# THE 2000 FIRST ROBOTICS COMPETITION

# TEAM UPDATE #3

Date: January 18, 2000

## IF YOU HAVE QUESTIONS

If you have questions regarding the rules, competition events, shipping, etc. please refer to sections 1.2-1.4 in the Administrative section of the manual. Do not send questions to webmaster@usfirst.org or others not listed in these sections.

## FOR TEAMS REGISTERED TO PARTICIPATE AT THE NATIONAL CHAMPIONSHIPS

The National Championship panel of judges has requested that each team competing at the National Championship provide one 5"x7" color photo which clearly shows their robot (with your team # clearly shown on the robot) and one or two team members in their team uniforms standing next to the robot. Please turn in your photo on Thursday, April 6, 2000 when your team checks-in at the Registration Table in the Pit Area. By providing this 5"x7" color photo, you will be giving the judges an additional "visual aid" to use during their deliberations.

## ABOUT SHARINGFIRST.MIT.EDU

About 30 Teams have logged on to SharingFIRST. Several have posted useful information including 3-D part drawings which can be imported by 3-D Studio Max. The X-Cats have posted very useful scheduling and integration templates. Teams have promised great stuff!

Despite what the rumor mill says, you can visit the site and check in without posting anything immediately. Just tell us what you plan to do and you get a password. Tom Gray is trying to turn around password requests within a few hours.

Remember that one of the measures of gracious professionalism is how much your team helps other teams. Especially veterans, help the rookies by posting things which teach. Post those spreadsheet which predict robot performance. Post scanned sketched of “slick” design ideas. If you are interested in having visual impact and/or interested in the AutoDesk prize, animate part of your posting via Studio Max.

Early postings, even in draft form, are most valuable. When the designs are done, the lessons are not as powerful.

## PNEUMATICS BAG

There has been an addition to the Appendix B: Kit of Parts of the manual to reflect the parts included in the Pneumatics Bag. The following is a list of the parts in the Pneumatics Bag.

The specification sheets will be included in the SMC package. They will also be posted at http://www.usfirst.org/2000comp/Docs/.

***Valves***

| Qty | Item | Description | Part # | Ports | Tubing | Voltage |
|---|---|---|---|---|---|---|
| 2 | Power Valve | single air pilot 5/2 valve, w/bracket | SYA3120-C6F2 | M5 | 6mm | N/A |
| 1 | Power Valve | double air pilot, closed ctr, 5/3, w/bracket | SYA3320-C6F2 | M5 | 6mm | N/A |
| 3 | Limit Valve | lever arm, 3/2 mechanical | VM131-01-01 | 1/8PT | N/A | N/A |
| 4 | Solenoid | 3/2 solenoid | SY113-6LZ-M3 | M3 | N/A | 12 volts DC |

***Cylinders***

| Qty | Item | Description | Part # | Ports | Tubing | Voltage |
|---|---|---|---|---|---|---|
| 1 | Rodless | magnetic cylinder, 8" stroke, 15mmq | CY2B15L-200 | M5 | N/A | N/A |
| 2 | Double acting | Double acting, 2" stroke, 1.5"q | CDM2B32-50 | 1/8PT | N/A | N/A |
| 1 | switches | Hall effect w/band NOTE: NPN | D-H7A1 | | | 12 volts DC |

***Accessories***

| Qty | Item | Description | Part # | Ports | Tubing | Voltage |
|---|---|---|---|---|---|---|
| 4 | flow controls | flow control | AS2201F-01-06 | 1/8PT | 6mm | N/A |
| 2 | flow controls | flow control | AS1201F-M5-06 | M5 | 6mm | N/A |
| 2 | Check valve | check valve | AK2000-01 | 1/8PT | N/A | N/A |
| 1 | Check valve | check valve | AK2000-02 | 1/4PT | N/A | N/A |
| 1 | regulator | pressure regulator with gauge, limited to max. 60 psig output | AR2000-02G-4* * 60 psig max. | 1/4PT | N/A | N/A |

