

# **2001 FIRST ROBOTICS COMPETITION**

## **TEAM UPDATE #6**

Date: February 6, 2001

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### **REGARDING SMC CHECK VALVES**

There have been some cases of the SMC check valves failing to hold pressure. The item is number 23 in the Bill of Material on page 15 of the pneumatics manual. A photo and discussion of the SMC check valve is on page 11. If you are not already using the Festo pilot-operated check valve, also shown on page 11, it can be used as a substitute. Air will flow from port number 1 through the check and out port number 2 but not in the reverse path as long as pressure is not applied to port 21. If this work around is not satisfactory, a limited quantity of replacement SMC check valves are available. If you have a defective SMC check valve and would like a replacement, please e-mail [first@hpeco.com](mailto:first@hpeco.com) with your phone number, team number, address, and an explanation that you would like to obtain a replacement check valve.

### **PNEUMATICS CAUTION**

The single-solenoid valves in the pneumatics kit use a spring return to return the valve to the default state when the solenoid is not powered. As a safety feature of the Innovation First control systems, power to all outputs is cut when your robot is disabled at the end of a match (or when you press your stop button). Therefore, the single-solenoid valves will return to the default state at the end of a match, which could cause a potential safety hazard and/or cause a negative impact on your score. Please design your pneumatic system accordingly.

### **SMALL PARTS, INC. ORDERING INFORMATION**

In the event that a part you wish to purchase from Small Parts, Inc. is out of stock, and they estimate that it will take more than one week to deliver the part, please contact FIRST for permission on a case-by-case basis to obtain an equivalent part from another vendor. See Section 1.3 in the Administrative section of the manual for information on who to contact at FIRST.

### **IMPORTANT ROTATING LIGHT INFORMATION**

The metal body and mounting screws on the rotating light included in the kit electrically connected to the black wire that goes into the light. Please mount the light on a non-conductive surface (such as polycarbonate sheet or plywood) and/or carefully insulate the leads where they mount to the robot chassis in order to minimize the chances of experiencing a short circuit on your robot.

### **VAN DOOR MOTOR INFORMATION**

There are no matching connectors for the Van Door Motors in the kit. Please cut the existing connectors off the powers leads coming out of the motors and attach your own electrical connectors. A simple solution is to use the spade connectors provided in the kit, but other electrical connectors may be used.

## CASTER WHEEL INFORMATION

The part number for the Fastenal caster wheels included in the kit is: 10247-00715.

### QUESTIONS & ANSWERS

- Q93. We would like to use the pneumatics on our robot, but not mount the pump on the robot. Is this allowed? What do we do about the pressure relief valve, since it is mounted on the pump?
- A93. Using the pneumatics without the pump on-board is allowed. You may pre-charge the volume tanks (and any cylinders used as volume tanks) prior to the start of the match at up to 120 psi using the pump. You shouldn't have to worry about going above 120 psi in the volume tanks because you will be charging them with the pump which is limited by its relief valve. Also, the 60 psi regulator included in the pneumatics kit is a relieving regulator, which means that it will dump air if an over-pressure situation exists on the output side of the regulator.
- Q94. May we use expanded aluminum on our robot?
- A94. Yes, if you purchase it from Small Parts or make it yourself from allowed raw materials. Expanded aluminum is not on the Additional Hardware List. See Rules K2 and K7.
- Q95. May we use 32 square feet of plywood or must it actually be physically cut from one sheet?
- A95. You may use a single 4x8' sheet of 1/4" thick plywood and a single 4x8' sheet of 1/2" plywood. The Additional Hardware List specifies maximum dimensions for a single sheet, not area.
- Q96. Regarding the rule that the light must be visible from 4 points 90 degrees apart, is this just at the beginning of the match or is it through the whole game? If it is through the whole game, how are we supposed to approach walls and such?
- A96. The color from the light must be viewable from 4 points 90 degrees apart around the robot during the entire match. The implication is that this will allow the color to be seen by looking at the robot from the perspective of the audience, teams, and referees no matter what direction the robot is facing. We do not require that the side of the robot up against the wall somehow be visible.
- Q97. In previous years, we were told during inspection that we were not allowed to Velcro the robot controller, the speed controllers, and the spikes down. Is this true for this year?
- A97. There are no restrictions on using Velcro to mount the control system components. However, it is not advised because components may be knocked loose during the course of a match and this could cause your robot to malfunction and/or damage the control system.

