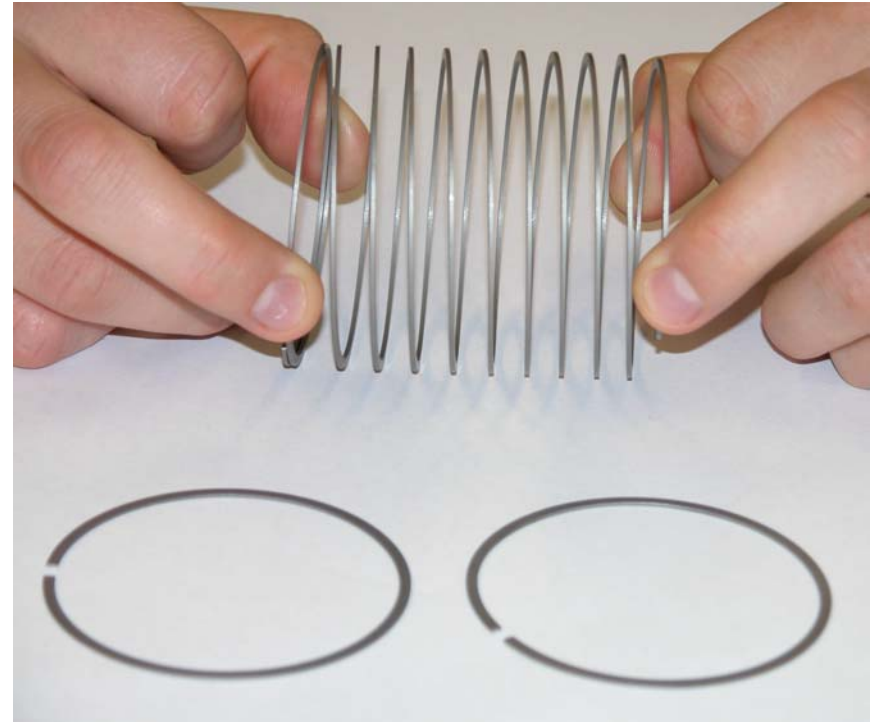
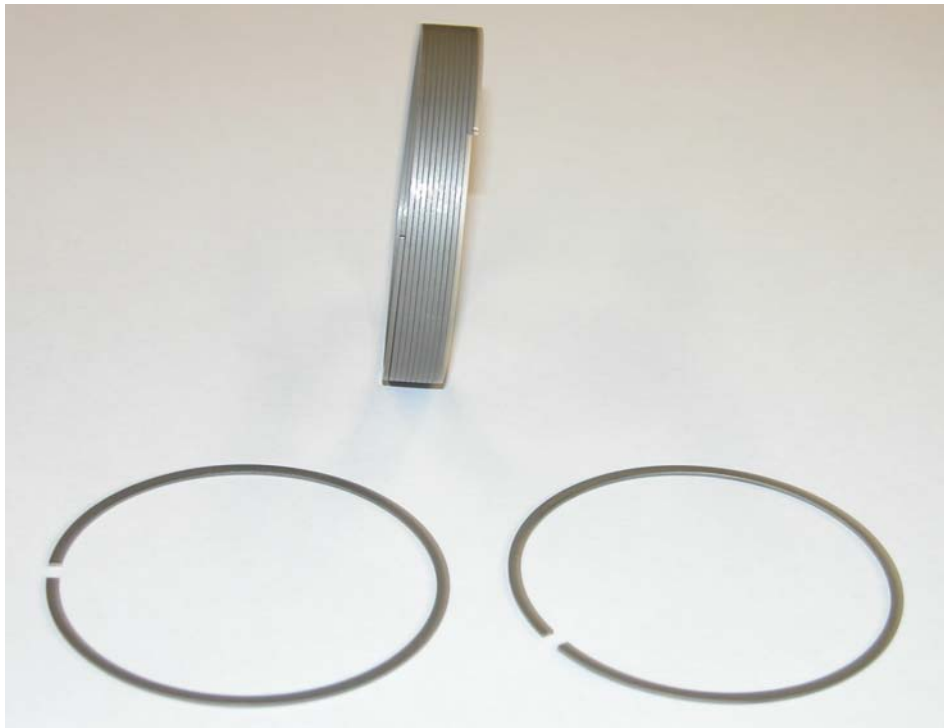




The Cross Spirallock Thread Insert

A Wire Thread Insert with
extraordinary properties.

Piston rings made from coil



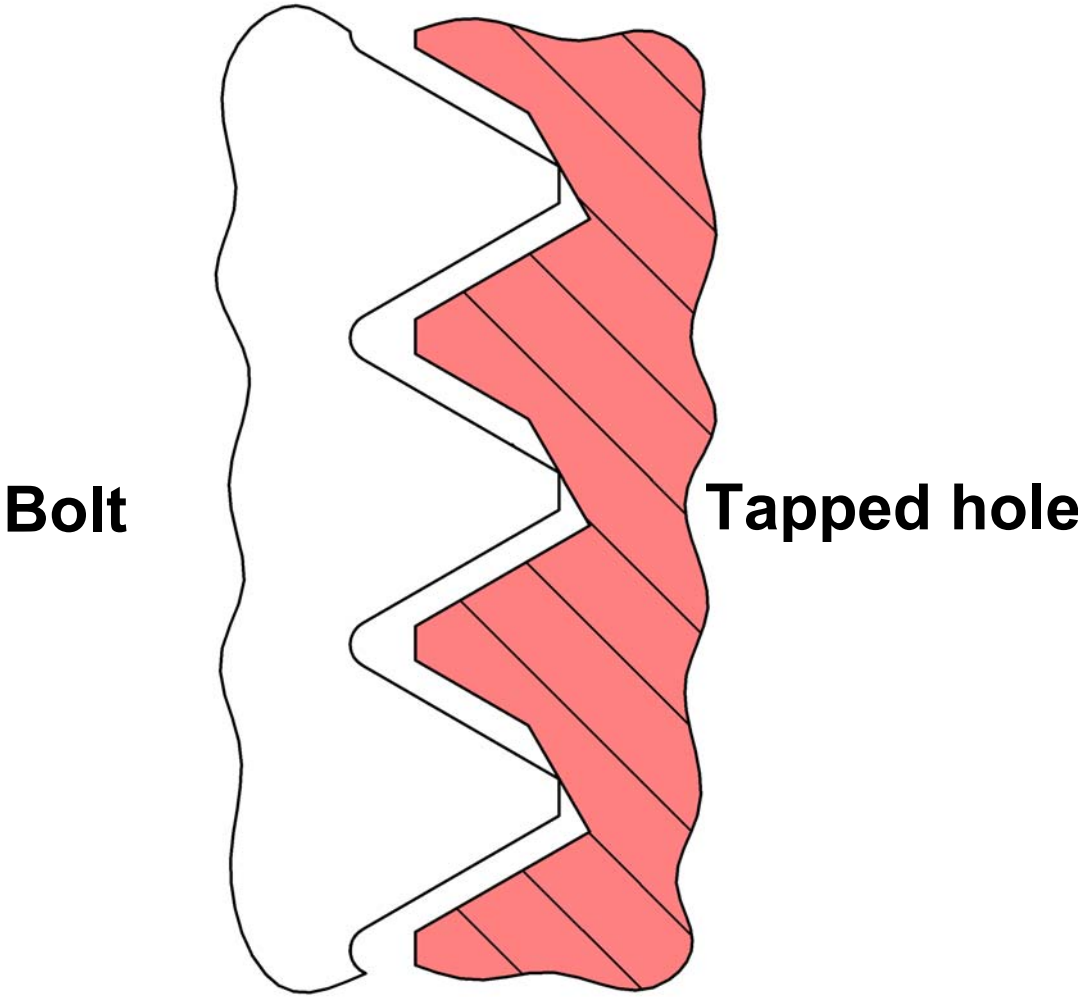
CROSS



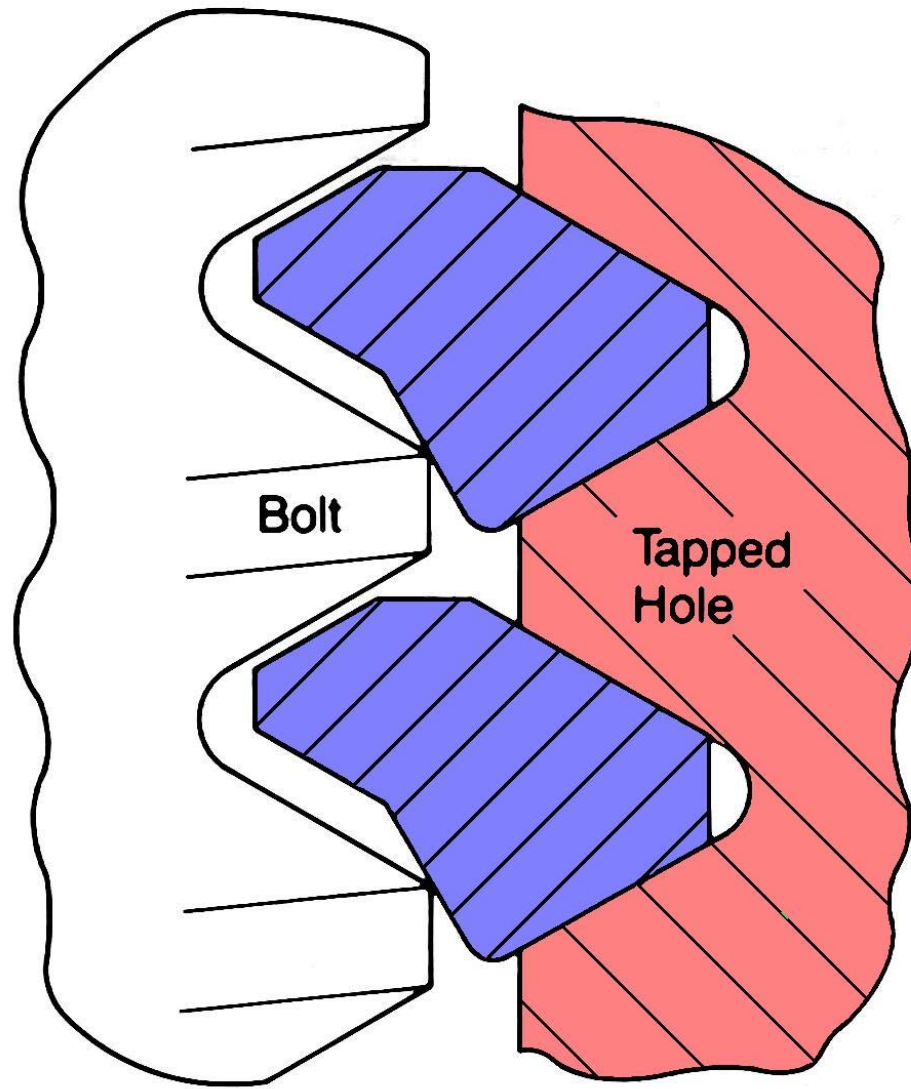
**Ralph
Flower**

CROSS

The Spirallock thread

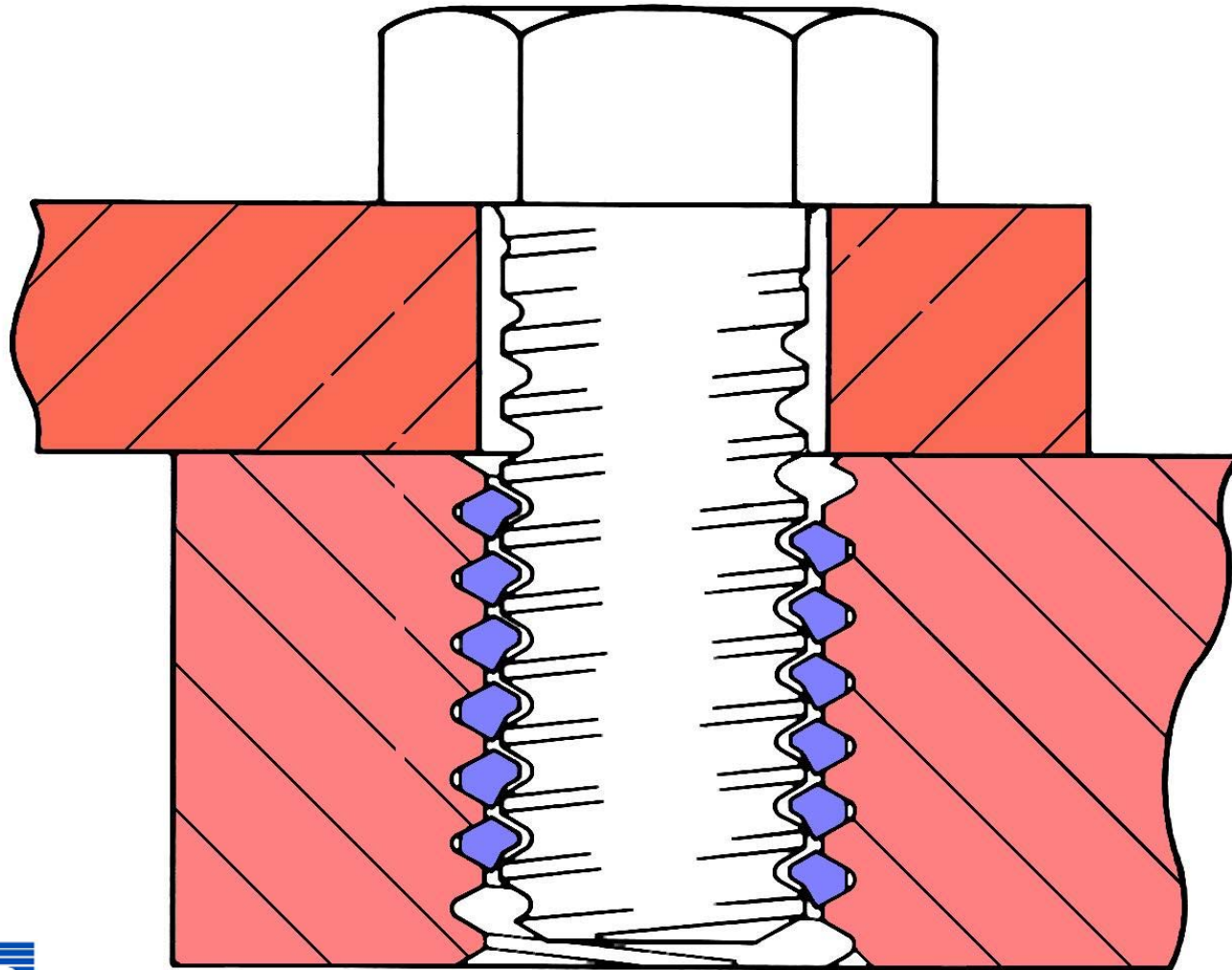


Cross Spirallock Insert wire section



CROSS

Cross Spirallock Insert assembly



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London Underground Central Line gearboxes