***Vacuum***

| Qty | Item | Description | Part # | Ports | Tubing | Voltage |
|---|---|---|---|---|---|---|
| 2 | Cups | Bellows type, NBR, 32mm diameter | ZPT32BN-B01 | 1/8PT | N/A | N/A |
| 1 | Generator | High vacuum, with valve | ZM131H-J6L-E15 | 1/8PT | N/A | 12 volts DC |

***Fittings***

| Qty | Item | Description | Part # | Ports | Tubing | Voltage |
|---|---|---|---|---|---|---|
| 1 | tubing, 6mm | 20 m. | TU0604B-20 | N/A | 6mm | N/A |
| 1 | tubing, 4mm | 20 m. | TU0425B-20 | | 4 mm | N/A |
| 6' | tubing, 1/4" | tank to regulator | TIUB-07B-20*CUT | | 1/4" | |
| 2 | connector | nipple, 10mm | KQ2N10-99 | | 10 mm | N/A |
| 1 | manifold | 6 mm tube, 6 out | KM11-06-10-6 | | 6 mm | N/A |
| 1 | manifold | 4 mm tube, 6 out | KM12-04-02-6 | | 4 mm | N/A |
| 1 | plug | 1/4 PT | Plug 1/4 PT | N/A | N/A | N/A |
| 3 | fitting, reg. | 1/4 PT x 10 mm | KQ2H10-02S | 1/4 PT | 10 mm | N/A |
| 4 | plugs | 6 mm | KQP-06 | | 6 mm | N/A |
| 4 | plugs | 4 mm | KQP-04 | | 4 mm | N/A |
| 1 | fitting | regulator inlet 1/4x1/4 | KQ2H07-U02 | 1/4 PT | 10 mm | N/A |
| 2 | fitting, str. | 1/4PT x 6mm | KQ2H06-02S | 1/4PT | 6mm | N/A |
| 20 | fitting, str. | 1/8PT x 6mm | KQ2H06-01S | 1/8PT | 6mm | N/A |
| 10 | fitting, str. | M5 x 6mm | KQ2H06-M5 | M5 | 6mm | N/A |
| 8 | fitting, str. | M3 x 4mm | M-3AU-4 | M3 | 4 mm | N/A |

**NOTE: ALL THREADS MARKED M OR PT ARE METRIC --- ALL TUBING IS METRIC**

| | | | |
|---|---|---|---|
| 1 | air tank | 1.5 gallon | Midwest Pressure Systems |
| 1 | check fitting | installed in tank | IN-289-140S |

## FISHER-PRICE MOTOR INFORMATION

The following are approximate performance data for the Fisher-Price motor / gearbox sets supplied in the kits. The motor used is a Mabuchi model RS-550PF-6534.

| | |
|---|---|
| Motor no-load speed | 15,000 RPM |
| Motor stall current | 57 A |
| Motor stall torque | 0.363 N-m |
| Gearbox ratio | 147:1 |
| No-load speed w / gearbox | 100 RPM (estimated) |
| Stall torque w / gearbox | 34.7 N-m (estimated) |

## CORRECTIONS AND UPDATES TO THE MANUAL

The following parts have been added to Additional Hardware List as follows:

**Control System**

| | |
|---|---|
| Switches | Any amount, Any type, non-illuminated |
| Potentiometers | Any amount, 100 KΩ, linear taper |

The following rules have been added to the manual:

C30. Only electronic components that are listed in the Kit of Parts List and Additional Hardware List are allowed to conduct electricity.

P14. Use of personal audio systems at the events is not allowed because it can interfere with the teams ability to hear important announcements.

**Teams are reminded to read the Pit Rules in Events Information in the Regional Events Section of the manual.**

## RULES QUESTIONS & ANSWERS

Q48. May we reach over a hanging opponent and grab / hook / clamp the bar in an effort to hoist our machine off the floor, if that entails our "grabber" coming down on, covering, or otherwise contacting the opponent's "grabber?" In other words, can an opponent make the entire bar or portions of it off limits to us by simply covering the bar with a part of their robot?