- Q98. Does rule GM25 modify the answer to A1, or may a team still submit a stretcher coupon without actually placing a robot on the stretcher?
- A98. No. GM25 defines the minimum set of components that must be present if you want to receive 10 points for having a robot on the stretcher when the stretcher is in the end zone. That is, by meeting the minimum, the stretcher is worth 10 and the robot on it is worth 10 more. An empty stretcher in the end zone is worth 10 points.
- Q99. With regards to SC11, if a team with a non-functioning robot decides not to field their robot in order to continue working on it, could they send only one team member to the alliance station without being considered a "no-show"?
- A99. Yes.
- Q100. Is the weight of the operator interface (joysticks) added to the weight of the robot for the 130 pound total?
- A100. No, because they are not part of the robot.
- Q101. Given that shaft couplers are included in the Additional Hardware List, are misalignment couplers considered shaft couplers?
- A101. Yes.
- Q102. May we use custom sprockets we used last year on this years robot?
- A102. No. See Rule M16.
- Q103. Is it ok to plan to use one of the four KK-70-7 fittings mounted to the side of the bridge to raise and lower it?
- A103. Yes, that is their intended purpose.
- Q104. May we use additional window lift tape beyond the 16' given to us in the kit? Could it be considered timing belt?
- A104. No, see Rule K1. The window lift tape is not considered timing belt.
- Q105. May we use a part design from a previous year's robot on our robot this year?
- A105. It is ok to use a design from a previous year as long as the parts are made this year. See Rule M16. However, if you are using a design not initiated by your team this year, we encourage you to share with any new team members an analysis of why that is a good design.
- Q106. We are considering making a suction device to pick up balls. May we use a pneumatic cylinder and move the piston using a motor instead of air pressure?
- A106. Yes. We purposely left the method of driving the piston undefined.
- Q107. What does the starting orientation of the robot have to be? Does the 30" side have to be facing front or may we put the 36" side front. May the robot start on an angle?
- A107. See Rule GM12. It is ok to start facing on a diagonal.

- Q108. I am having trouble finding the shipping deadline for the robot. Could you please tell us the date and time?
- A108. The shipping deadlines are printed in the Regional and National events sections.
- Q109. How do we hookup the servos? Is 24 AWG wire acceptable? May they be powered directly from the robot controller through a circuit breaker, or must a relay be used?
- A109. Yes, 24 AWG is ok. The servos are designed to be operated directly from the PWM output of the robot controller, so you don't need a speed controller or relay. The robot controller has a built in current limiter for the PWM outputs, so you don't need a circuit breaker either. We recommend using a standard PWM/Relay cable to connect the Servo to the Robot Controller.
- Q110. May we make our own small springs? The springs included in the kit are too powerful for our proposed application.
- A110. No, see Rule K4. You may purchase smaller springs from Small Parts, Inc.
- Q111. Are the gussets for connecting the Bosch extruded aluminum considered "Joining Plates for Extrusions" listed on the Additional Hardware List, or do they count against the \$1200 Small Parts limit?
- A111. Yes, they are considered Joining Plates.
- Q112. The Additional Hardware list specifies that we may use as much resin & hardener to form epoxy as needed for fiberglass. Typically, a filler (also an epoxy that contains a resin and hardener) is used to finish the exterior for cosmetic purposes. Would using the epoxy filler violate any of the competition rules?
- A112. No. Since it is used for appearance, it would fall under Rule M9 and therefore be allowed.
- Q113. May we connect the outputs of two Victor Speed controllers to the same motor? Could this cause damage to the controllers?
- A113. No. That would damage the speed controllers because there is no way to synchronize the high frequency switching of the FETs between the controllers and you would wind up with a short circuit from one speed controller to the other.
- Q114. May we purchase commercially produced suction cups or are we restricted to the small parts and kit parts?
- A114. You may fabricate your own suction cups from allowed raw materials. See Rule M14. You may not purchase off the shelf suction cups because they are not on the Additional Hardware List. See Rule K1. You may purchase suction cups from Small Parts (if available) but may not use them for pneumatics. See Rule M14.

