Litens automotive group

Mechanical Friction Tensioner Vs. Hydraulic Comparison

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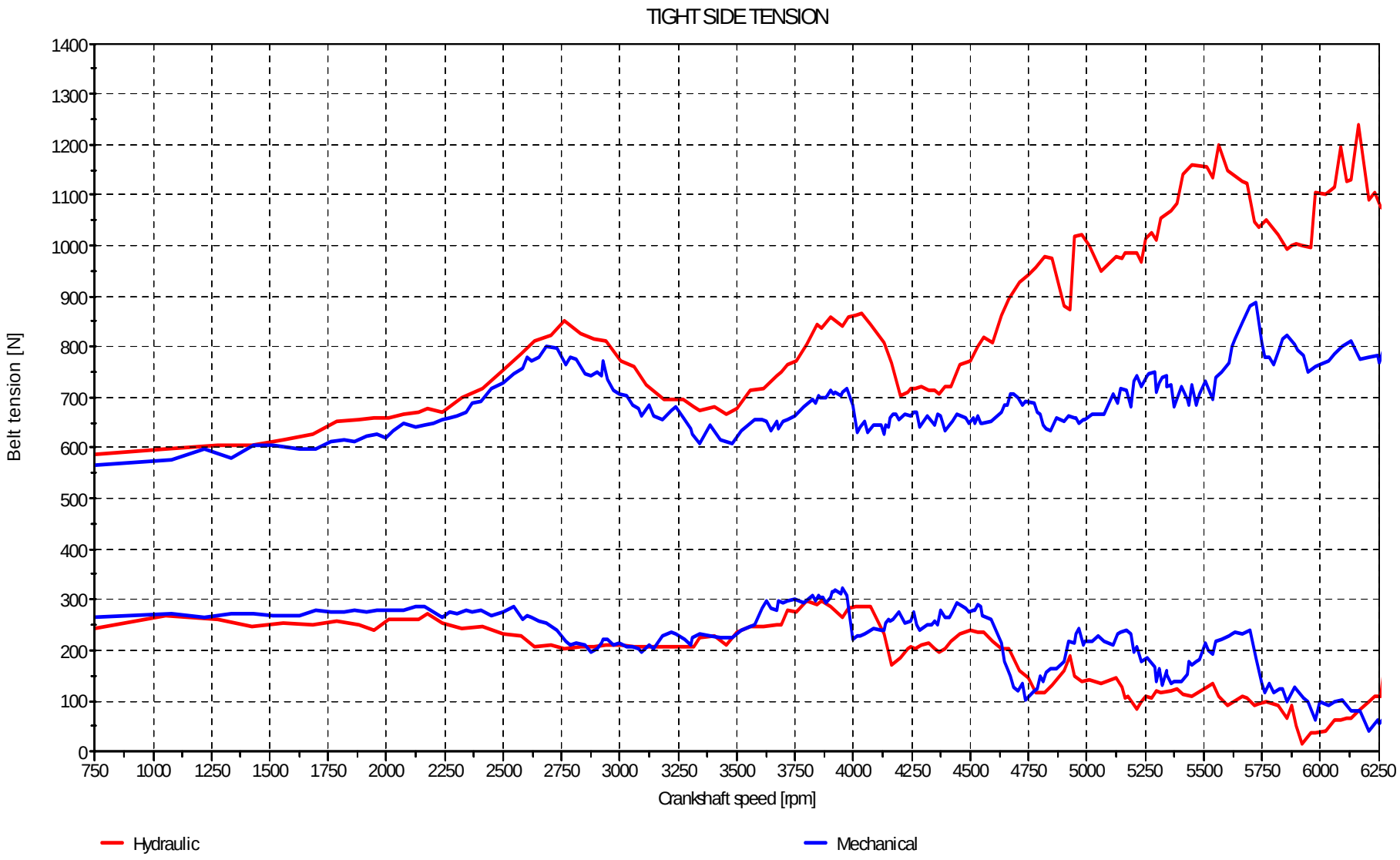
Frictional vs. Hydraulic: Why Differences in Behavior at Resonance

- Frictional tensioners respond differently than hydraulics due to:
  - Fluctuating belt loads at resonance
  - Belt flutter effects
- Hydraulic tensioners pump-up; Mechanical TBTs do not!

Frictional vs. Hydraulic:
Why Differences in Behavior at Resonance Fluctuating Belt Loads

- At resonance the relative difference in angular motion between the cam sprockets and the crank creates a corresponding stretching and relaxing of the belt joining the two.
- Frictional tensioners respond to this effect by providing the system with a degree of freedom that reduces the amount the belt is stretched (tensioner arm oscillation).
- Hydraulic tensioner's response to this effect is limited to one direction, inward (due to check valve), as a result peak dynamic tensions tend to increase accordingly.

Frictional vs Hydraulic: Dynamic Belt Tension



Frictional vs. Hydraulic:
Why different behavior at Resonance
Belt flutter effects

- Engines having long belt spans are prone to belt flutter both inside and outside of the system resonance:
  - flutter causes an apparent shortening of the belt which the frictional tensioner compensates for by changing position (winding up).
  - this apparent belt shortening has a cumulative effect coming from each span i.e. one span simultaneously with another which could change to just one etc.
- By "winding up", the system tension is kept closer to constant, i.e. tensioner spring rate is much less that belt spring rate.
- Hydraulic tensioners do the opposite and push into the belt creating a corresponding increase in tension.

Reasons for Frictional Timing Belt Tensioner

- Frictional Timing Belt Tensioner Provides:
  - stable tension control.
  - reduced dynamic tension when compared to hydraulic.
  - potentially increased belt and bearing lives.
  - similar torsional vibration control as hydraulic.
  - no changes to mount bolt position.