# OIL PRESSURE CALCULATION SHEET

The formula widely used 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**.

$$\text{Load Transfer Factor} = \frac{\text{Tensioning Force}}{\text{Bolt Load}} = 1.01 + \frac{\text{Bolt Diameter (mm)}}{\text{Grip Length (mm)}}$$
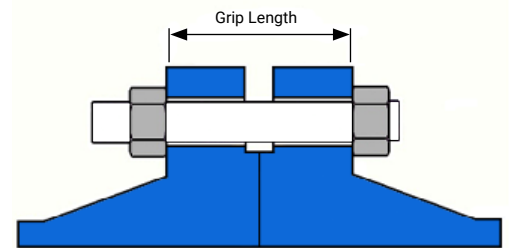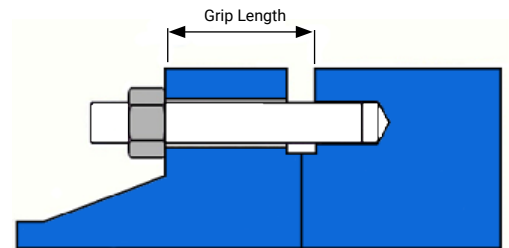
If the **Load Transfer Factor** calculates to less than 1.10 then use 1.10.
**Tensioning Force** = Bolt Load x Load Transfer Factor

$$\text{Oil Pressure (bar)} = \frac{10 \times \text{Tensioning Force (Newtons)}}{\text{Tool Pressure Area (mm}^2)}$$
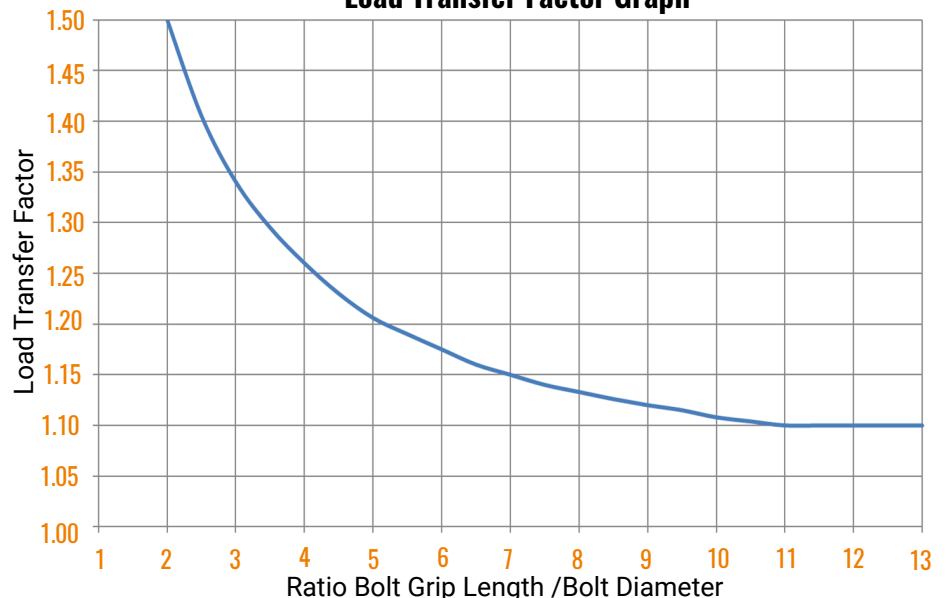
**Check that the oil pressure calculated does not exceed the maximum working pressure of the bolt tensioning tool. Users who require highly accurate residual bolt stresses should perform a bolt extension measurement before and after tensioning.  In this way residual bolt stresses can be calculated from the actual bolt extensions measured.**

Grip Length

Grip Length

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. Please contact your representative for advice on this.

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 perform a  bolt length measurement before and after tensioning, then calculate the residual load from the measured bolt extension. Boltight accepts no responsibility for the actual residual loads achieved with it's bolt tensioning tools.

**Load Transfer Factor Graph**

Y-axis: Load Transfer Factor (1.00 to 1.50)
X-axis: Ratio Bolt Grip Length /Bolt Diameter (1 to 13)

# 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

## Calculate 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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