

# FIRST Robotics Competition®



## Applications Using Gates Rubber Synchronous Belt Drives

### Welcome from Gates Corporation

Gates Corporation is excited to be an Official Sponsor of the *FIRST* Robotics Competition®!

### Belt Benefits

Gates 5M PowerGrip® HTD® belts are ideally sized for drives and functional applications on a *FIRST* Robotics Competition® robot.

- **Lightweight** – much lighter than chain and gearing systems for comparable loads
- **Useful** – PowerGrip HTD rubber belt drive systems are ideal not only for drives, but also for linear motion, lifts, game object conveying, positioning, and even for precisely flinging objects
- **Easy to Work With** – aluminum sprockets are easy to machine and belting can be wrapped, cemented, or riveted to the structure
- **Oil-Free** – these drives remain clean because oil is not needed and present a complete image of current technology
- **Quiet** – reduced noise as compared with other drive technologies such as chain and gears

### Additional Information

If you require more assistance please go online to [www.gates.com/FIRST](http://www.gates.com/FIRST) to watch helpful videos, use online calculators, and download additional resources.

### Part Information

Your belt drive chassis kit includes:

- Six Gates PowerGrip HTD belts
  - Four 520-5M-15 belts
  - Two 800-5M-15 belts
- Two aluminum sprockets
  - 39 grooves, 1/2" bore with key, double wide
- Eight AndyMark plastic sprockets
  - 42 grooves

See Appendix B for part nomenclature.

### Where to Get More

For details on getting additional or different Gates parts, please reference the *FIRST* Robotics Competition® "Where to Get More" document or visit [www.gates.com/first](http://www.gates.com/first).

Best of luck in your *FIRST* Robotics Competition®!

## Appendix A: Belt Drive Application Tips

Best advice – One test is worth 1,000 calculations.

**Handling the Belts** – Do not bend belts smaller than the diameter of the 15 groove sprocket. A single tight bend or crimp will break the belt's fiberglass tensile member and cause loss of strength and potential premature failure of the belt.



Do not pry belts onto or off sprockets. To correctly install or remove belts, create slack by adjusting center distance or moving belt tensioner. Do not roll belts onto or off sprockets either.



**Sprocket Flanges** – Provide flanges on either both sides of one sprocket or one side on the driver and the opposite side on the driven sprocket. All belts naturally migrate to one side of the sprocket. You must use flanges as described.



**Belt Tensioning** – Tension the belt so that when the drive is under full anticipated load (including shock loads) the belt does not get slack on one side, or the belt teeth try to climb out of the sprocket grooves. Make sure the mounting structure does not deflect when either tensioning the belt or under operating conditions. If you lose tension, the belt will jump teeth. Keep belt shafts parallel and sprockets in line with each other. Apply as much tension to the belt as possible without damaging any equipment.



**Belt Alignment – Sprockets must be aligned and shafts parallel in both planes. Alignment can easily be checked using a straight edge.**



**Belt Wrap – Keep a minimum of 6 belt teeth fully in mesh on the circumference of each sprocket. This will allow a properly tensioned belt to perform at 100% of its load rating. A backside idler can be useful for both tensioning the drive and increasing the belt wrap around the sprocket. The idler is used on the slack side of a belt drive and must be 1.25" in diameter for 5mm pitch PowerGrip HTD belts.**



**Guarding & Debris Protection – A piece of flat plastic supported in between the belt spans is a simple way to eliminate pinch points and keep debris out of the drive.**



**Product Ratings – Load capacity of the belts is proportional to their width. Gates belt ratings are set to guarantee long life on industrial applications. For *FIRST Robotics Competition*® applications, your load capability is going to be determined by the shaft-to-sprocket connections, belt wrap, and the ability to pre-tension the drive so that the belt does not jump teeth. With adequate belt wrap and proper installation tension, you will be surprised by the durability of this product!**

**Splicing Belts – Belts or belting should not be field connected or spliced together by any means other than connecting the belts with clamp plates. You need to use the correct pitch length belt.**

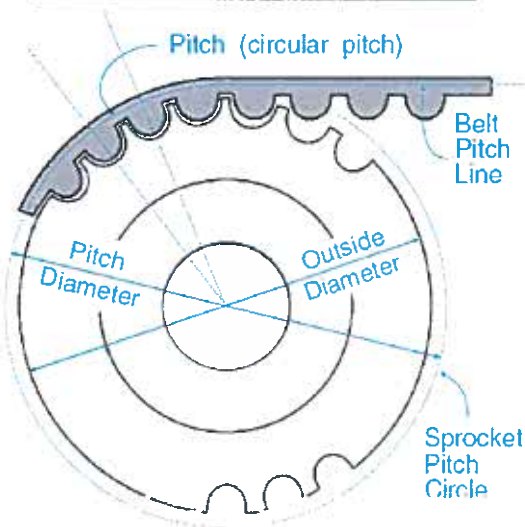
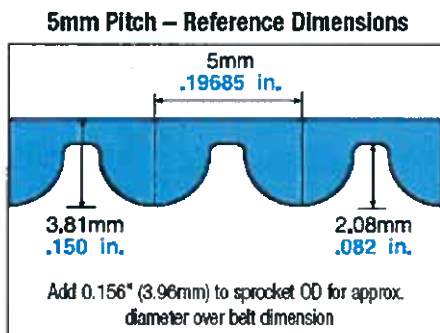
## Appendix B: Component Specifications

Components are categorized by “pitch”, which is the distance from the center of one tooth to the center of the next tooth on a belt.

Gates belts are identified by length, pitch, and width. Example: the 520-5M-15 is a belt with a 520 mm length, 5 mm pitch, and 15 mm width.

Gates sprockets are identified by tooth count, pitch, width, and material. Example: P16-5M-15AL is a 16 tooth sprocket, 5 mm pitch, 15 mm width and made of aluminum.

NOTE: 25mm wide sprockets are not available as a stock part through Gates.



## Belt & Sprocket Compatibility

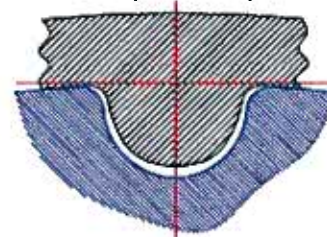
It's possible that some teams have received Gates PowerGrip® GT<sup>2</sup> belts and sprockets in the past, which should not be confused with PowerGrip HTD components (GT2 and HTD describe two different tooth profiles or shapes).

Gates recommends only using belt types with their corresponding sprocket types. PowerGrip GT2 belts can be used in PowerGrip HTD sprockets, **but it's not recommended.**

### **DO NOT USE POWERGRIP HTD BELTS IN POWERGRIP GT2 SPROCKETS.**

The figures below illustrate the tooth meshing characteristics of the two belt/sprocket combinations.

#### **5M PowerGrip GT2 Belt in PowerGrip HTD Sprocket**



#### **Not Recommended**

- Reduced performance
- The sprocket/bushing capacity may be too low for new designs

#### **5M PowerGrip HTD Belt in PowerGrip GT2 Sprocket**



#### **No Compatibility**

- The belt tooth is too large to fully seat in the sprocket groove