Blade attachment to main rotor head mast



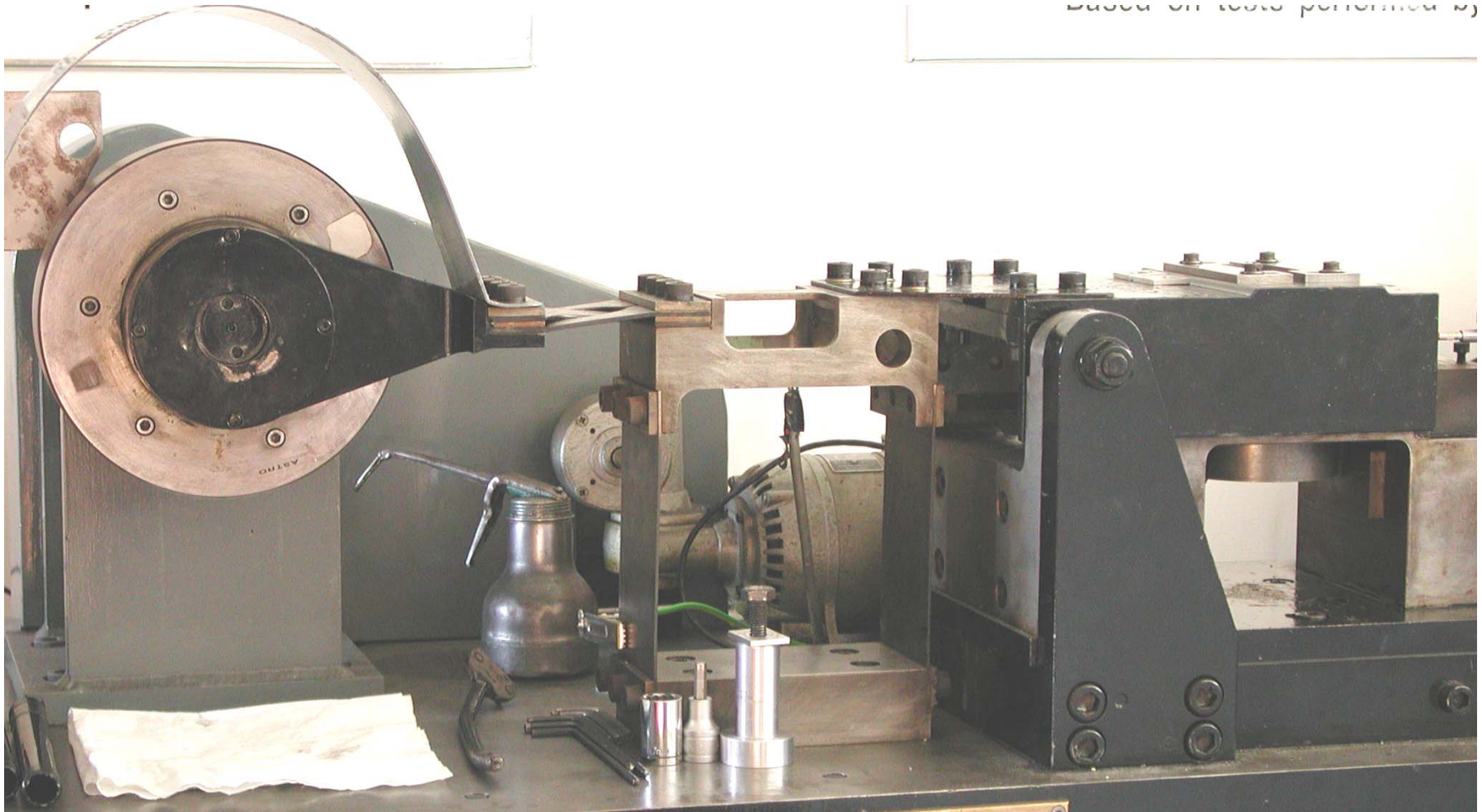
CROSS



**Ralph
Flower**

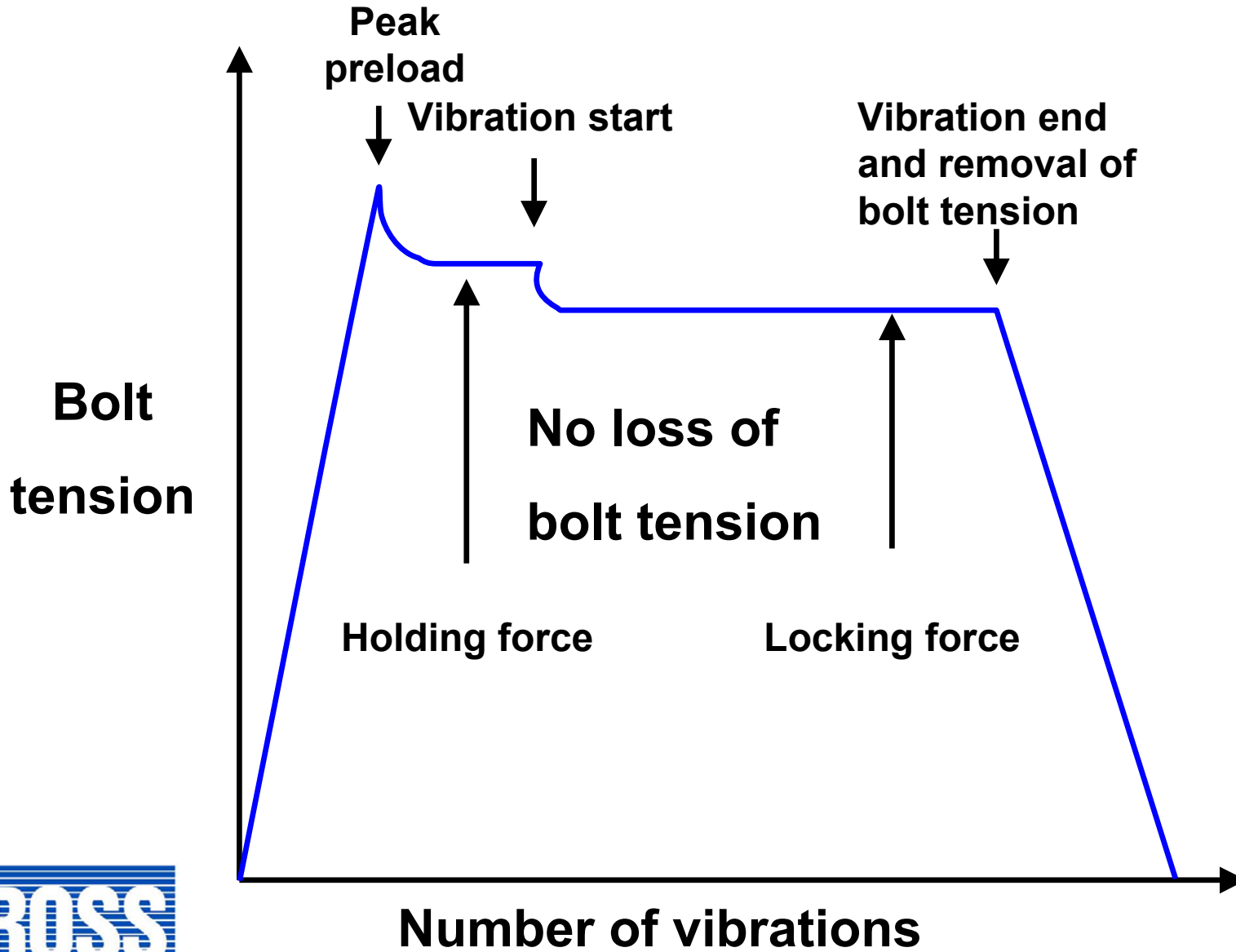
The Junkers Vibration Rig

Based on tests performed by



CROSS

The vibration test

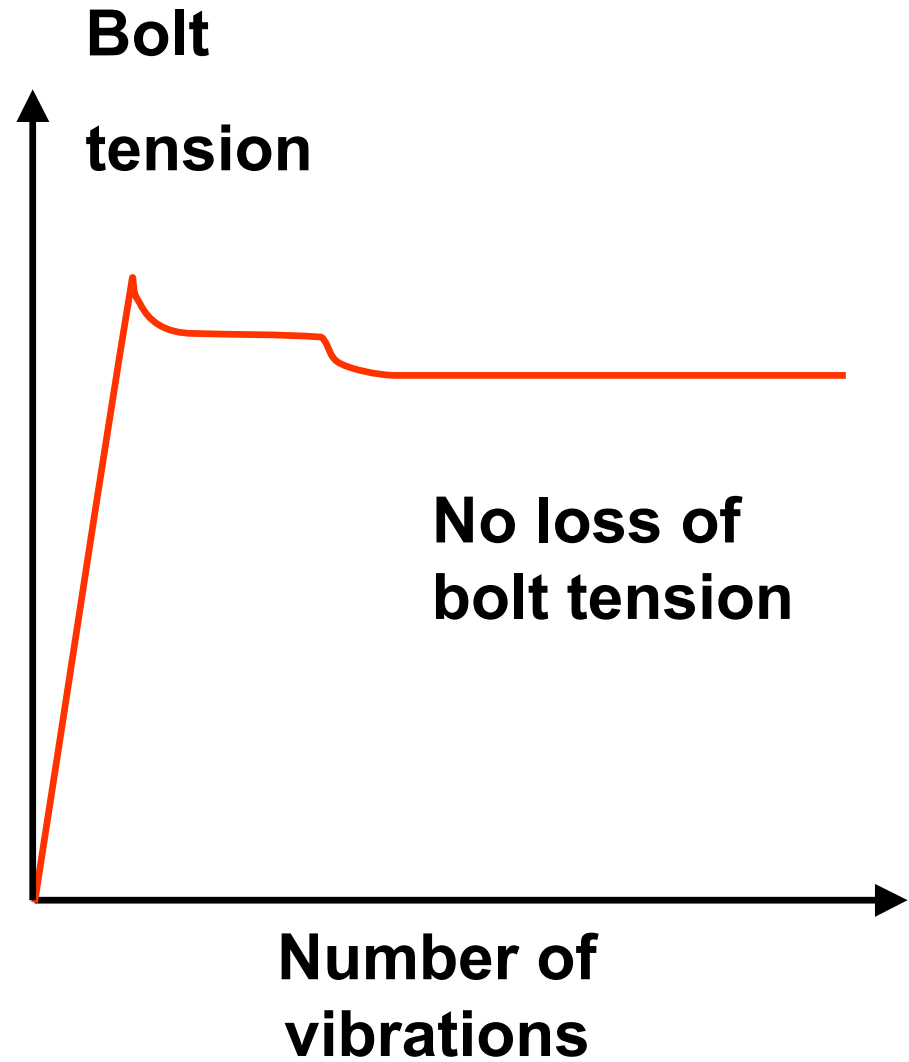
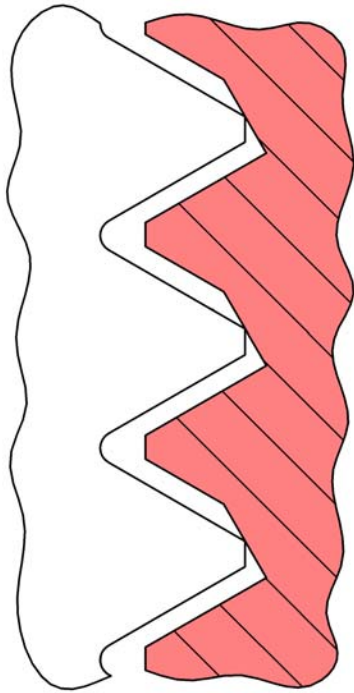


Test other available Thread Locking Systems:

