Gears
Educational Systems, LLC

105 Webster St. Hanover Massachusetts 02339 Tel. 781 878 1512 Fax 781 878 6708

Assembly Tips and Techniques

Working and Learning with the GEARS Invention and Design System

Mechanical Tips

#1 The GEARS axles are made from 305 stainless steel. This material is relatively soft and allows for the setscrew to "Bite" into the steel shaft. After each assembly and usage , it is good practice to use a small, fine flat file to debur and smooth the axles where the setscrews have impressed the metal axles.

#2 High gear ratios in drive trains create significant torques. The components supplied with the GEARS-IDS™ kit are designed to produce torques within an acceptable range for the components and systems supplied with the kit. However, when significant torques are expected to be applied to an axle/hex adapter assembly, it is best practice to file a small flat on the axle where the setscrew bears down. This will prevent slippage and galling of the axle.

#3 Use lock washers and flat washers on all assemblies, wherever and whenever possible. This will limit "robot droppings" after competitions.

#4 The motor shafts have flats machined into them. The flat will not always be where you want it, depending on how you decide to position the hex adapter, sprocket or gear on the shaft. When necessary, create your own small flat using a dremmel tool with a grinding wheel. The shafts are made of hardened steel and cannot be easily filed.

#5 The GEARS-IDS™ gear head motors have ¼" hardened steel shafts. It is not possible for a setscrew to bite into a hardened steel shaft since the shaft is nearly as hard or harder than the setscrew. When Hex adapters or other set screw components are used on the hardened steel motor shafts it is best to apply Loctite© blue or similar thread locking liquid to the set screw threads before final assembly. A small drop of super glue will also help lock the set screw.

#6 Whenever possible, use the bronze sleeve bearings *(Included in the kit)* to support drive axle assemblies.

#7 The Pittman gear head motors supplied in the GEARS-IDS™ kit have (2) #10-32 threaded mounting holes. We chose to use both #10-24 and #10-32 screws so students and teachers would learn to identify thread sizes. If students keep forcing #10-24 screws into the #10-32 motor mounting holes, then you can re-tap the motor mounting holes. Simply drive a #10-32 tap through the mounting holes and you will again be able to use the #10-32 machine screws included with the kit.

105 Webster St. Hanover Massachusetts 02339 Tel. 781 878 1512 Fax 781 878 6708

#8 There are many drive systems available when designing a mobile mechanism. These include belt drives, gear drives, chain drives and direct drives. Each system has its benefits. High gear ratios provide slower wheel speed for better control. Chains are rugged and great for outdoor use and direct drive systems with wheels connected to the motor shafts are fast. Think about which options or combinations to use when solving a particular engineering problem. GEARS-IDS™ options include: sprocket & chain, gear drive, direct drive, belt drive (polycord & 3" wheel)

Electrical/Electronic Tips

#1 Use zip ties to provide strain relief for the motor wires.

#2 For best results, position the RC receiver as far away as possible from the electronic speed controllers. The electronic speed controllers are switching relatively large currents that in turn create electrical interference either through radio frequency "noise" or induced currents in nearby conductors, or both. For this reason it is always best to separate sensitive electrical components.

#3 Always use and antenna mast. Do not let your antenna wire drag on the metal chassis or on the floor. Antenna wires that are chaffed or cracked can ground out on the metal chassis and this will cause unexpected and erratic behaviors. Always check that there are no bare spots, chafes or cracks on the antenna wires.

#4 Mount speed controller so you can see initialization LED's. This will help if troubleshooting is needed.

Pneumatics

#1 Test for Air Leaks: Air leaks are best detected by using a mix of water and dishwashing soap in a mixture of 10 parts water and one part dishwashing soap. Apply the mixture liberally and carefully to every possible tubing and fitting connection. Look for foaming or bubbles of any kind. An especially likely place is under the pressure gauge where it screws into the regulator. When a leak is found, unscrew the fitting. Clean the threads and treat them with a drop of Red Loctite™ (red) then screw the fitting back into place. Red Loctite™ is the best possible solution for sealing small threaded fittings.

#2 Design and build protective solenoid switch mounts. The electronic circuit and connection are vulnerable to direct impact.

105 Webster St. Hanover Massachusetts 02339 Tel. 781 878 1512 Fax 781 878 6708