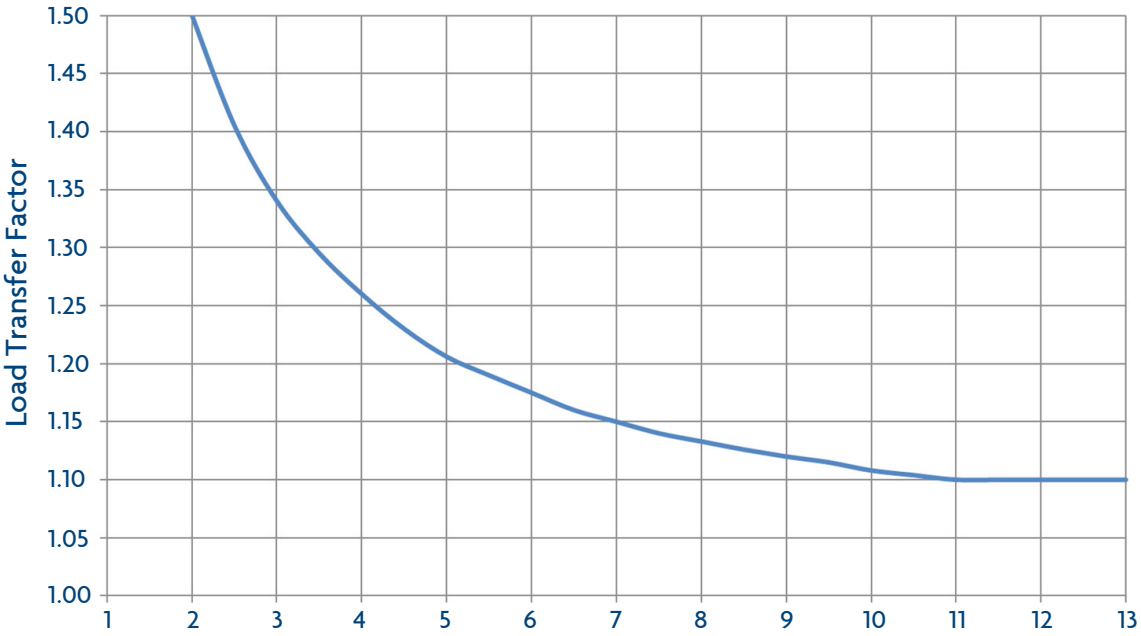
Load Transfer Factor Graph



IMPORTANT - This chart should only be used as a guide. It has been created using formulae widely used in the industry. The actual residual load can be affected by many factors. These include but are not limited to; damage to bolt and nut threads, squareness of the nut washer face to the nut threads, squareness of the joint faces, condition of the joint face under the nut, and the use of washers. Users who require accurate and known residual bolt loads should not rely on this graph but make other measurements to determine the actual residual load achieved. For example, perform a bolt length measurement before and after tensioning and calculated the residual load from the measured bolt extension. Boltight Limited accepts no responsibility for the actual residual loads achieved with its bolt tensioning tools.

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Oil Pressure Calculation - Worked Example

Flange	18 inch 900 lb
Bolt diameter (D)	1-7/8 inch UN8
No. of bolts	20
Bolt grip length (G)	204 mm
Residual bolt stress required	275 N mm^2 (40,000 psi)
Bolt tensioning tool no.	Tool No. 23A
Hydraulic pressure area	5489.8 mm^2

Calculate residual load

Bolt stress area	1567 sq mm (2.43 inch^2)
Residual load per bolt	= 275 x 1567 / 1000
	= 430.9 kN

Calculate load transfer factor

Load transfer factor (LTF) = 1.01 + D/G where :-

D = 1.875 x 25.4 = 47.652 mm

G = 204 mm

= 1.01 + (47.625 / 204)

= 1.01 + 0.233

= 1.243

Calculate initial bolt load required

Initial bolt load = Residual bolt load x load transfer factor

= 430.9 kN x 1.243

= 525.6 kN

Caculate oil pressure B

Oil pressure B = Initial bolt load / Hydraulic pressure area

= 525.6 kN / 5489.8 mm^2 x 10

= 957.4 bar (say 960 bar)

Calculate oil pressure A

Oil pressure A = 1.25 x Oil pressure B = 957.4 x 1.25

= 1196.7 bar (say 1200 bar)

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