Q115. According to the Additional Hardware List, we are allowed 5 rubber bands. If we cut up the rubber bands into smaller pieces, is it still considered 5 rubber bands or is each smaller piece considered a separate rubber band?

A115. The 5 rubber bands are what you may purchase. If you modify them, such as by cutting them into 35 smaller pieces, it still counts as 5 rubber bands.

Q116. I have a question regarding the use of a Styrofoam material for a core material for a fiberglass structure. Is this allowed?

A116. Core material is not on the Additional Hardware List. However, you may be able to purchase this type of material from Small Parts, Inc.

Q117. May a fan belt be used to cover a wheel in order to gain better traction?

A117. Fan belts are not on the Additional Hardware List, so you would need to get it from Small Parts. Timing belts are on the Additional Hardware List, so you could get those anywhere. You are allowed to wrap belts around wheels.

Q118. Will the “down” end of the bridge start differently in elimination than qualifying?

A118. No.

Q119. There are several categories of items on the Additional Hardware List. May any item on the list be used for any purpose, or are the items restricted to their category use? Are controls items only for use as controls? Specifically, may we use magnets to lift the ramp?

A119. The categories listed on the Additional Hardware List do not necessarily indicate how parts may be used. They exist mostly just to make it easier to find items on the list. The rules in the Appendix A of The Game and Appendix A of The Robot, as well as the Team Updates, describe how the parts may be used. In most cases, there are no restrictions other than safety, electronics and pneumatics being exceptions. You may use magnets from the Additional Hardware List to lift the ramp as long as they do not leave a strong residual magnetic field in the bridge materials.

Q120. Would a ball supported by a goal and a barrier, such as the pipe railing that bisects the field or either end barrier, count for scoring?

A120. No. Rule SC3 states that balls touching the surface of the playing field do not count.

Q121. Is it legal for a team to intentionally topple a goal?

A121. Yes.

Q122. Since a carpet sample was included in the kits, may the same type of carpet be used on the robot as additional hardware? If so, would it be a limited quantity?

A122. Carpet is not on the Additional Hardware List, so you may not get additional carpet and use it on the robot. See Rule K1. You may use the carpet sample included in the kit on the robot.

Q123. Are hinges considered fasteners?

A123. No.

Q124. May we weld parts together?

A124. Yes. Welding rod is considered a fastener.

Q125. In the manual, under additional parts, it states that a team may use a timing belt of up to 20' in length. Does that have to be one timing belt or may we use two belts whose total length equals 20' or any combination of belts such that it does not exceed 20'?

A125. You may use any combination of timing belts that does not exceed 20' in length. If you need more than 20', then the extra length must be purchased from Small Parts, Inc.

Q126. May we use linear potentiometers instead of rotational as part of our additional hardware?

A126. Yes.

Q127. May we use potentiometer knobs other than the ones included in the kit?

A127. Yes, but not on the robot. See Q5 in Team Update #2.

Q128. We would like to include additional LED's on our robot as non-functional decorations. May we do either or both of the following: 1) Connect the LED's through the fuse block with resistors in series. 2) Add a low voltage power source (i.e. 1.5v batteries) solely for the LED's.

A128. Both are ok for non-functional decorations, must be properly insulated.

Q129. May we connect the pilot-operated check valve in the pneumatics kit to the exhaust port of one of the SMC valves?

A129. Yes.

Q130. Are we limited to the utilization of the VELCRO products contained within the kit, or may we purchase additional and/or different VELCRO products?

A130. Velcro is considered a fastener and is thus allowed per the Additional Hardware List.

Q131. May we purchase a 25 pin cable, cut it in half, plug one end into the sensor inputs on the robot controller and wire the other end into terminal blocks?

A131. Yes. Off-the-shelf wire, electrical connectors and terminal blocks are on the Additional Hardware List. Using an off-the-shelf cable is an acceptable extension of the allowance for wires and electrical connectors.

Q132. We would like to use extruded aluminum linear motion bearings sold by 80/20. Are these units legal to use?

A132. Bearings are not on the Additional Hardware List, so they would not be legal.

Q133. Is there a limit to the number of switches allowed on the controls for the robot operators?