A48. Yes, it is okay to attempt to raise yourself by clamping onto their grabber if their grabber is blocking your access to the pipe. Note that we make the distinction between the grabber and the "arm" that leads up to the grabber, so that you are not allowed to try to pull yourself up by pulling on their arm or the rest of the robot. The referees will use a common-sense definition for applying this.

Q49. The "Additional Hardware" list states that we may use "chains / belts of any length." Can the belt be made of any material?

A49. Yes, but you may only use materials that are specifically belts.

Q50. What is the floor space, width x depth footprint, for each teams pit area at the 2000 FIRST Nationals Competition?
A50. Each team will have a pit area that is 10 feet by 10 feet at the 2000 FIRST National Competition.

Q51. Can the human player shoot the balls from behind the plastic barrier directly to the robot?
A51. It is allowed to have the human player shoot balls directly at the robot over the safety shield, as long as the robot does not pass the safety shield into the Alliance Station and the human player maintains him/herself in the Alliance Station. Refer to Rules DQ10 and DA6.

Q52. May we ship spare mechanisms with our robot in the crate?
A52. Yes.

Q53. With respect to the "Joining plate for Aluminum Extrusion" in the Additional Hardware List, what about small items, like hinges, and linear bearing slides, also made from extruded aluminum sections, with Ultra High Molecular Weight Polyethylene bearing pads? Since we have a block of HDPE in the kit, I wonder if we could use their assemblies as purchased, as long as the amount of UHMW-PE does not exceed the allowable amount of HDPE in the kit.
A53. Per the additional hardware list, you are allowed unlimited use of joining plates for the extruded aluminum. Other hardware (slides, hinges, etc.) are not covered, but you could get a hinge from Small Parts, Inc. and attach it to a joining plate. You can't substitute another part for the HDPE in the kit, but you could use the HDPE in the kit to make a slide.

Q54. May we design a mechanism intended to prevent our robot from being pushed off the ramp by extending wider than the distance between the "uprights"?
A54. If the mechanism is designed to react with the structure of the goal when you are being pushed, then it is designed to react with the goal and is not allowed per Rule M7.

Q55. May we use miscellaneous parts, such as large belts, not listed in the Small Parts catalog?
A55. Yes. See the Additional Hardware List.

Q56. Are there any rules against blowing up a device, such as a balloon, in the opponents trough to remove or prevent scoring?
A56. Blocking an opponent's goal is allowed. Inflatable devices such as balloons are not. See Rule M15.

Q57. In the finals, does the scoring still use the 3 times format, or does the winning team continue no matter what the scores?
A57. The 3 times format applies to the qualifying points, not the match points. Qualifying points are not used during the elimination matches.

Q58. If our robot is hanging from the pole and not touching the floor, but an opponent's robot ends up touching us as the round ends, pushing us into the floor, are we still "on the bar"? That is, if we end up clearing the floor when the opponent's robot is removed, will we get 10 points?
A58. No. If your robot is touching the floor, then it is not hanging. It does not matter why your robot is touching the floor.

Q59. May we use a grappling hook to attach to that pole?
A59. A hook may be used to attach to the pole. Projectiles other than balls are not allowed per Rule S7, so the robot may not "throw" a hook at the pole. Also, Rule M18 prevents mechanisms which present a risk of entanglement. If the hook itself or a cord attaching it to the robot is likely to get snagged on another robot, it will not be permitted.

Q60. I was wondering who I would contact about getting extra parts, such as the 8" wheelchair wheels?
A60. If you look at the supplier column in the Kit of Parts list, you will notice that the wheelchair wheels are supplied by Skyway Recreational Products. The Additional Hardware List shows the types of extra wheels that you can use on your robot. Contact information for Skyway and other suppliers is listed in the Supplier Contact Directory in Appendix G of the same section of the manual. Part Specification sheets for the Skyway wheels are located in Appendix H.

