

## Introduction

The following document is a guide to aid FIRST teams in their design and prototyping process. This is not a how-to guide on robot design, it's intent is to make teams aware of materials that we think are useful to have on-hand for rapid prototyping and problem solving. Think of it as an extension of your kit. You don't want to find

yourself waiting to order parts tomorrow when you have a problem to solve tonight!

This guide is divided into several equally important sections addressing issues that your team may face in the race that is FIRST.

Good Luck!

**“Do NOT find yourself waiting to order parts tomorrow when you have a problem to solve tonight!”**

## Small Parts, Inc.

The rules of the FIRST Competition state that a team may use \$425 dollars worth of components from Small Parts, Inc. on their robot. The key words are “on your robot”. You may purchase as many items, at any expense, as you feel necessary. You may only use \$425 on your finished robot. With this in mind, we have generated a list of components that you may consider ordering early. This will save you time and shipping costs.

The following list of Small Parts items is provided to give your team a collection of parts for prototyping as well as exposure to the “feel” of various structural members. You should find all of these parts invaluable in saving precious days of your schedule.

### TIP:

Although Small Parts is excellent at shipping supplies out quickly, some items, such as steel are very expensive to ship overnight. Try to purchase your main structure members as soon as possible.

**Table 1: Suggested Early Purchase from Small Parts, Inc.**

QTY	Part Number	Description	Cost
2	R-RA2-16/16-36	Iron, Hot Rolled - Angles 1" x 1" x 1/8" x 36" (p.97)	\$ 9.18
3	R-MAT-1	Non-Slip Matting - 18" x 3' (p.125)	\$ 19.50
1	R-FGA-16-36	Fiberglass - Sq. Tubing 1" x 1" x 1/8" x 36" (p.131)	\$ 12.75
10	R-RRCS-25	Roller Chain - Carbon Steel 1/4" (p.359)	\$ 28.60
6	R-RRCS-25CL	Roller Chain - Connecting Link (p.360)	\$ 3.90
1	R-RCB-1	Chain Breaker (p.360)	\$ 29.54
2	R-RCS-9	Roller Chain Sprockets - Nylon - 1/4" 9 tooth (p.360)	\$ 5.40
2	R-RCS-10	Roller Chain Sprockets - Nylon - 1/4" 10 tooth (p.360)	\$ 5.54
2	R-RCS-12	Roller Chain Sprockets - Nylon - 1/4" 12 tooth (p.360)	\$ 5.90
2	R-RCS-16	Roller Chain Sprockets - Nylon - 1/4" 16 tooth (p.360)	\$ 6.28
2	R-RCS-18	Roller Chain Sprockets - Nylon - 1/4" 18 tooth (p.360)	\$ 6.66
2	R-RCS-20	Roller Chain Sprockets - Nylon - 1/4" 20 tooth (p.360)	\$ 6.92
2	R-RCS-24	Roller Chain Sprockets - Nylon - 1/4" 24 tooth (p.360)	\$ 7.54
1	R-RCS-28	Roller Chain Sprockets - Nylon - 3/8" 28 tooth (p.360)	\$ 7.30

QTY	Part Number	Description	Cost
1	R-RCS-30	Roller Chain Sprockets - Nylon - 3/8" 30 tooth (p.360)	\$ 7.61
1	R-RCS-36	Roller Chain Sprockets - Nylon - 3/8" 36 tooth (p.360)	\$ 8.50
1	R-RCS-40	Roller Chain Sprockets - Nylon - 3/8" 40 tooth (p.360)	\$ 8.94
1	R-RCS-48	Roller Chain Sprockets - Nylon - 3/8" 48 tooth (p.360)	\$ 10.01
5	R-LTR-6	Latex Tubing, 3/8" OD (p.42)	\$ 6.45
2	R-ARA2-16/16-36	Aluminum - Angle 1" x 1" x 1/8" x 36" (p.84)	\$ 10.90
1	R-FGA-16-36	Fiberglass - Angles 1" x 1" x 1/8" x 36" (p.131)	\$ 7.95
1	R-ASC-4836	Anti-Slip Cleats (p.242)	\$ 2.85
8	R-SC-4	Steel Collars 1/4" (p.321)	\$ 8.88
4	R-SC-6	Steel Collars 3/8" (p.321)	\$ 5.16
2	R-SC-8	Steel Collars 1/2" (p.321)	\$ 2.70
2	R-FBB-4/6	Bearings - Sintered Bronze 1/4" ID (p.335)	\$ 2.72
5	R-ORBK-4	O-Ring Splicing refills - 1/4" - 6' (p.367)	\$ 5.20
1	R-ORBK-ADS	O-Ring Splicing Adhesive (p.367)	\$ 3.85
1	R-PH-3-6	Continuous Hinge - Stainless 2" x 6" (p.195)	\$ 3.72
1	R-MCS-300-10'	Cable - Polyethylene Fiber 0.04" dia. 10' (p.303)	\$ 6.97
2	R-ZRS-6-36	Steel, Cold Rolled - Bar 3/8" dia. x 36" (p.94)	\$ 7.88
2	R-ZRTA-4/16-36	Aluminum - Rectangular Bar 1/4" x 1" x 36" (p.83)	\$ 20.60
2	R-ZRS-4-36	Steel, Cold Rolled - Bar 1/4" dia. x 36" (p.94)	\$ 4.36
1	R-VT-15-B	Teflon Sheet 6" x 12" x 0.015" (p.119)	\$ 4.02

### Additional Hardware List

The Additional Hardware List in the FIRST rule book allows teams to buy unlimited dollar amounts of the listed items (within the quantities specified). Ideally, you will buy all of the items on the list as soon as possible. Having these items on hand throughout the competition will: save time, prevent delays, be useful during prototyping, allow the students and engineers to "touch and feel" the parts available.

If it is not practical to buy all the Additional Hardware List parts up front, we recommend you at least buy the following items.

#### These are important during prototyping:

- PVC Pipe (all sizes)
- PVC fittings (all types and sizes)
- ELECTRICAL Conduit Pipe (EMT)
- Wooden Closet Rod
- Plywood

#### These items may be difficult to obtain quickly:

- 15 Pin connectors and hoods used for building Y-cables to increase the useable number of joysticks
- 2 additional Joysticks
- Servo extension cables (needed to connect Victor 883)
- additional speed controllers

### Other Important Items

The final important item to have on hand is extra fuses for the control system. It is not uncommon during development to blow fuses. The most common fuses blown are the PWM fuses (Receiver F19-F26). Refer to the FIRST manual for a current listing of replacement fuses. We recommend ordering 5-10 extra fuses of each type and at least 20 of the F19-26 fuses.

### Spare Kit Items

There are several items supplied by FIRST in your kit that you will probably need to replace due to wear or damage. The sources for these items are listed in the FIRST rules book.

- 1-2 spare motors of each type
- The motor you use for your main drive should be replaced with a new motor before regional and national competitions.
- Spare drill motor transmissions