A133. There is no limit to the number of switches that may be used. As a practical matter, there are 16 switch inputs on the Operator Interface, so it probably doesn't make sense to use more than 16 unless you are wiring switches in series or parallel.

Q134. With respect to Rule M12, may we use spare motors on accessories as long as we never use more than what is allowed at any time in any configuration?

A134. When building a modular robot, you may not use duplicates of parts included in the Kit of Parts unless those parts are also on the Additional Hardware List (electrical connectors, wire, wheels, etc.) or available from Small Parts, Inc. (structural materials, etc.). For example, you may not build two different modules that both contain two van door motors, because that would require four identical motors and only two were included in the kit. However, you may design the modules such that the van door motors could be swapped back and forth between both modules. The restriction on duplicate kit parts is intended to help maintain a "level playing field" between teams.

Q135. Is threaded rod considered a fastener per the Additional Hardware List?

A135. Yes.

Q136. May we use heat sinks on the motors? They are not specifically listed on the Additional Hardware List, but if they are aluminum, would that be considered to be extruded aluminum?

A136. It depends on the heat sink. If it is an off-the-shelf heat sink made from extruded aluminum with a cross section no larger than 2" x 3", then it is ok. If it is a heat sink made from joined layers of sheet metal or some other process that is not extrusion, is not aluminum, or is something custom fabricated by your team, then it does not count as extruded aluminum.

Q137. May we crimp and solder terminal connections and then tape them up with electrical tape?

A137. You may use off-the-shelf electrical connectors and terminal strips to wire the robot. Connectors may be crimp-on, solder-on, screw-on, etc. If the outside of the connector does not provide it's own insulation, then you must insulate it with electrical tape, heat shrink tubing, or some other suitable means.

- Q138. May we switch which circuit breaker powers the motors via a relay so that we don't have to wait for a circuit breaker to cool after it trips?
- A138. No. You may only have a single circuit breaker in series with a speed controller and may not put a relay between a speed controller and circuit breaker. You are welcome to replace the circuit breakers in between matches, but may not do so during a match.
- Q139. May we use a 4-pin harness plug to connect electrical parts of the robot together?
- A139. Yes, as long as it is insulated and rated for the current.
- Q140. May we use a 2" x 3" piece of extruded aluminum angle since the angle is extruded?
- A140. Yes, extruded aluminum angle falls within the category of extruded aluminum and therefore 2x3" aluminum angle is ok. Angle formed by bending sheet metal, which has an obvious radius at the corner, does not fall into this category.
- Q141. We would like to develop voice-operated controls for some of the functions operated by relays on our robot. Would we be able to use some other kind of sensor or non-Parallax software to process the sound and then send it to the STAMP chip in the form of a single number for interpretation by the program?
- A141. That's a neat idea, but the rules do not allow such devices to be connected to the inputs of the Operator Interface or Robot Controller.
- Q142. May we use 4 joysticks at the same time?
- A142. Yes. You get two in the kit and, per the Additional Hardware List, may get two more. See Rule K1.
- Q143. May we purchase casters which have a lower profile than those provided in the kit? May we use casters with wider steel wheels?
- A143. Yes, caster wheels (up to 3" diameter) are on the Additional Hardware List. There is no restriction on the width of the allowed caster wheels. See Rule K1.
- Q144. May we use high current diodes that are not included in the kit?
- A144. No. You may only use the electronic components included in the kit and the items listed under "Control System" in the Additional Hardware List to conduct electricity.
- Q145. May we replace or modify the clevis pin in the end of a pneumatic cylinder to facilitate mounting the cylinder on our robot?
- A145. Changing the cylinder mounting features is allowed as long as it does not compromise the strength of the cylinder chamber and/or piston so as to create a safety hazard.

Q146. May we use epoxy as a surface for the outside of our wheels?

A146. Yes. Epoxy is an adhesive, and adhesives are listed under "fasteners" in the Additional Hardware List. See Rule K1. Therefore you may use Epoxy on the robot including the wheels. However, please make sure that the epoxy will not crack and leave lots of debris on the playing field after driving around. If that happens, the referees will ask you to remove the epoxy from the wheels before returning to the field.

Q147. Does aluminum diamond plate count as aluminum plate per the Additional Hardware List?