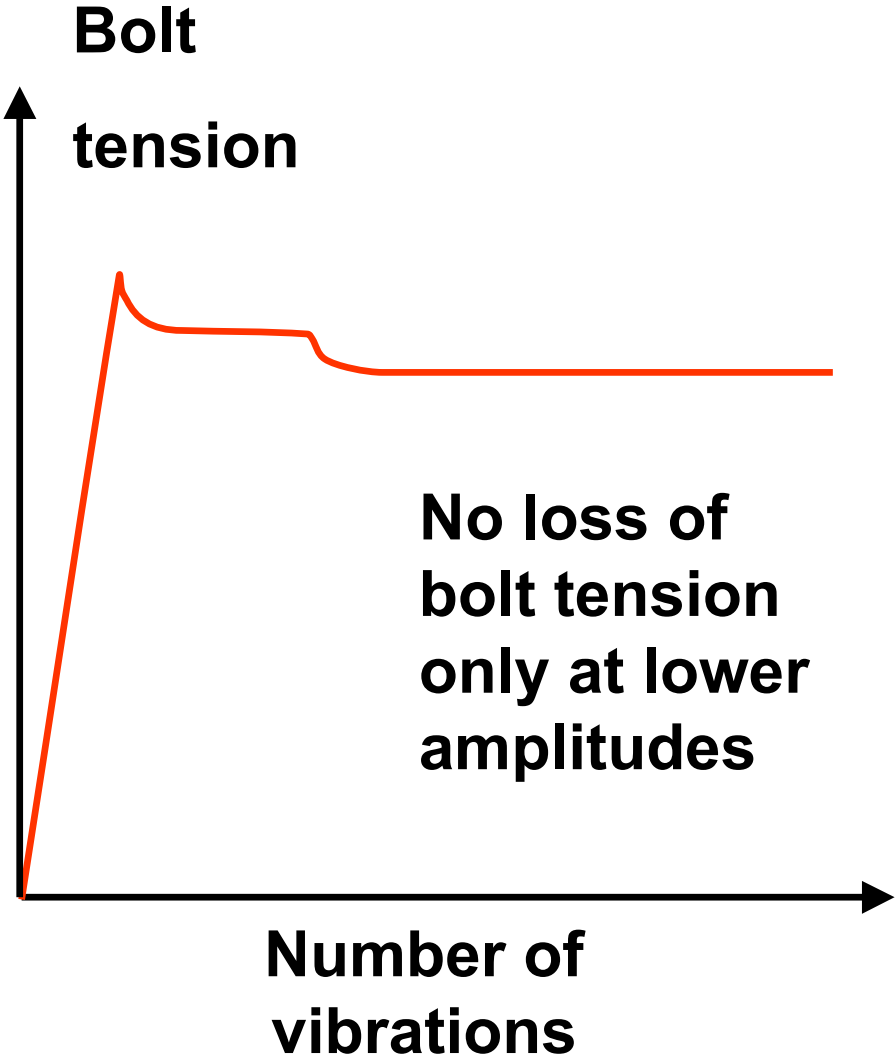
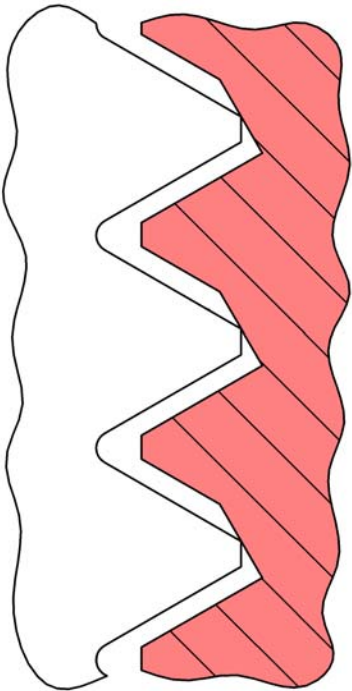
- Spirallock taps
- Prevailing torque inserts
- Thin wall inserts
- Spring washers
- Schnorr safety washers
- Nord-Lock
- Loctite



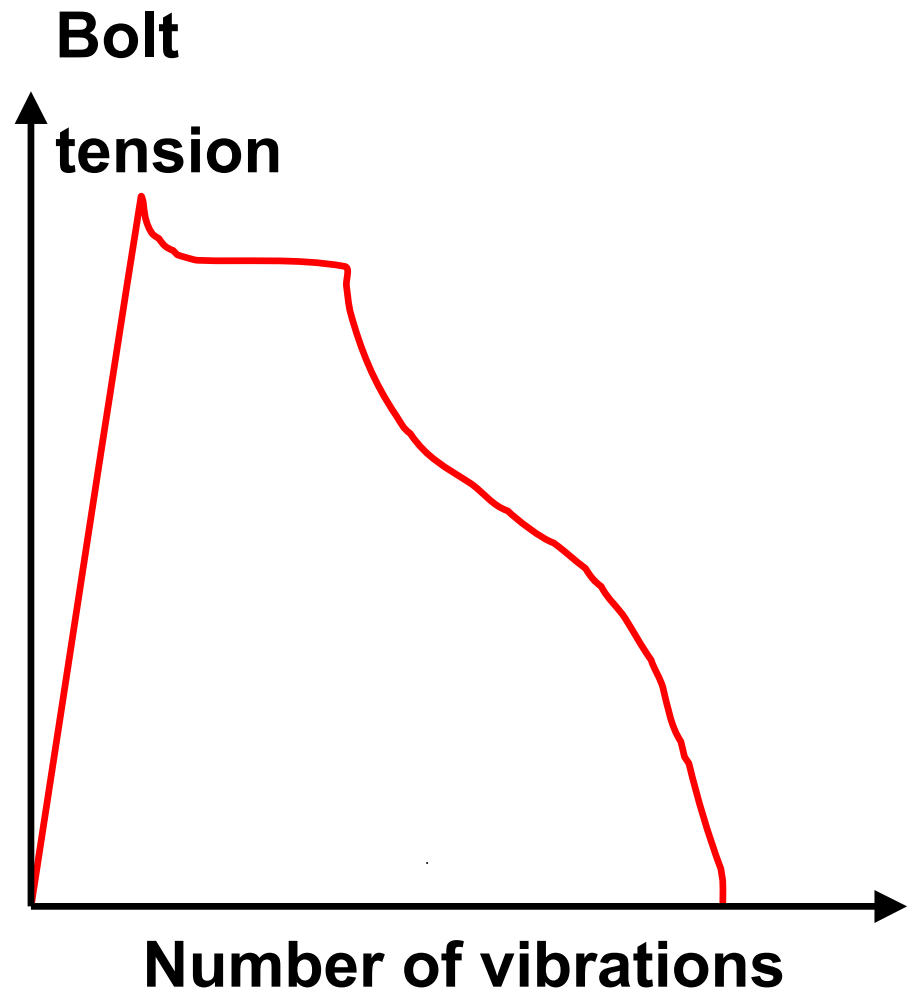
Spiralock Standard Thread (steel)



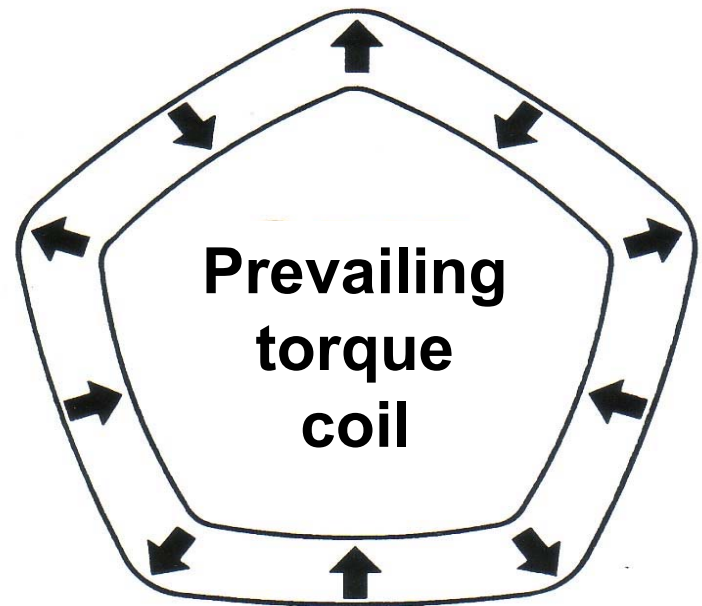
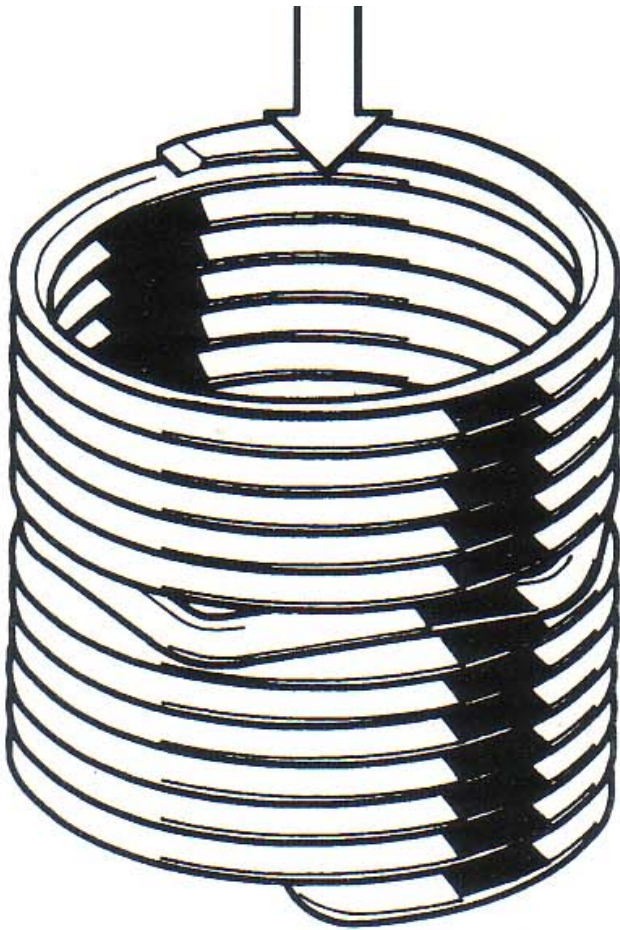
Spiralock standard thread (light alloy)



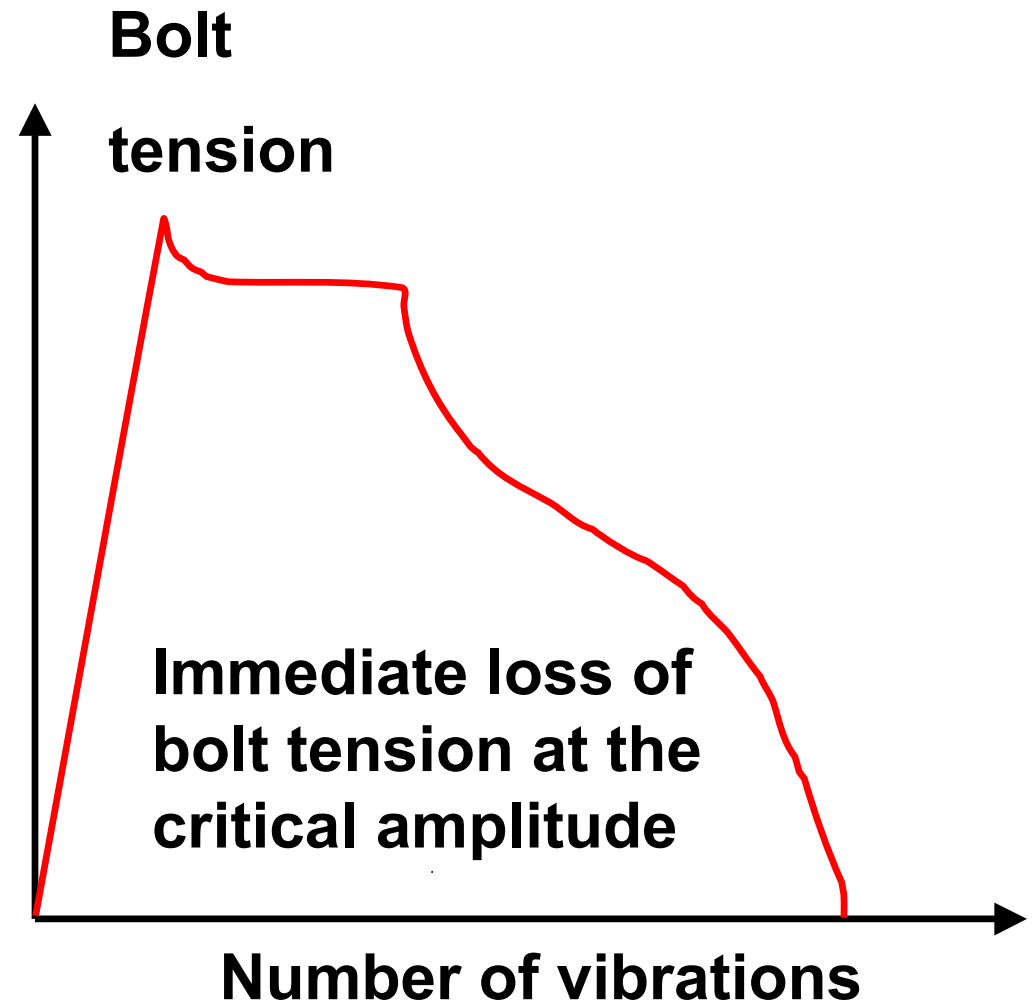
Standard insert (non-locking)