Q61. Would it be legal to purchase a length of rod from Small Parts, Inc. that is custom cut? There is, in the description of the rod, bold print to “call the purchasing department if you need longer sections and we can cut it to the length you specify.”
A61. If it says you can order longer pieces on that page, then it is okay. See Rule K9.

Q62. Would threaded rod be considered a piece of extruded aluminum?
A62. No.

Q63. Does aluminum tubing count as extruded aluminum?
A63. Yes, aluminum tubing is considered an extrusion.

Q64. Would we be able to substitute rope netting for the rope listed in the Additional Hardware List?
A64. No, but you could purchase rope and weave it into a net.

Q65. May balls be put into the opponents' chute?
A65. Yes.

Q66. We have a question concerning the amount of motors that are available to be used in this years competition, especially if we can purchase more Drill motors. If not, can we use or purchase any more of any kind of motors for this years use?
A66. You are only allowed to use the number and type of motors in the kit. If you purchase identical motors from an outside source, you can use them as replacements, but not in addition to the motors in the kit.

Q67. The light beacon (red and blue) is needed to identify team alliance. Must the beacon be mounted within the envelope of the robot or can the beacon be mounted outside of the required envelope?

A67. The beacon is a part of the robot and must be mounted within the starting size envelope.

Q68. On page 33 of the Additional Hardware List (Appendix C), it says "sprockets, gears and pulleys - any size, any amount." Are we allowed to manufacture these sprockets, gears and pulleys to our specific requirements, or do we have to purchase them from stock items?

A68. Per the updated Rule K3 (see Team Update #1 on the FIRST web site), you may now fabricate your own gears, pulleys, and sprockets.

Q69. Is it allowed to have a gear box on the robot? If so, is it allowed if we have more than one gear in that gear box?

A69. You are welcome to build gearboxes. We let you get the gears themselves per the additional hardware list, but it will be up to you to construct a gearbox around them using the other materials allowed for robot construction.

Q70. May I write my own program to read the data streams from the OI? I would like to write my program in Visual Basic, however reading these data streams off the serial port. The Innovation First website states their program is written in Visual Basic, will they open the source of their code so that I can use it to "develop really cool visual feedback" without having to spend too much time reverse engineering the OI.

A70. Yes, you can write your own program to read the data. Innovation First is planning to document the data protocol, but not give away the VB source code. However, there is someone on the Chief Delphi board (a discussion board run by one of the teams but open to everyone) who has offered to write some VB routines once the data spec is released and give them away. Check http://www.chiefdelphi.com and look at the forums for more information.

Q71. For the light on the robot, is it possible that instead of changing the colored caps on and off before each match, we could have clear, but colored parts of our sides that we could change on and off (similar to stage lighting, how you can insert colored gels over the clear light). We see it to be very probable that we'll be mounting the light down on the chassis of our robot and have the light come from the sides. It will be easier to change sides then a cover down there.

A71. We need to stick with using the colored domes on the lights. This makes it fair for everyone and insures that the light quality is the same for all teams.

Q72. If our robot were to grab onto the center bar and move forward, beginning to pull itself up and, in the process, hit/slide up or down/put pressure on an opposing robot sitting on the ramp, is that illegal? (Assuming that the robot can lift itself without needing that assistance)

A72. If your robot is pulling itself onto the bar, and another robot is in the way, it is okay to keep pulling yourself up onto the bar.

Q73. Are round stocks such as round aluminum stock considered extruded?
A73. Yes, if the stock is actually extruded. Rolled stock is not considered extruded.

Q74. Under drive components, gears, sprocket and pulleys there is an unlimited amount of these items, however, no mention was made of bearings that might go with them. Are we restricted to using the bearings that come with the kit and any that might come with other components (e.g. the wheelchair wheels) or can we purchase additional bearings as needed by our design?
A74. You may use the bearings in the kit and may purchase additional bearings from Small Parts, Inc. as part of your $425 allowance on parts from SPI.

Q75. How often will the balls be replaced during the competition? And will they be re-inflated or replaced with new ones?
A75. We won't really know how often they will be replaced until we get to the first events this year. However, the plan is to use new balls at the start of each event and replace them as needed if they are popped, become severely deformed, get really dirty, etc.