A147. Yes, as long as the thickness does not exceed the 1/4" dimension specified.

Q148. Are there any limitations on the size of the shipping crate we will use to ship our robot?

A148. YES! Please read the Events section of the manual.

Q149. May we use quarter inch spiral tubing for our pneumatics system?

A149. No. You may only use the pneumatics parts (including tubing) that were supplied in the pneumatics kit or ordered from the custom cylinder order form.

Q150. We would like to put a transparent cover over the Robot Controller in order to protect it from damage, but this makes pressing the reset button difficult. I've seen many teams put fingers inside robots where moving parts exist. Innovation First programmed the RC to only process downloaded code once the reset button was pressed as a safety issue. Having to put your finger inside the machine seems to be just as risky. May we solder wires directly to the RC's reset switch and mount a switch elsewhere in order to reset the RC?

A150. No, that would constitute an illegal modification of the control system and would also void your product warranty. However, there is a simple and safe solution. Just use the robot reset button located on the Operator Interface to remotely reset the Robot Controller after it has been reprogrammed.

Q151. Does perforated or expanding aluminum constitute an aluminum sheet?

A151. Perforated aluminum does count as aluminum plate, per the Additional Hardware List. Expanded aluminum (an aluminum foam) does not.

Q152. We would like to use the window motor with the spur gear on it. Small Parts does not sell spur gears of that pitch. May we buy a matching gear elsewhere?

A152. No. Gears are not on the Additional Hardware List. However, you are welcome to fabricate a gear from allowed raw materials.

Q153. Will we receive points for goals in the end zone?

A153. No. See Appendix A of The Game section of the manual for scoring rules.

Q154. Is the 10% bonus for the big balls only during qualification matches?

A154. Yes. There is no 10% bonus during the elimination matches. See Rule SC8.

Q155. As a follow-up to Team Update #5 A83: Are off the shelf slip ring electrical connectors allowed on the robot?

A155. Yes.

Q156. May we use the pneumatics system for cooling other parts of the robot?

A156. Yes, the pneumatics may be used to blow air on non-pneumatic components of the robot for the purpose of cooling them. However, you will probably find that the muffin fans included in the kit do a better job of providing cooling air flow for much less weight than the pump.

Q157. Is any piece of aluminum considered extruded aluminum? Could I take an aluminum rod with a 2" diameter and machine out of it whatever I want?

A157. Solid aluminum is considered extruded if it was obviously formed by the process of extrusion (versus casting, rolling, forming, etc.) It is likely that most aluminum rod is formed by extrusion. Therefore, you are welcome to use a 2" diameter aluminum rod and machine parts out of it for your robot. Note that there are certain restrictions on what you may make out of it (i.e. no pneumatics).

Q158. May the Goals and Stretcher be held or secured by a robot in any way, or must it use the handle bars?

A158. You may pickup the goals and/or stretcher in any way as long as it does not cause damage to them. We anticipate that with reasonable handling a robot will be able to pickup the goals by the PVC pipes, tow the stretcher by any section of its perimeter pipe, etc.

Q159. May we wire the pressure sensor in series with the air pump so that at 120psi the circuit will open and the air tanks will be kept at that pressure? If so, may we not use the spike relay module to control the air pump so that the air pump is completely independent of the controller?

A159. No. First, it violates the wiring rules specified in Section 2 of The Robot section of the manual. Second, the switch will burn out because it is not rated to handle the current drawn by the pump. Third, it would make it impossible to shut off the pump at the end of the match, or in the event of a safety hazard. In order to use the pressure switch, it must be connected to a digital input on the Robot Controller. In order to use the pump, it must be powered by a Spike Relay. Lastly, the pressure switch is calibrated to switch at approximately 110 psi so that you can shut off the pump before the pressure relief valve is triggered.

Q160. Section 2.2.3 of The Robot states that teams are permitted to connect a "portable computing device" to the RS232 output of the dashboard output for the purpose of displaying feedback from the robot while competing in FIRST Robotics Competition. May we build a custom portable computing device to connect to the dashboard port for the purpose of displaying feedback from our robot? If so, are there any restrictions on the materials used to build this custom portable computing device?