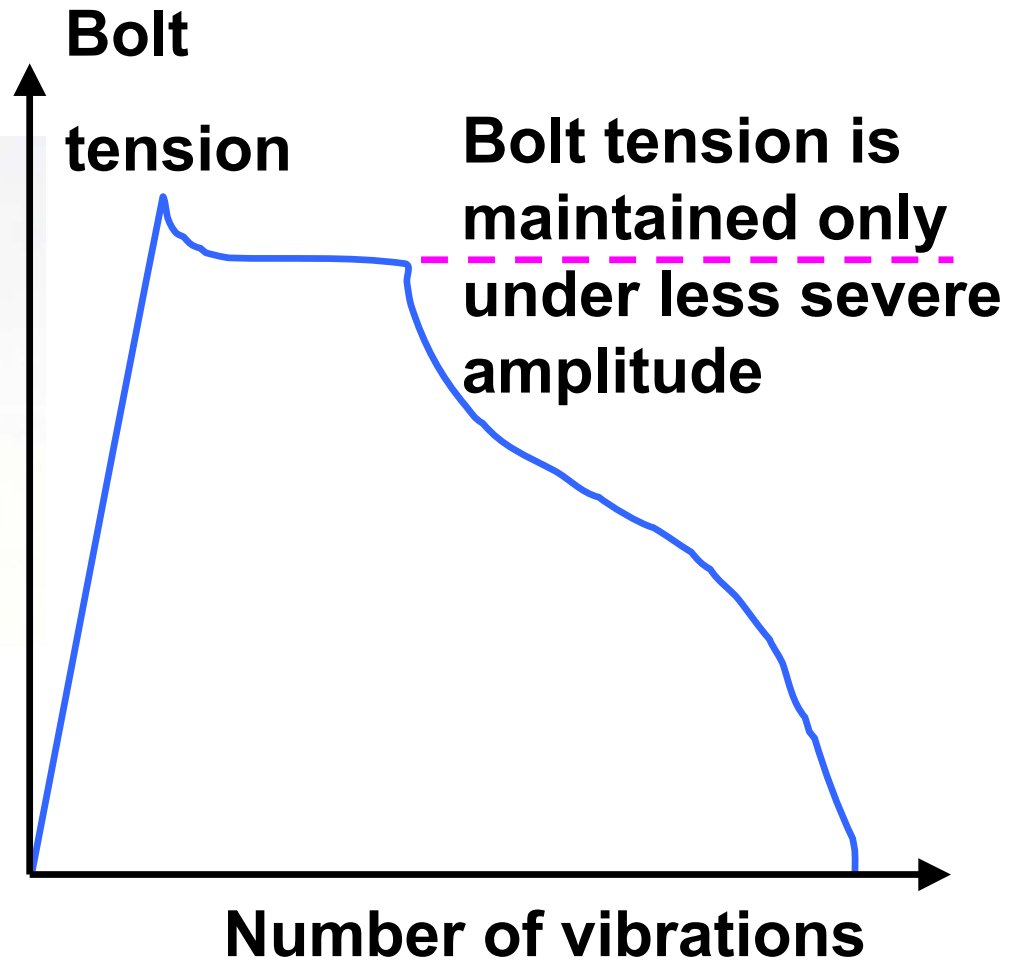
Prevailing torque insert



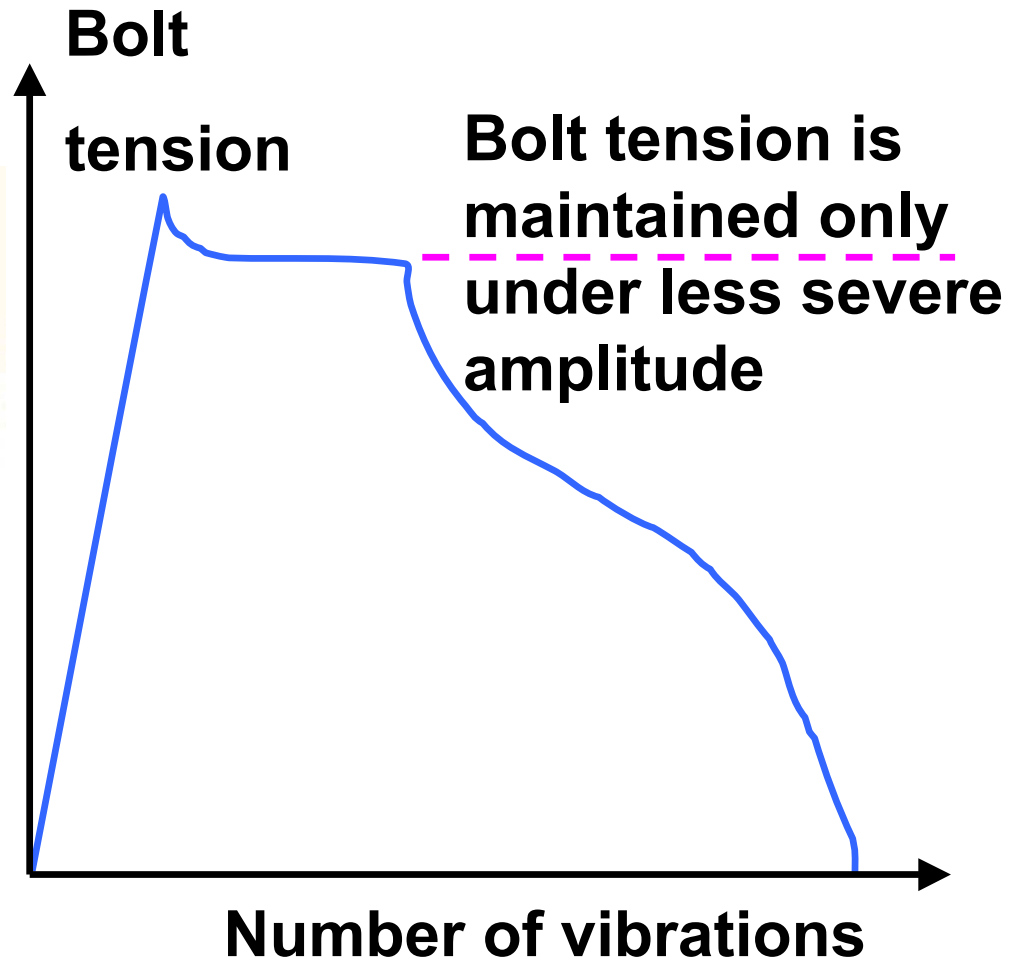
Prevailing torque insert



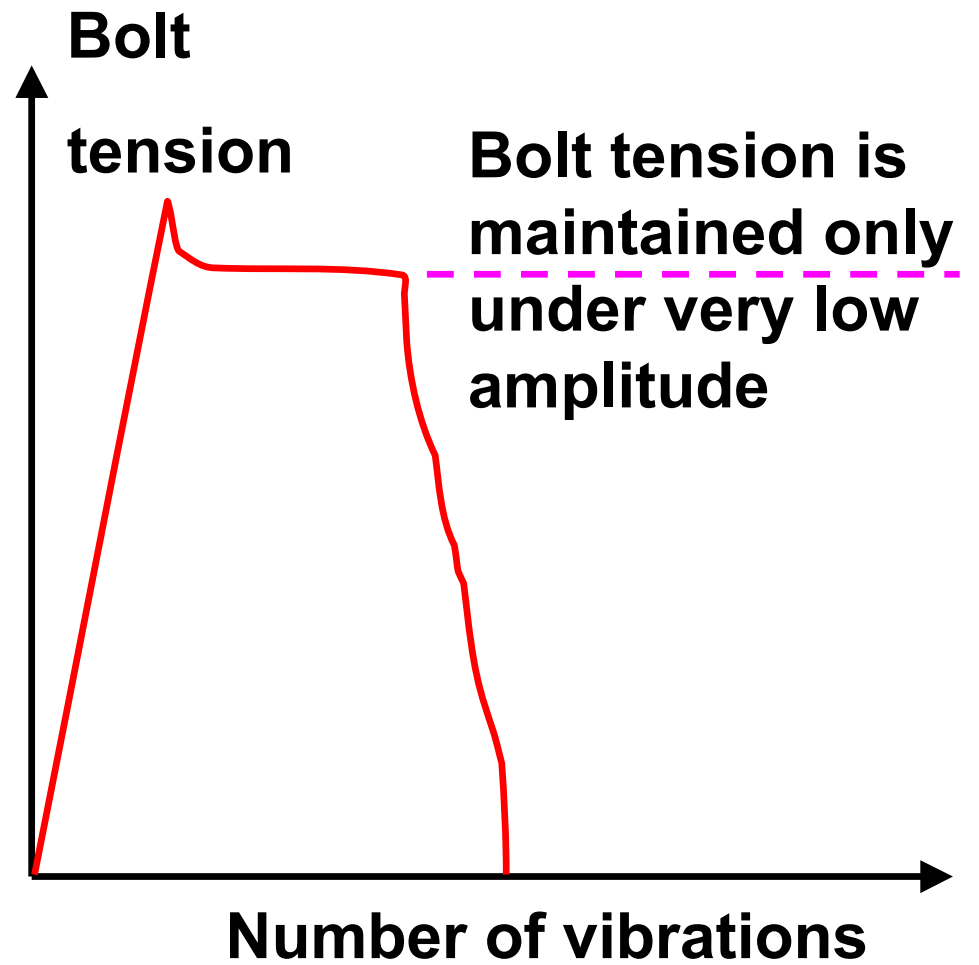
Cross spring washer (BS 2 SP.47)



Cross Grover washer

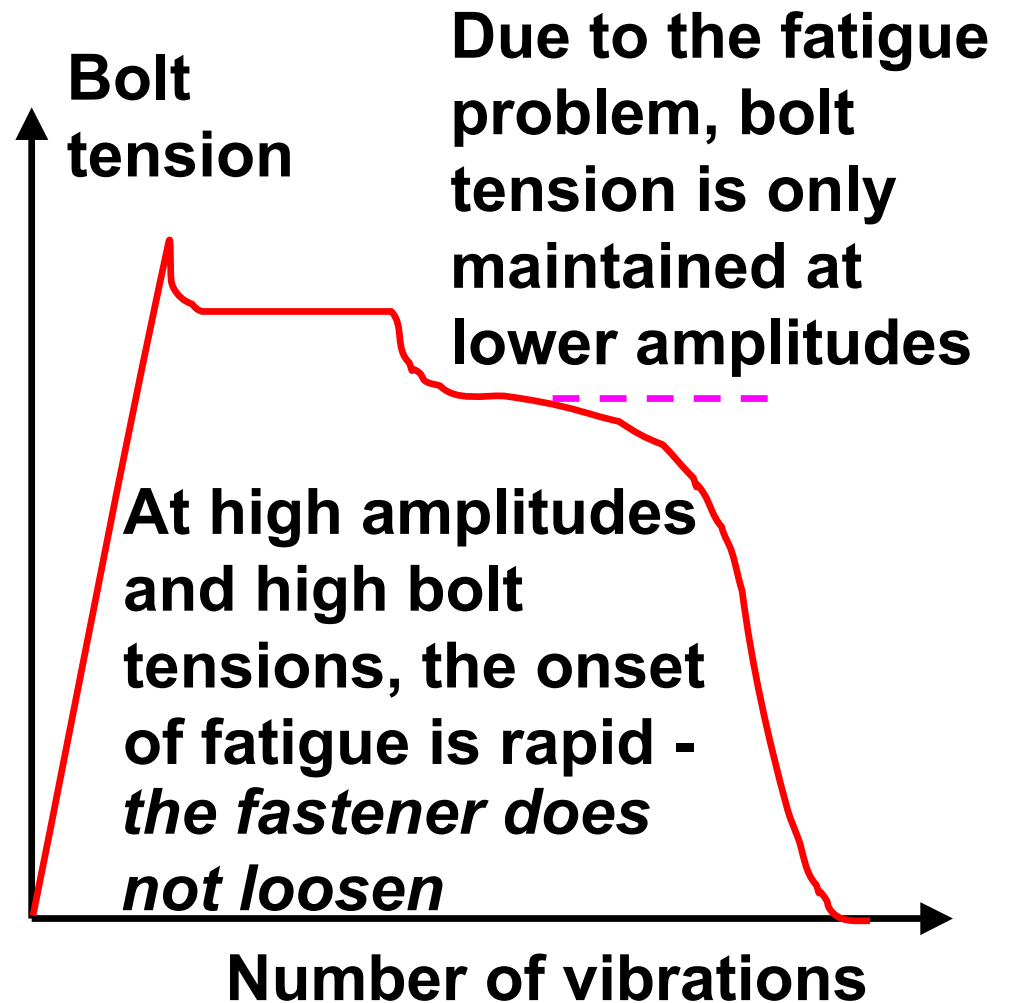


Commercial spring washer



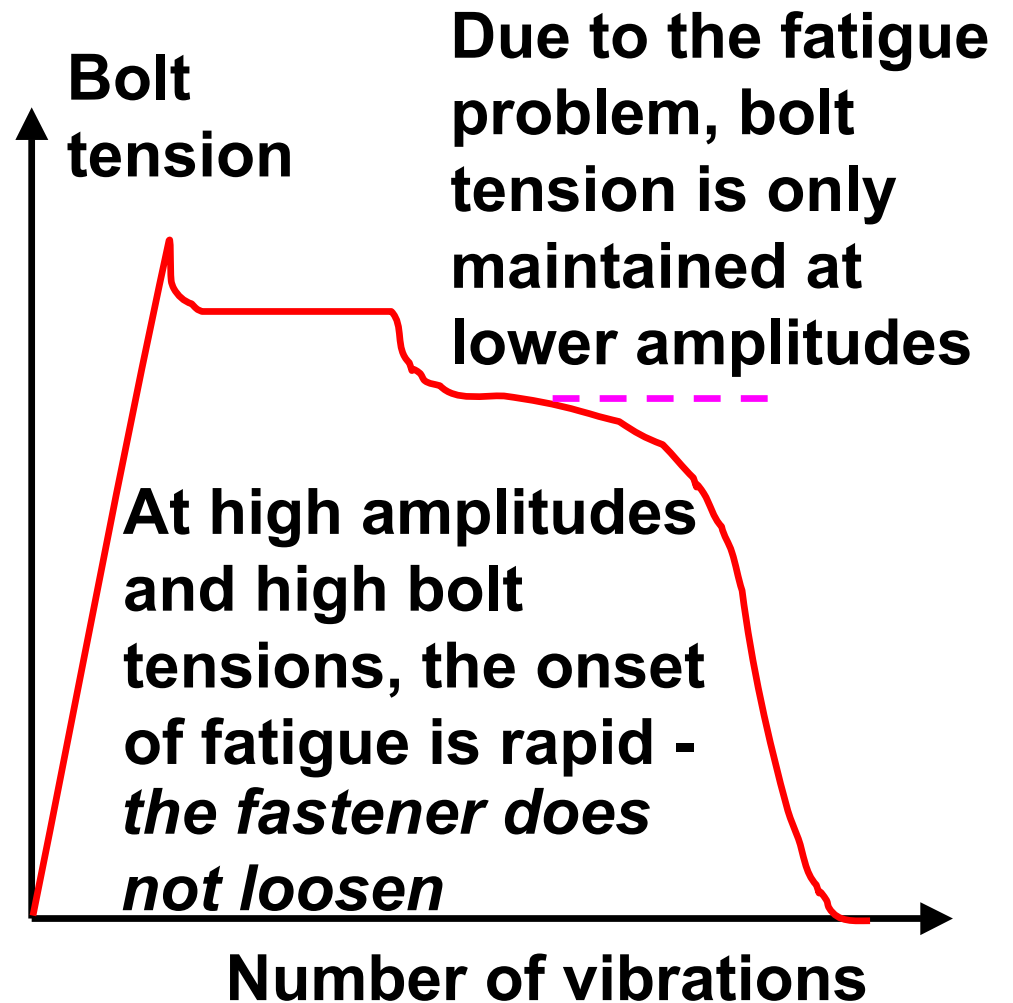
Loctite 270 (studlock)

