GRAB THE POWER™

White Paper: Notched and Synchronous Belts vs. Fabric-wrapped Belts

Summary

Rubber-impregnated, fabric-wrapped V-belts (*Fig. 1*, below) are the workhorse of industry. They have a rugged, multi-purpose design that transmits high power and works well in the presence of dust and other contamination.

Figure 1 Sidewall of a fabric-wrapped V-belt

Fabric-wrapped V-belts running in sheaves coated with Vulcan Grip® make for a potent combination that gives users previously unheard of advantages.

There are however, alternative belt constructions to consider; namely, *notched belts* and *synchronous belts*. These can offer greater performance but at the expense of certain tradeoffs.

This white paper examines the different constructions and the application for which they are best suited.

Notched V-belts

The sidewalls of “raw-edged” or “machined-edge” belts (see *Fig. 2*) are a necessary consequence of the molding process required to manufacture notched belts. Notched belts are a distinct construction from fabric-wrapped belts, which are extruded.

Figure 2 The sidewall of used notched V-belt

At low belt speeds, a notched belt has almost no performance advantage over fabric-wrapped belts. At the highest speeds however, notched belts undergo less internal flexural heating so users can get roughly half-again more horsepower versus fabric-wrapped V-belts. Notched belts can also function with smaller sheaves so designers can obtain greater step-up / step-down ratios in a single stage than with fabric-wrapped belts.

The tradeoff with raw-edged belts is they do not handle dust nearly as well as fabric-wrapped belts; it’s about as easy trying to get a raw-edged belt to grip a sheave in a very dusty environment as it is to get a Post-it® Note to stick to a rusty piece of steel.

Fabric-wrapped belts (*Fig. 1* at left) are ideal for dusty environments like saw mills and agriculture—and even then, sheaves without Vulcan Grip operating in heavily contaminated environments can require as much as a 1.8 service factor to function properly. Raw-edged belts simply fall on their face in such conditions.

Synchronous belts

Because they have molded teeth, synchronous belts (*Fig. 3*, below) also must necessarily have raw-edged construction. The promise (siren song) of synchronous belts is they have double the power ratings of regular fabric-wrapped V-belts for any given width of sheave or sprocket.

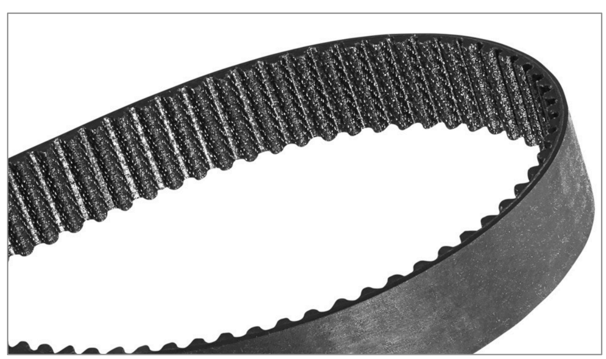

Figure 3 A synchronous belt

However, synchronous belts are exceedingly fussy and unforgiving of anything off-specification. Synchronous belts are suitable for tight-tolerance, sophisticated equipment with either soft-start motors or low downstream inertia in applications where the equipment will be serviced by experienced plant-maintenance personnel equipped with the proper tools. Synchronous belts are exceedingly intolerant of excessive startup and shock loads because, rather than momentarily slipping like a V-belt, they jump one or more teeth (cogging) on the sprocket (*Fig. 4*, below), which is very damaging.

Figure 4 A sprocket (not "sheave") for a synchronous belt

Particularly suitable applications for synchronous belts are those where machine-component timing (synchronicity) is the objective rather than trying to solely exploit the synchronous belt's higher power capabilities. Because of their low mass (in comparison to metal chains), synchronous belts shine in timing-critical, high-speed equipment. Imagine a hopper being filled with an 50-pound load of dog food and quickly accelerating (by a computer-controlled servomotor) over six feet as it synchronizes its motion with a moving empty bag, dumps its contents, and accelerates back to its starting point.

Synchronous belts are *not* for loose-tolerance equipment operating in dirty industrial or agricultural environments… being worked on by field employees… on the tailgate of their truck… in the cold… with neither belt alignment nor tensioning tools. Yet it is not uncommon to see synchronous belts shoe-horned into precisely such situations by OEMs desperate for a solution to a particularly high-contamination, high-slip, high-wear, application.

It's worth noting that synchronous belts and sprockets are relatively expensive, so if they are used in dirty, high-torque applications, it is not hard to find end users very frustrated from repeatedly replacing costly belts and sprockets.

The worst application for synchronous belts is where they are subject to operator-dependent power loading. This is where *employee productivity*—whether it be cutting through a block of cement or cutting a swath in a wheat field—*is controllable with a throttle or material feed rate*. Allowing equipment operators control over *power demand* is a prescription for cogging and wearing out synchronous belts.

Furthermore, applications where the equipment operator determines power demand also tend to subject belts to shock loading, which is a stress V-belts withstand quite well but is one at which synchronous belts perform abysmally.