Welcome from Gates Corporation!

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

Gates Corporation is a global leader in manufacturing products for industrial and automotive replacement markets, as well as original equipment manufacturers. The PowerGrip® rubber synchronous belts in your kit were manufactured by Gates. The synchronous belt sprockets were manufactured by a trusted Gates Supplier and Distributor - B & B Manufacturing.

Belt Benefits
Gates PowerGrip® GT®2 5MM belts are ideally sized for drives and functional applications on a FIRST robot.
- Lightweight – much lighter than chain and gearing systems for comparable loads
- Useful – PowerGrip 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 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 belt drive technology such as chain and gears

Additional Questions
Feel free to contact Gates before, during, and after the competition for any questions, opportunities, or inquiries you may have.

- Email ptgasupport@gates.com. Please include the words “FIRST” and your team name in the Subject line of the email
- Or call 303-744-5800
- Or visit www.gates.com/drivedesign - Download the Light Power and Precision Drive Design Manual or 2008 Industrial Power Transmission Solutions Catalog - Evaluate new drive designs using the Design Flex Pro software

Part Information
Your PowerGrip Component Kit Includes:
- 3 PowerGrip GT 2 Synchronous belts
- 3 pair of synchronous belt HTD® Sprockets
These parts can be used with the parts that were supplied in last year’s kit!

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Qty</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>5MR-535-09</td>
<td>1</td>
<td>PowerGrip GT2 belt, 5mm pitch</td>
</tr>
<tr>
<td>5MR-535-15</td>
<td>1</td>
<td>PowerGrip GT2 belt, 5mm pitch</td>
</tr>
<tr>
<td>5MR-900-15</td>
<td>1</td>
<td>PowerGrip GT2 belt, 5mm pitch</td>
</tr>
<tr>
<td>P16-5M-09AL</td>
<td>2</td>
<td>Sprocket (fully finished with flanges)</td>
</tr>
<tr>
<td>P32-5M-15AL</td>
<td>2</td>
<td>Sprocket (requires machining for bore hole)</td>
</tr>
<tr>
<td>P56-5M-15AL</td>
<td>2</td>
<td>Sprocket (requires machining for bore hole)</td>
</tr>
</tbody>
</table>

See Appendix C for specification details for these parts as well as additional part availability.

Buying Additional Parts
B&B Manufacturing is a proud supplier to Gates Corporation and a supporter of FIRST Robotics, and will ship sprockets to locations across the USA. They accept credit card orders and can expedite delivery.

B & B Manufacturing
1712 Genesis Drive
La Porte, IN 46350
www.bbm.com
1-877-787-4022

Gates sells all products only through our distributor network. To find a distributor in your area, please visit www.gates.com/distributors.

Best of luck in your FIRST competitions!
Appendix A: Belt Drive Application Tips

Best advice – One test is worth a 1000 calculations.

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

Do not pry belts off of sprockets. To remove, create slack by adjusting center distance or moving tensioner.

Sprocket Flanges – Provide flanges either on both sides of one sprocket or one side on the driver and the opposite side on the driven sprocket. All belts drive 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.
Belt Alignment - Sprockets must be aligned and shafts parallel in both planes.

Belt Wrap – Keep a minimum of 6 belt teeth fully in mesh belt wrap 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.

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 capability of the 9 and 15mm width belts is proportional to their width. Gates belt ratings are set to guarantee long life on industrial applications. For FIRST applications, your load capability is going to be determined by the shaft to sprocket connections, belt wrap, and the ability to pretension the drive so that the belt does not jump teeth. With adequate belt wrap & proper installation tension, you will be surprised by the durability of this product!

Splicing Belts – Belts or belting can 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: Drive Design

Example 1: 6-Wheel Synchronous Drive

- CIM motor primary drive uses 9mm wide belt.
- Higher torque load on wheel drives uses 15mm wide belt.
- Front wheel would be 9 or 15mm wide depending on loading.
- Total drive ratio is 7.9:1

Rule of Thumb: If using belts for speed reduction, use narrower belts on higher speeds (usually coming from the motor) and wider belts at the lower speeds (powering the wheels)

Note the use of sprocket flanges and belt tensioning points.

Provide adequate structure to maintain parallel shafts, sprocket alignment, and ability to maintain tension under load.

Example 2: Ball Positioning

- 2 stage, 13:1 ratio positioning drive.
- Small sprocket on inside of belt span drives a position feedback pot.

Example 3: Ball Pitching Applications

- Ball Pitching using opposing belts and a PowerGrip Twin Power belt (teeth on both sides) to reverse rotation.
- Fast and Accurate!
Example 4: Telescoping Lift with Door Motor & 5mm Long Length Belting

- 1.25" diameter flat rollers with a flange can be used for idlers (either side of the belt.)
- Make an easy end connection long length belting.
  - Make a ferrule from ½ diameter x .035 x 1” Al or Cu tubing.
  - Wrap belting around min. ½” diameter cylinder (to avoid belt cord damage) and insert belt loose ends through ferrule.
  - Crimp the ferrule in a vise. Don’t crimp too tight and you will have a removable connection.
- Belt Tensioning – note adjustment screws

Need a reversing drive? PowerGrip Twin
Power® belts have teeth on both driving surfaces.
Appendix C: Sprocket and Belt Size Availability

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.

Belts are identified by belt pitch, pitch length, and width. Example: the 5MR-535-09 is a belt with a 5mm pitch, 535mm length, and 9mm width.

Sprockets are identified by tooth count, pitch, width and material. Example: P16-5M-09AL is a 16 tooth sprocket, 5mm pitch, 9 mm width and made of aluminum.

NOTE: The part number for a 15mm wide sprocket has "15-AL" at the end, rather than "09-AL".

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

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5mm Pitch - Reference Dimensions

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5mm Pitch Stock Belt Widths

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5mm Pitch Belt Lengths

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Gates Corporation

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