The *studlock* version of this *threadlocker* produces a 'permanent' bond between fastener and nut

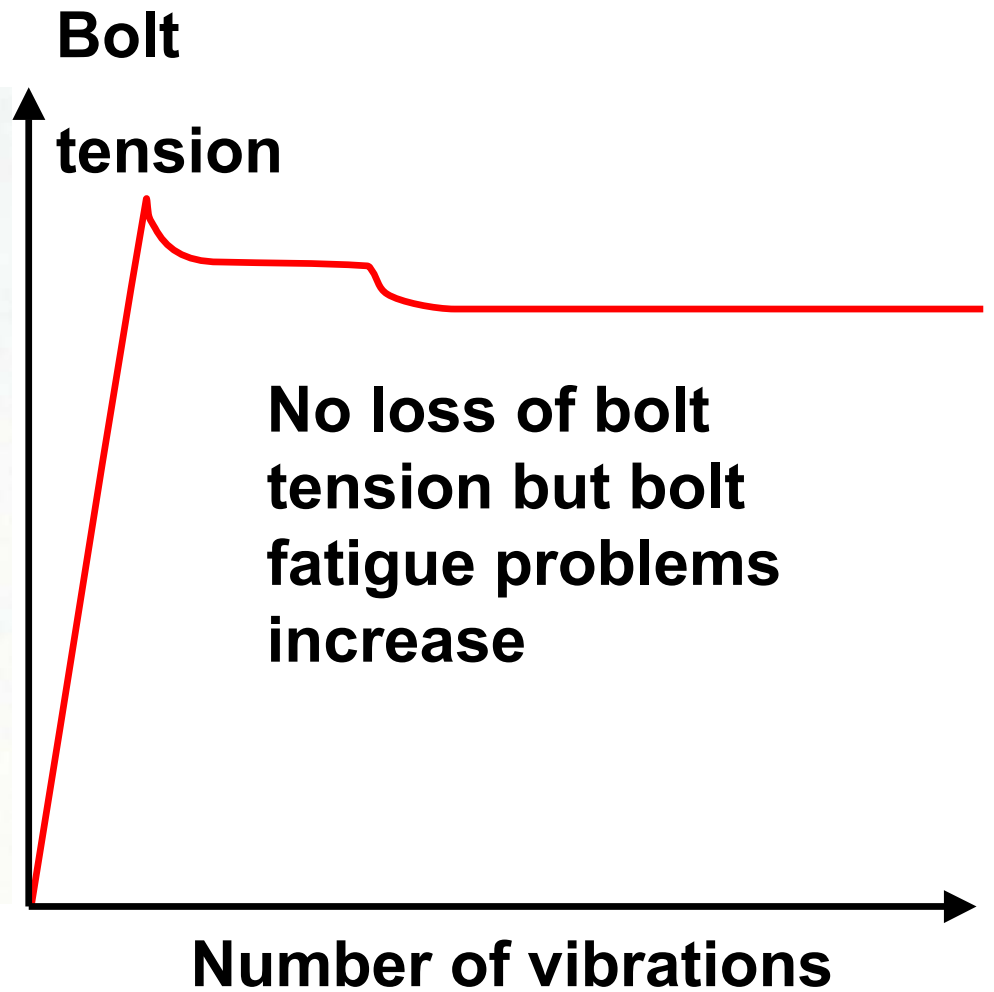


Loctite 268 (threadlock)

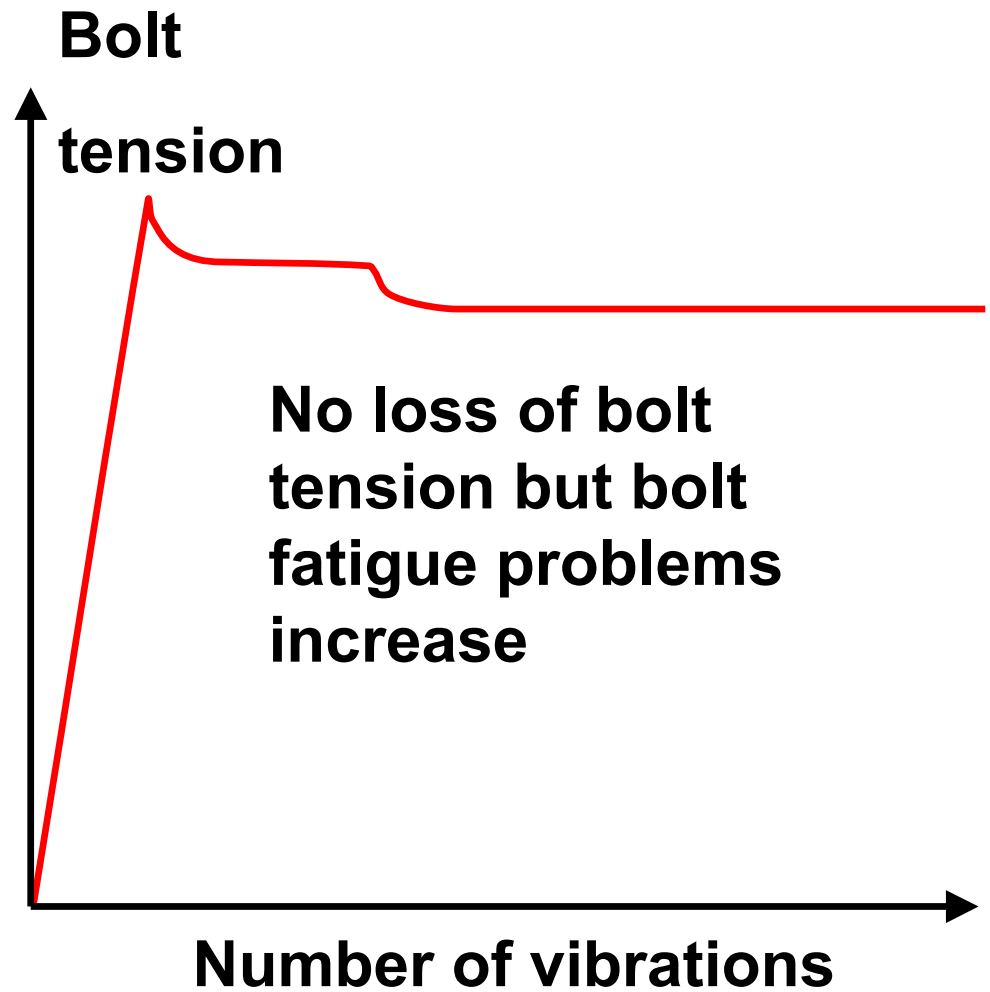
The '268' version of this *threadlocker* is in the form of a 'Pritt Stick' – a self-feeding stick applicator



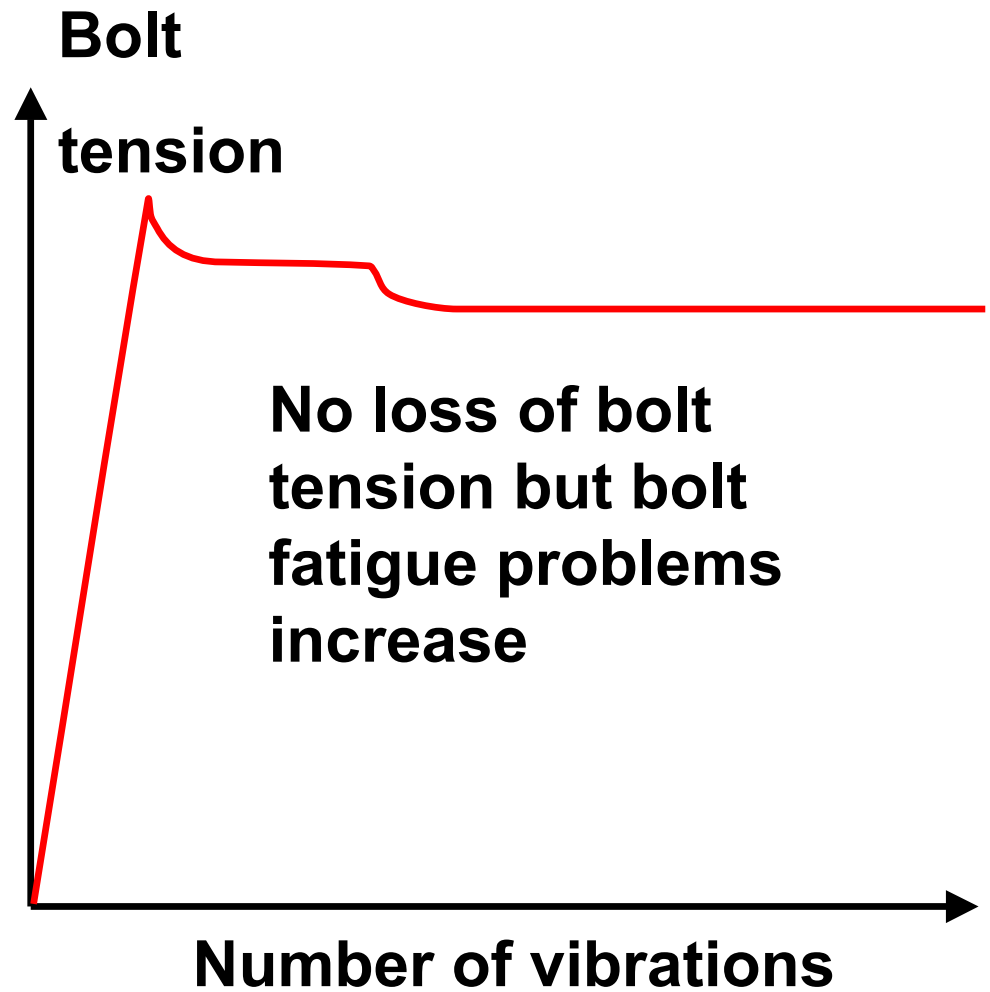
Schnorr Safety Washer



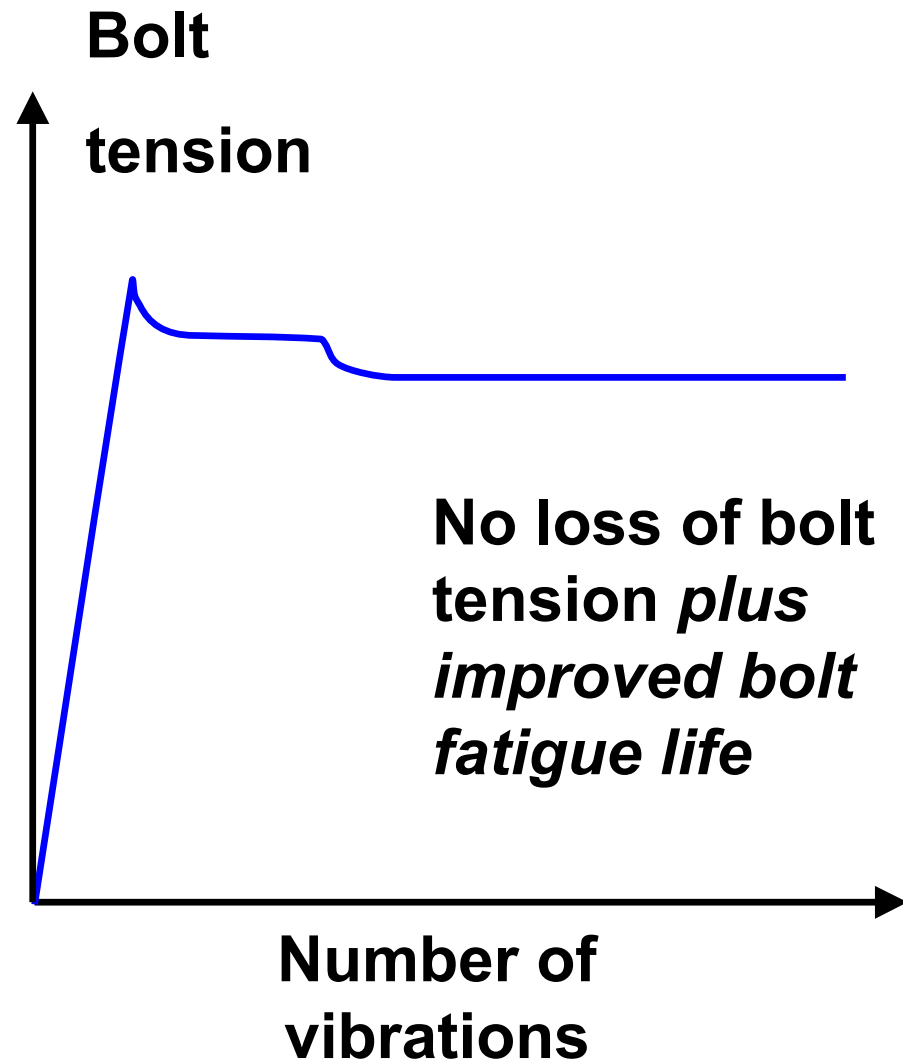
Nord-Lock



Thinwall insert



Cross Spirallock Wire Thread insert



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What we needed to find out:

- What's the ideal bolt tension?
- What happens if the tension is reduced?
- Is the length of the thread insert significant to its locking effect?
- Do “base” materials alter the locking effect?
- How many times can you “do and undo bolts” and still get the locking effect?
- How long do bolts stay locked?



