

## Instruction Document

### Tips on Bolt Tensioning.

All Detachable Type Bolt Tensioners.

Document No: TDR146r2

Issued: 09/09/14

#### Load Transfer Factor. (LTF)

Any stretch bolt tensioner regardless of make, exhibits a load loss as the bolt load is transferred from the tensioner to the joints hexagon or round nuts. Load loss is a direct loss of bolt elongation; this is due to many different factors, such as thread deflections, radial expansion of the nut and 'bedding in' of the nut into the joint reaction surface. Because of this phenomenon it is essential that a load allowance (LTF) is made when calculating the working load of a tensioner, to achieve a known final bolt load. Extra load must be applied so the bolt will relax down to the required load on transfer. The load transfer factor is a direct function of joint clamp length and the nominal diameter of the bolt, and can be calculated using the following formula:

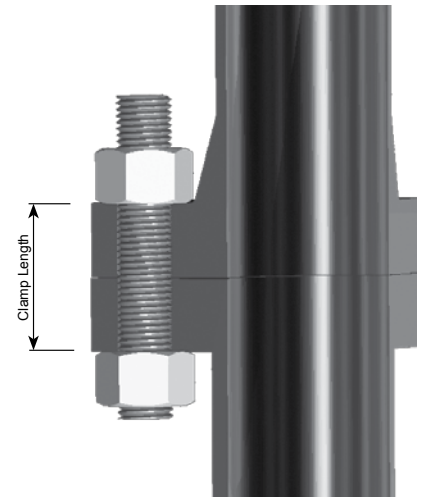
$$\text{Load Transfer Factor (LTF)} = 1.01 + (D / C)$$

Units:-

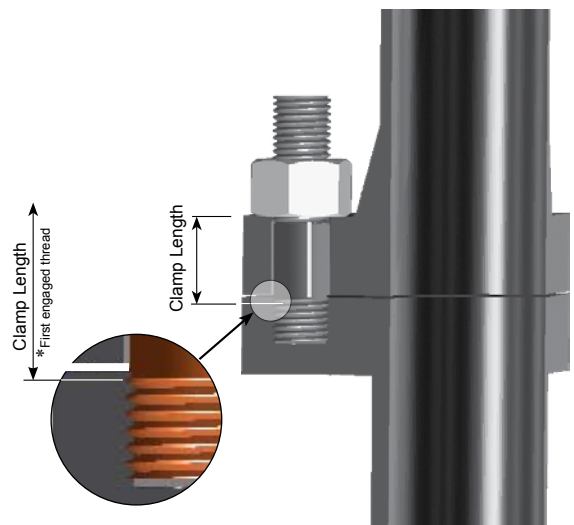
D = Nominal Bolt Thread Diameter (mm or In)

C = Joint Clamp Length (mm or In)

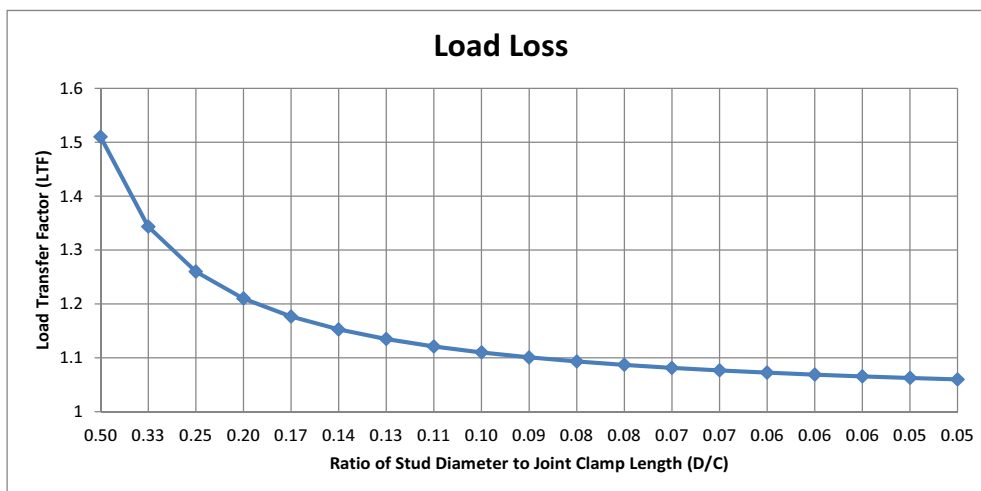
**Note: If the calculated LTF is less than 1.15, then use 1.15**



Through Bolt



Blind Bolt



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## Cross Load Factor (CLF)

For less than 100% bolt to tool ratio tensioning it is recommended to use two tightening pressures. Tentec refer to these pressures as Pressure A and Pressure B. These two pressures compensate for the bolt load loss that occurs when a bolt is tensioned adjacent to an already tensioned bolt. The already tensioned bolt loses load as load is being applied to its adjacent partner.

To compensate for this load loss, extra load is applied in the form of pump pressure A, to the first bolt so that it relaxes down to the required load.

