# Hub Load in Power Transmission Drives

Hub load is a physical necessity for power transmission. Hub load is created by belt tension. Belt tension, or the difference between the tight side and slack side is called the effective tension (*Te).* Effective tension is what creates torque for belt drives and torque is required for power transmission. Hence, hub load is required for power transmission. This relationship is governed by the following equation:

$$hp = \frac{Torque \times rpm}{5252}$$

*hp* = Power in horsepower
*rpm* = Speed in revolution per minute
*Torque* = Torque in ft/lbf

For a given Power, Speed and pulley diameter, *Te* is fixed. This is true for all belt and chain drives. To examine the difference between power transmission types, look closer at the effective tension. *Te* is given by the following equation:

$$T_e = T_1 - T_2$$

$T_1$ = Tight side tension
$T_2$ = Slack side tension

Chain drives work quite well when the slack side tension ($T_2$) is zero. Too much slack in the chain can cause issues with span whip and tooth skip.

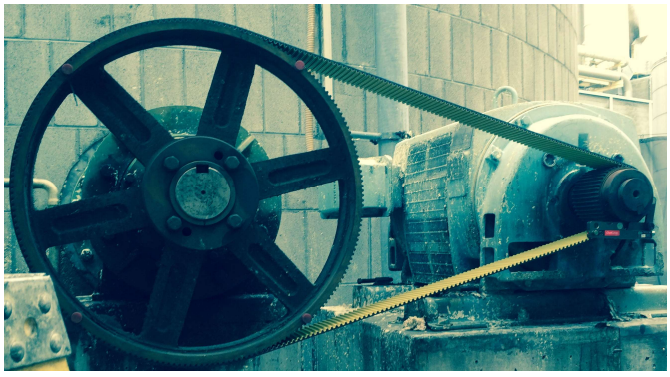
Synchronous belts work best with a small tension on the slack side. This increases the total value by about 15% compared to having $T_2$ equal to zero. Synchronous belts can be run at an under tensioned condition. This is could be done intentionally in order to reduce the hub load. However, belt life will be reduced without proper tension. Once $T_2$ reaches zero, the hub load will be the same as a chain drive given the same power, speed, and sprocket diameter.

V-Belts rely on friction to prevent slip. They require a higher $T_2$ value for proper operation and increased hub load. Around 50% higher compared to chain drives or synchronous drives.

Once a chain or synchronous drive is operating with $T_2$ equal to zero, no additional reduction in hub load is possible without reducing *Te,* which will reduce the power transmitted.

If hub load is a concern, chain and synchronous drives are better than v-belt drives. Regardless of the drive type, the hub load can be reduced by increasing the sprocket diameters. From the equation above, *Te* is inversely proportional to sprocket size. Power and speed are often fixed properties of the drive.

In summary, to reduce hub loads; choose Synchronous products over v-belts and keep sprocket diameters as large as possible while keeping the drive width as narrow as possible.



Narrowing the belt drive width will move the hub load closer to the bearing. Moving the pulley as close to the bearing as possible will reduce hub loads on both bearings. Hub load reduction will improve bearing life and is significant in saving downtime and replacement costs.