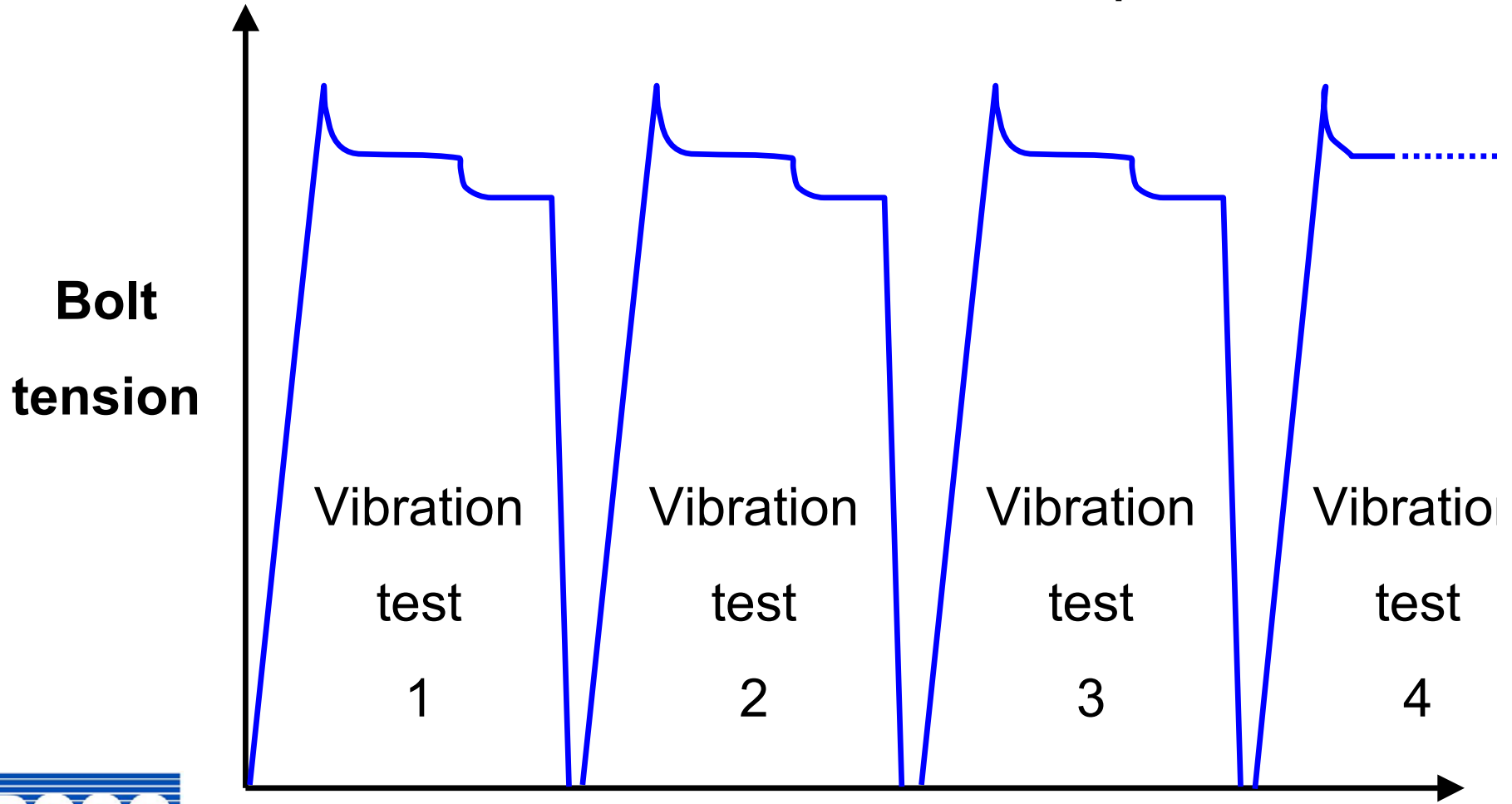
Insert re-use assessment

**Multiple repeating of vibration
test cycles**



Cross Spirallock Wire Thread insert

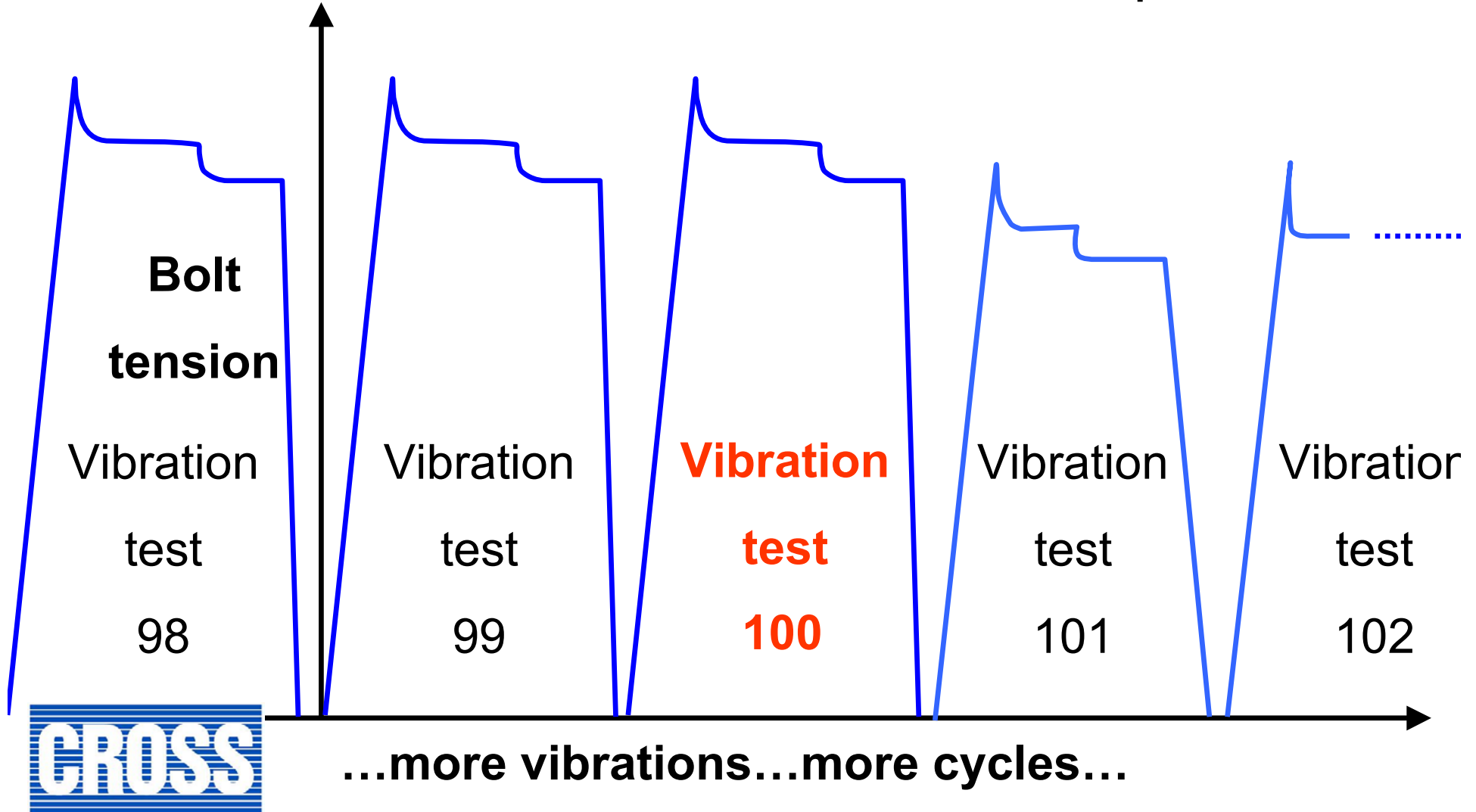
Repeat vibration tests – 75% $R_{p0.2}$



Number of vibrations...increasing number of cycles

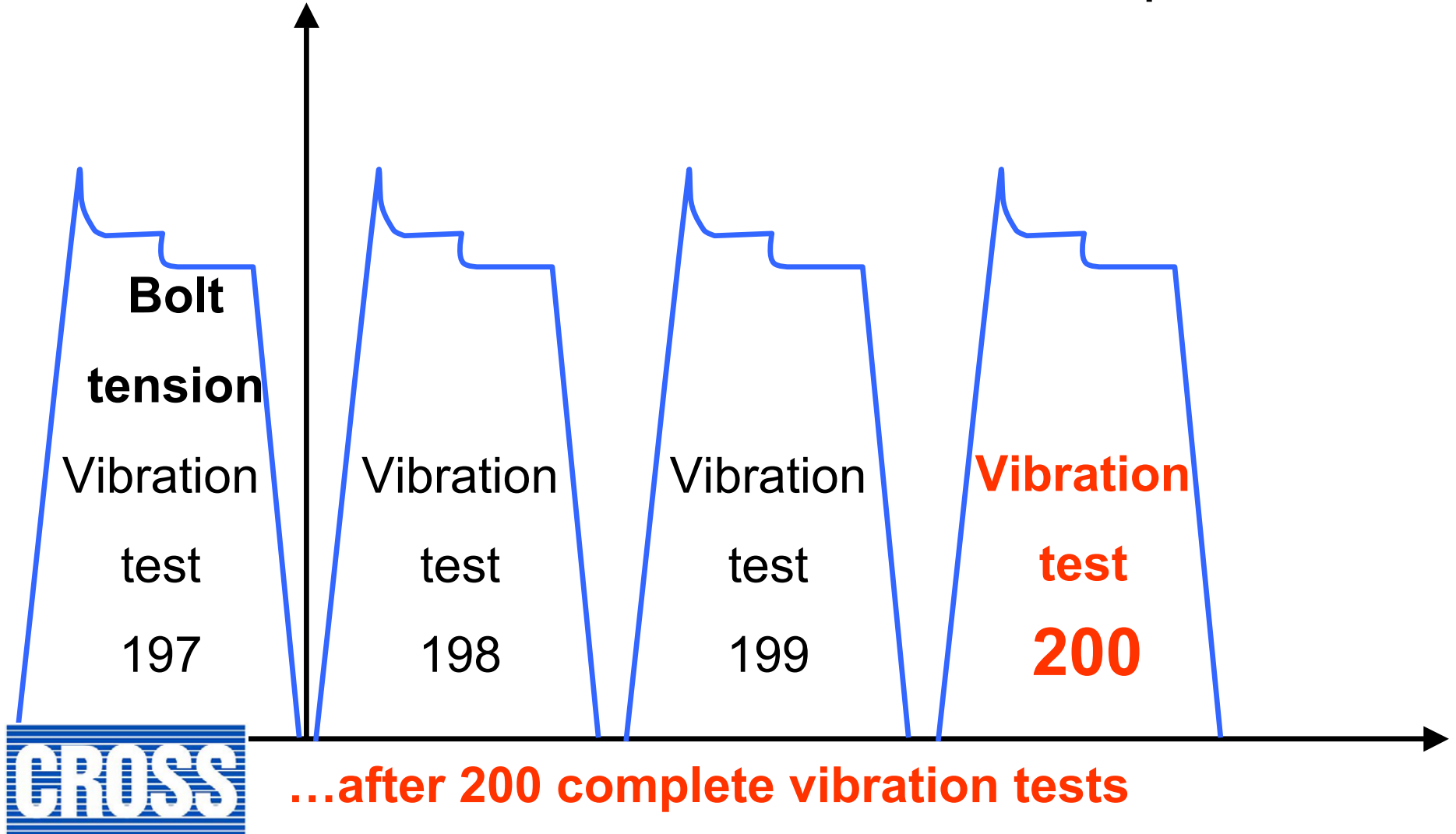
Cross Spirallock Wire Thread insert

Repeat vibration tests – 62.4% $R_{p0.2}$



Cross Spirallock Wire Thread insert

Repeat vibration tests – 62.4% $R_{p0.2}$



Extended vibration testing

Continuous testing of a Cross
Spiralock Wire Thread insert



Cross Spirallock Wire Thread insert

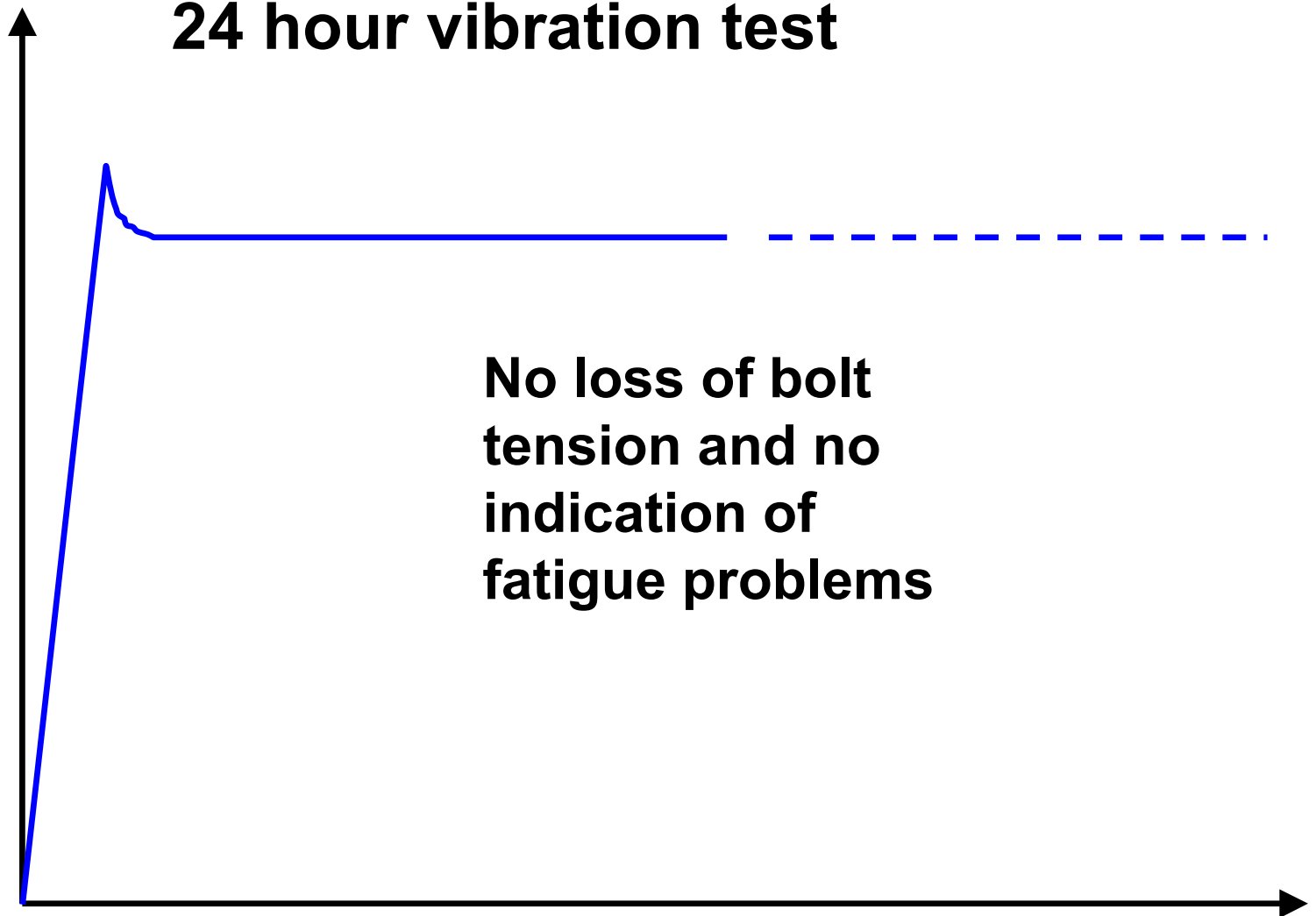
24 hour vibration test

Bolt
tension

No loss of bolt
tension and no
indication of
fatigue problems

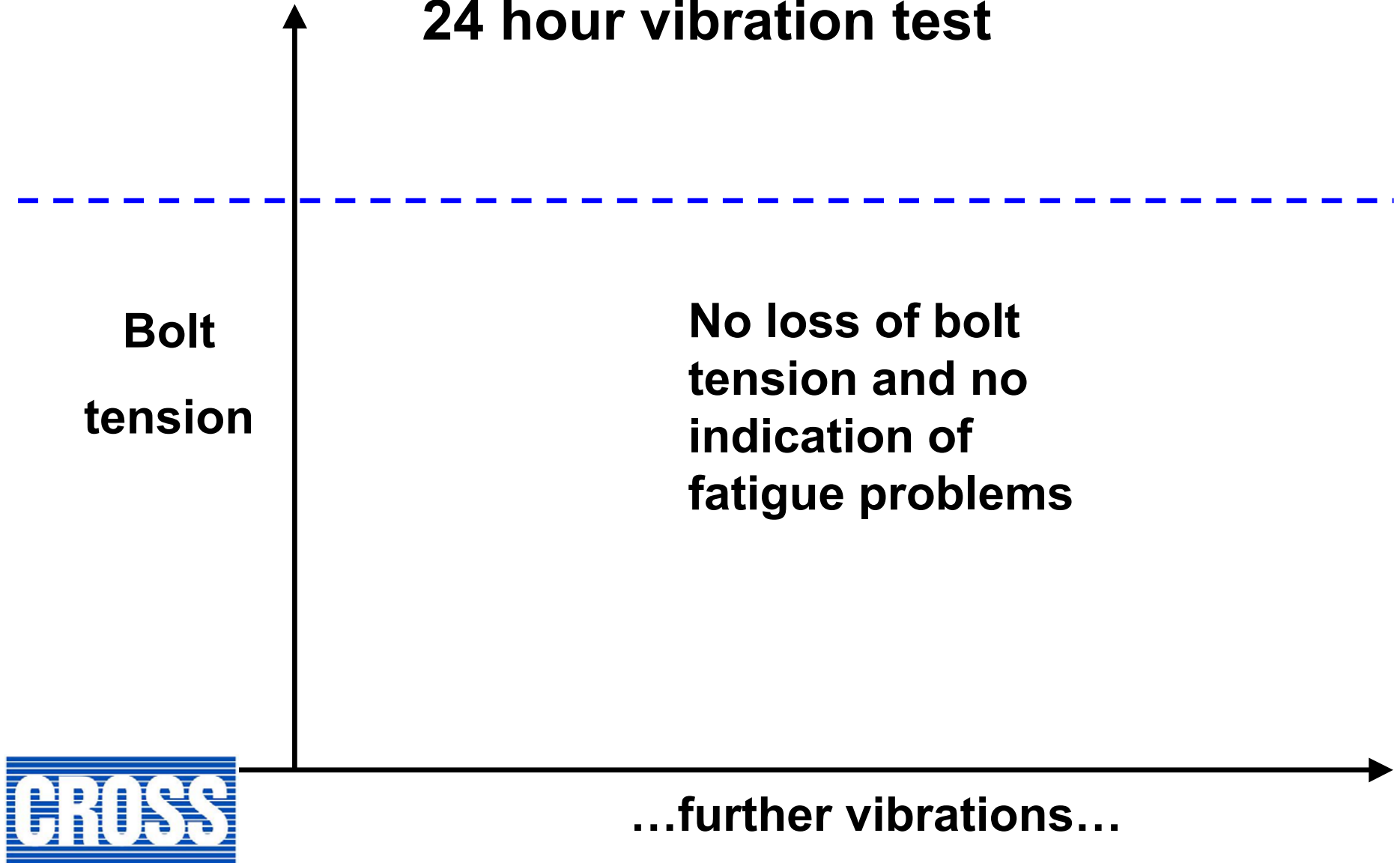


Number of vibrations



Cross Spirallock Wire Thread insert

24 hour vibration test