Generally Tentec recommend a cross load factor of 1.2.

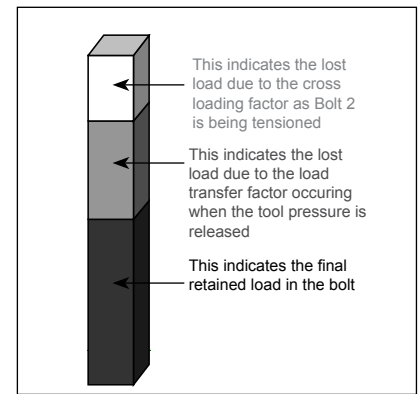


Fig 2 Shows the breakdown of load losses and the final retained load

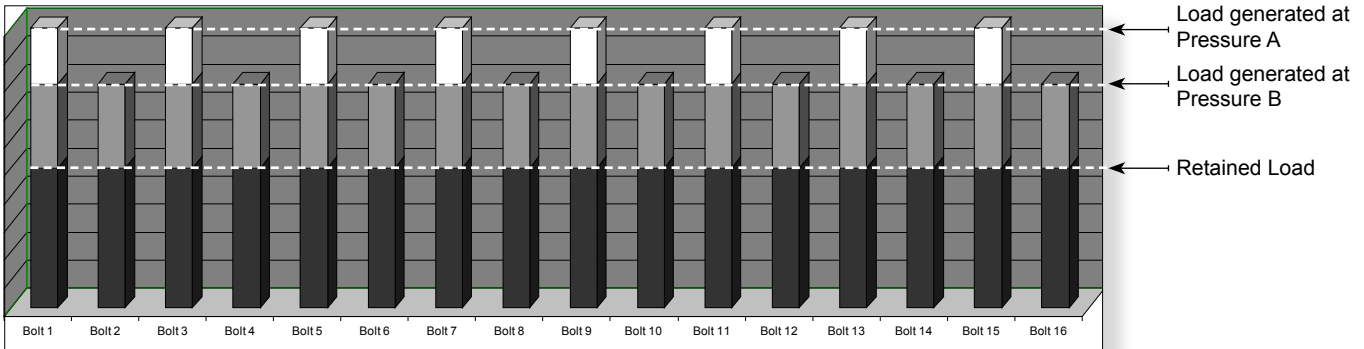


Fig 1 This diagram shows the normal load losses associated with stretch bolt tensioners

The 2 pressure tightening pressure procedure is not mandatory, however it is a procedure that when followed, reduces the number of times a bolt is tensioned before equal load is achieved in all bolts. If it is not possible to apply an elevated A pressure, then simply apply Pressure B to all bolts and continue tensioning until the break loose check is satisfied. (Refer to the Tentec Instruction manual supplied with your tensioners).

## BTS - Bolt Tightening Software.

Available from the Tentec website.

[www.tentec.net](http://www.tentec.net)

Takes the complexity out of bolt tightening calculations.

## Useful Formula Relating to Bolt Tensioners

### Determining required bolt load from known bolt stress.

Retained Bolt Load = Retained Bolt Stress x Bolt Tensile Stress Area

Units:

Retained Bolt Load = (N or Tons)

Bolt Tensile Stress Area = (mm<sup>2</sup> or In<sup>2</sup>)

### Determine Tool Pressure B to achieve required Bolt Load.

Tool Pressure = (Retained Bolt Load x LTF) / Tool Hydraulic Pressure Area

Units

Tool Pressure = (N/mm<sup>2</sup> or Ton/In<sup>2</sup>)\*

retained Bolt Load = (N or Ton)

LTF = (No Units)

Tool Hydraulic Pressure Area = (mm<sup>2</sup> or In<sup>2</sup>)

\*To convert N/mm<sup>2</sup> to bar: Multiply by 10

\*\* To Convert Ton/In<sup>2</sup> to psi: Multiply by 2240

### Determine Tool Pressure A to achieve required Bolt Load.

Tool Pressure =

(Required Bolt Load x LTF x CLF) / Tool Hydraulic Pressure Area

Units

Tool Pressure = (N/mm<sup>2</sup> or Ton/In<sup>2</sup>)\*

Retained Bolt Load = (N or Ton)

LTF = (No Units)

Tool Hydraulic Pressure Area = (mm<sup>2</sup> or In<sup>2</sup>)

\*To convert N/mm<sup>2</sup> to bar: Multiply by 10

\*\* To Convert Ton/In<sup>2</sup> to psi: Multiply by 2240

### % of Bolt Yield

(Bolt Stress Required / Yield Strength of bolt ) x 100 x LTF x CLF

Units

Bolt Stress Required (N/mm<sup>2</sup> or Ton/In<sup>2</sup>)

Bolt Stress Required (N/mm<sup>2</sup> or Ton/In<sup>2</sup>)

The tool Hydraulic Pressure Area and Max Working

Pressure can be found hard stamped on the Tentec tool.