Q76. We were wondering if we could use a comparable product to what is in the small parts catalog. In specific we were wondering on linear sliders. The sliders are not identical to those shown in small parts but they are comparable. Would this be okay to use as long as we account for the price as is listed for the comparable item in small parts?
A76. You are welcome to prototype your robot with any hardware, but for the final build you need to get the part from Small Parts, Inc. The only time we make an exception to this is if Small Parts runs out of an item and can't deliver in a reasonable amount of time. If that happens, please contact us first in order to get permission and to alert us of the part shortage.

Q77. We where told you can not hang on the goals. May we push on the goal to tip our basket of balls?
A77. No. That would be considered designing your robot to react with the goal. See rule M7.

Q78. A15 says we may NOT climb up on our opponent who is hanging on the bar and hoist ourselves off the ground (although we may climb for 10 points on our hanging ally). May we intentionally push, pull, lift, ram, attack the "bar grabber", or otherwise interact with a hanging opponent from a position on the floor or the ramp, with the intention of removing him from the bar or bringing him into contact with the ramp surface?
A78. You may push and bump an opposing robot to try to get it out of a scoring position on the bar. See Rule GM21. You may not try to lift an opposing robot off the bar, per Rule DQ12. Pulling on a robot is likely to cause damage to the robot and could be viewed as entanglement or trying to hoist yourself up by an opposing robot, both of which are disallowed. See Rule DQ3, and A15.

Q79. May we make incidental contact with a hanging opponent when attempting to get on the ramp or to hang from the bar ourselves?
A79. Yes.

Q80. Are we disqualified if our efforts to hoist our robot up on the bar incidentally result in a hanging opponent falling from the bar or contacting the ramp surface?
A80. No, you would not be disqualified for this.

Q81. At the beginning of the match, my robot is taller than 30". When I drive underneath the goal, part of my robot is acted upon by the bar and is pushed back and down. Now, I am less than the 30" height and can move beneath the goal. Once the robot clears the bar, it pops back up to its original height. Is this a legal design? If not, would it be legal if the robot "shrunk" in size when the driver activated a motor?
A81. That would be a clear case of the robot being designed to react on the goal, which is not allowed per Rule M7. Making a motorized retracting mechanism is okay.

Q82. For the elimination rounds, could the alliance captain be a coach?
A82. Only if the coach is a pre-college team partner (i.e. high school student). See Rule GM28.

Q83. If a robot arm is designed to reach inside a goal and remove balls, is it a violation if any part of the arm accidentally touches a part of the goal? In other words, is it just like the Operation game?
A83. Incidental contact with the goal is okay, there will be no warning buzzer.

Q84. Is it legal to use abrasive belts (R-AB-xxx-xx) in the SPI catalog to improve friction between the ball and a "ball grabber"?
A84. Yes, in theory. However, if the belts damage the balls, then they will be disallowed. See Rules DQ5, and DA1. Please test your design to see if this wears down the surface of a ball before risking your robot design on this part.

Q85. May we use/modify gears, sprockets, or pulleys as drive wheels? May they be used to manipulate balls if they don't have chain, or belt attached?
A85. Yes, but with the same caveats as in the previous answer.

Q86. Is it okay for our robot to tip over after the start of the match so that it then runs with a base that is up to 5 feet long in one dimension?
A86. Yes, that is okay.

Q87. Given that the additional hardware list says we can use "Steel Plate," does this mean that we can also use sheet metal? How about things that are prefabricated from sheet metal such as HVAC ducting? How about sheet metal straps?
A87. Steel sheet metal may be used since it has a thickness of less than 1/4". "Steel Plate" is intended to indicate raw structural material and not prefabricated items.

Q88. What (or where) are the specs for the globe motor, specifically the torque speed curves?
A88. The globe motor specs are not in alphabetical order with the rest of the part specs. See page 76 of The Robot section of the manual. Torque-speed curves are not available.