Cross Spirallock Wire Thread insert

24 hour vibration test

End of test

Bolt
tension

No loss of bolt
tension and no
indication of
fatigue problems

1 million cycles

Number of vibrations

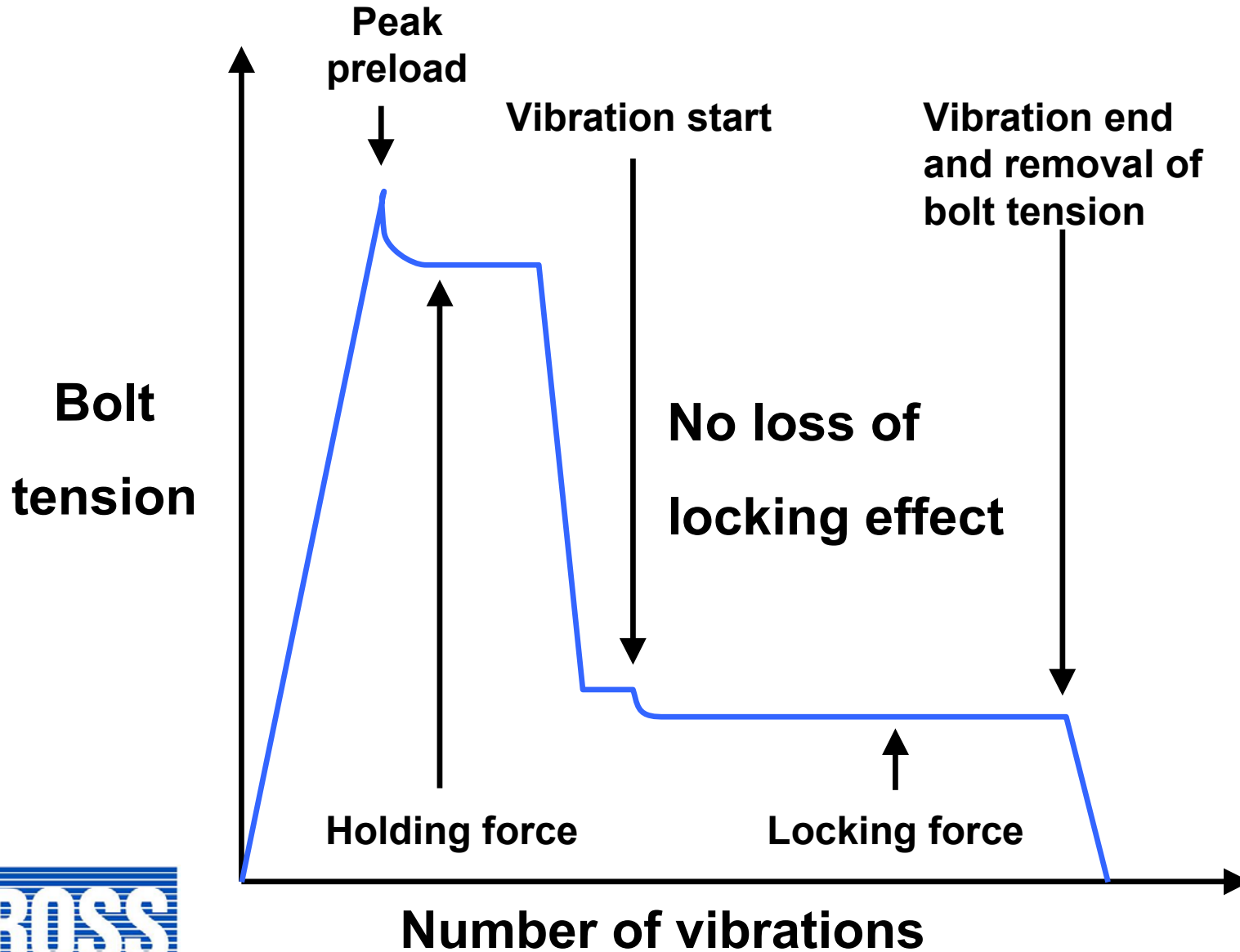


What have we found out about the locking effect of the Cross Spirallock Thread Insert?

- Base materials
- Length of insert
- Finish of bolt
- Lubricant
- Long term
- Undoing & doing up
- Straight line relationships
- Bolt tension reduction



The vibration test – reduced bolt tension





**Ralph
Flower**

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...better than we thought it would be...



Cross Manufacturing Co (1938) Ltd

Midford Road

Combe Down

Bath

BA2 5RR

01225 837000

www.crossmanufacturing.com/spiralock

.....better than we thought it would be.....



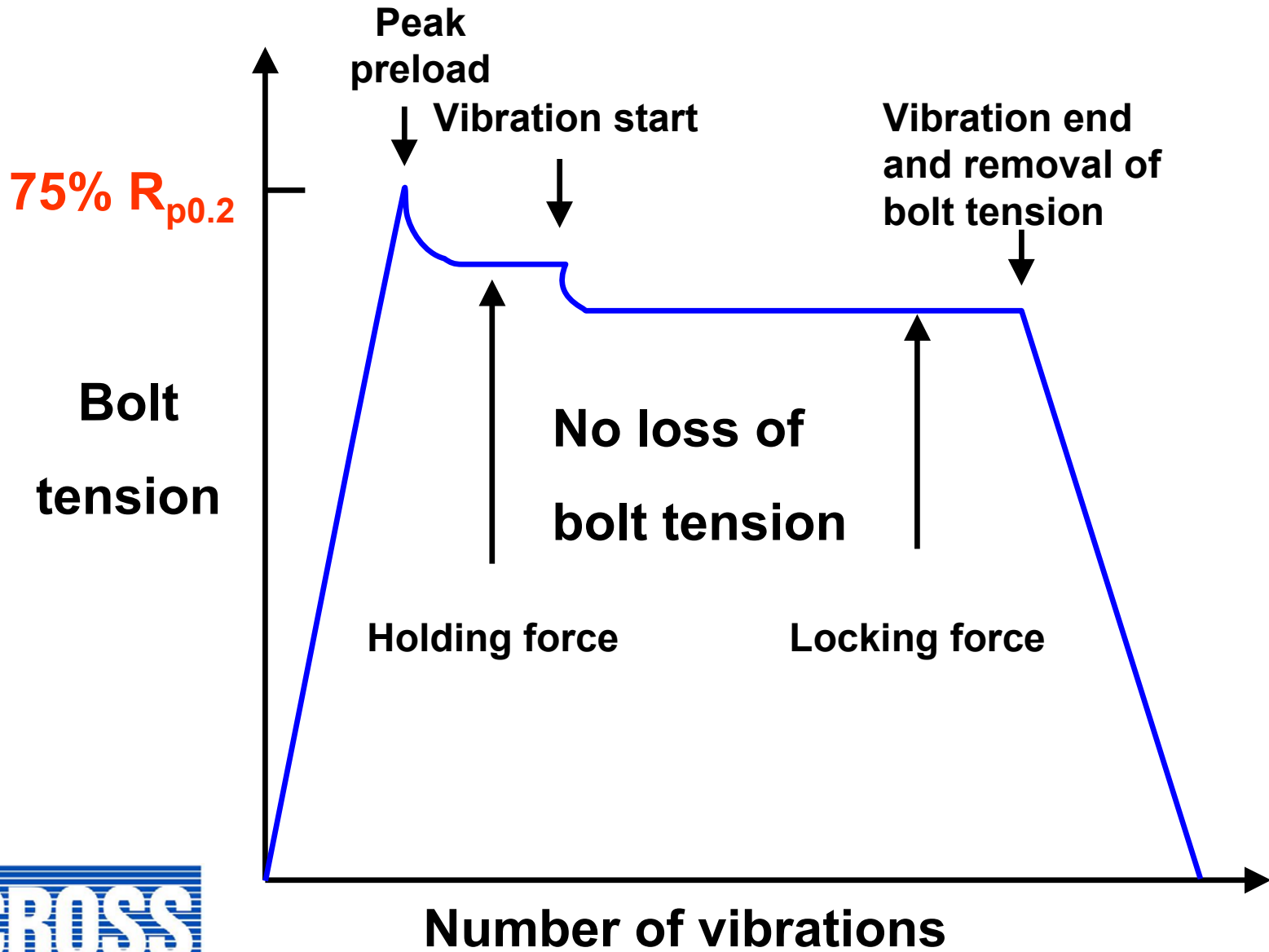
Torque / preload relationships

Torque resistance (T_r)

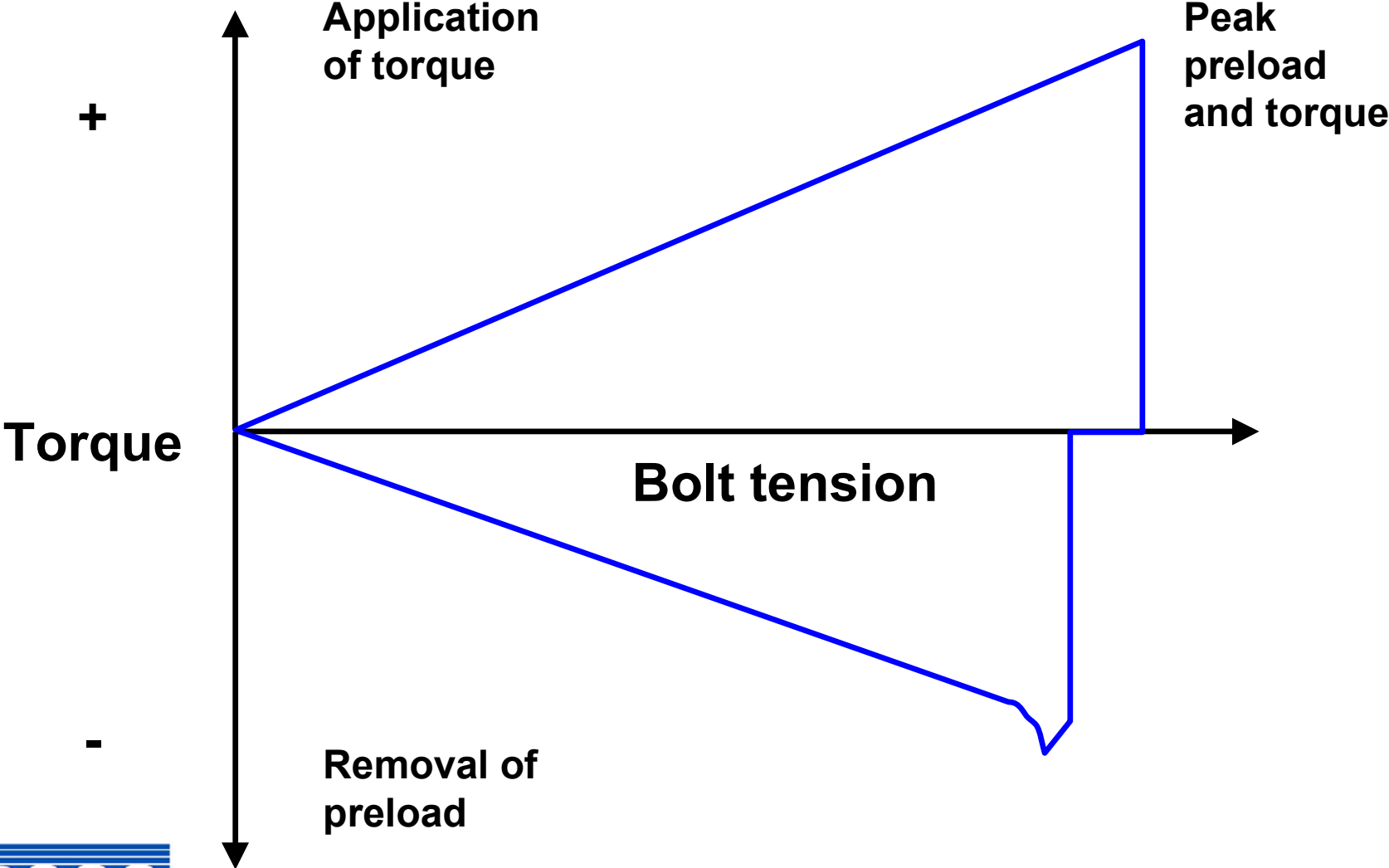
- Frictional effects – underhead, thread, etc.
- Torsional effects – eg the release of stored energy when vibration starts
- Embedding – interactions between fastener, insert, parent material, head and clamping material and washer, etc.



The vibration test



The vibration test – hysteresis curve



Torque resistance (T_r)

Application of a Universal Equation

$$T = PDT_r \text{ where}$$

T = torque

P = preload (bolt tension)

D = fastener nominal diameter

T_r = torque resistance



Constant bolt tension

CMC research has proved that this relationship is correct for...

Torque

All
fastener types,
finishes,
lubricant types



Torque resistance

Constant torque

CMC research has proved that this relationship is correct for...

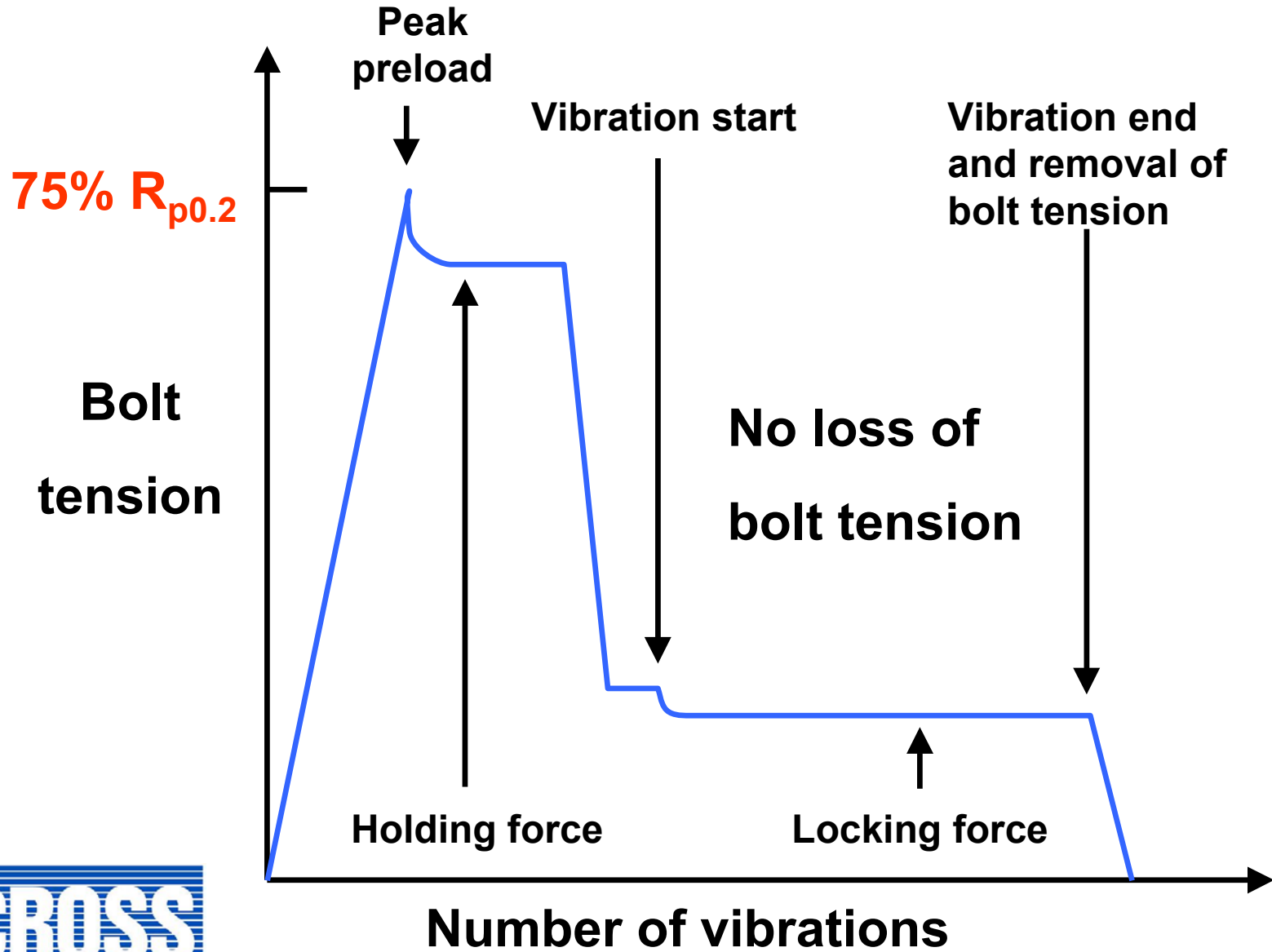
**Bolt
Tension**

All
fastener types,
finishes,
lubricant types

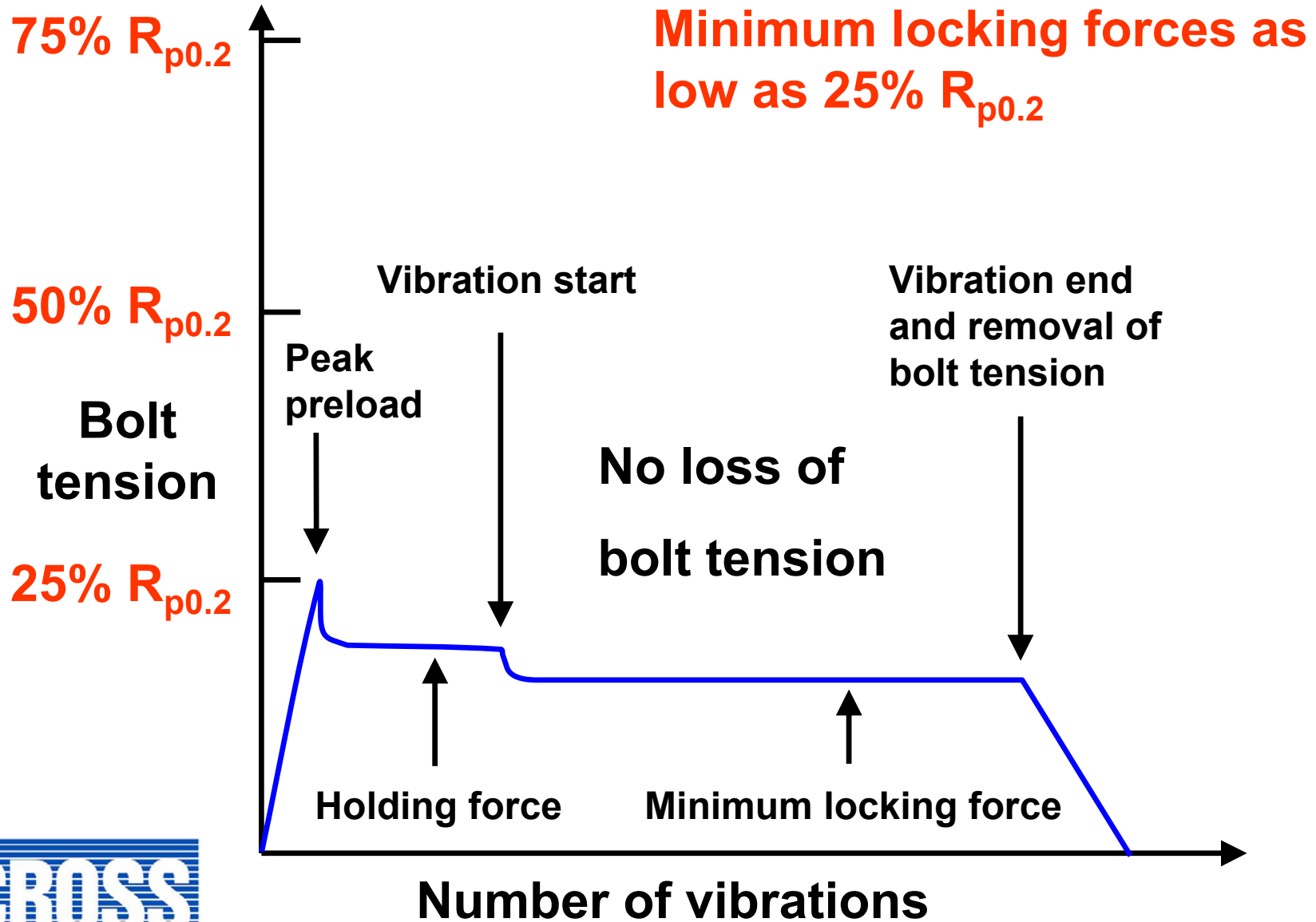
Reciprocal of torque resistance



The vibration test – reduced bolt tension



The vibration test – minimum locking force



The Blanchard Effect

- The ***minimum locking force*** is inversely proportional to the ***torque resistance***
- Fasteners having ***high values*** of ***torque resistance*** lock at ***lower bolt tensions*** than fasteners having ***a low torque resistance***





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