A160. You may make your own "portable computing device" to view the dashboard data as desired. The only restrictions are that it must not interfere with the operation of the robot control systems (900 MHz radios), it must be battery powered (no AC available on field), and may not be connected back into any inputs on the Operator Interface.

Q161. May we use string to initially retain a component until the start of the game, the string will break and a component will deploy?

A161. Yes. The string in that application would be considered a fastener. Just be sure that the broken string does not get left behind on the playing field or cause a risk of entanglement.

Q162. We would like to know if we could use item # U-STAT-48M in the Small Parts catalog as a foundation for our robot. It will not be a functioning part of the robot.

A162. That is allowed. There are no rules which forbid it from being a "functioning" part of the robot.

Q163. May we balance the motors or rotate the magnets located inside the motors?

A163. No. See Rule M18.

Q164. We have parts for the robot, such as bearings from previous years that are in the Small Parts Catalog. May we list these with a cost from the catalog as parts used on the robot? Would we have to order the parts even though we have them on hand?

A164. You should purchase parts you wish to use on this year's robot from Small Parts. The reason for using the catalog is to insure that all teams have a "level playing field" with regard to selection of parts as well as lead time in securing parts.

Q165. Are Kee Klamp components considered fasteners per the Additional Hardware List?

A165. Yes.

Q166. Are bolts used to attach the wheelchair wheels to the robot (allowing them to rotate) considered "fasteners" (allowed) or "shafts" (not allowed)?

A166. Bolts are considered fasteners no matter how they are used. This is a change in interpretation from previous years.

Q167. May we use "push-on" / "fast-on" terminals (small size) on the limit switch terminals? Is insulation on the barrel sufficient or must the contact portion also be insulated on these small terminals?

A167. Yes, you may use electrical connectors that slide onto the limit switch contacts. You should insulate the outside of the contact, but that may be done with heat shrink tubing or electrical tape if the connector itself does not provide the insulation.

Q168. May we wire the coast/brake jumpers leads on the Victor speed controllers to a switch? This technique is spelled out in the Victor user guide.

A168. Yes, that is allowed. Please use a separate switch, or separate poles on the same switch, for each speed controller.

Q169. With respect to Rule M12, may a mechanism be "loaned" to another team, so that they can add it onto their robot for one match, as long as no robot design rules are broken when this happens?

A169. Mechanisms may not be shared between teams. Part of the spirit of Rule M16 is that FIRST expects teams to do their own work unless they specifically outsource the making of a part (for example, something they don't have the capability to fabricate) that will be for use exclusively on their robot. FIRST does not object to the gracious exchange of small components and sub-assemblies (sprockets, chain, wire, electrical connectors, etc.) from one team to another at an event for the purpose of making repairs to a robot.

Q170. May we use heat-shrink tubing to restrict the view of the optical sensor? This tubing would be placed around the "eye" of the sensor to narrow its field of view.

A170. Yes, that is allowed. Heat shrink tubing is on the Additional Hardware List.

Q171. May we use paint to change the reflectivity of a robot surface, in order to trigger the optical sensor?

A171. Yes, but only if the paint is from Small Parts, Inc. Paint is not on the Additional Hardware List or in the Kit. See Rule K1. Paint used for a "functional" purpose does not satisfy Rule M9.

Q172. May we use a non-skid surface covering (similar to what you might find on a flight of stairs) to change the reflectivity of a robot surface, in order to trigger the optical sensor?

A172. Only if it is available from Small Parts, Inc. See Rule K1.

Q173. Rule NC8 states that crates must be sitting on 4" X 4" lumber. We have acquired professional crate materials where the bottom is solid molded plastic with already built-in space for a forklift, i.e. it is made to be handled in a professional manner. We used this same crate material last year with no "complaints" by drayage/shippers. Is it ok?

A173. Yes. As long a fork-truck will be able to easily pick up the crate, it is ok.

Q174. We recognize in this year's rules that the robots will not be re-enabled after the end of the match. May we bring a power source onto the field to power down certain sections of the robot, or may we have one waiting off to the side with the cart?

A174. No, you may not bring power to the robot while it is on the field. You may energize the robot after it is off the field, such as by using the tether cable.

Q175. We would like to use a piston with a large bore and a very large stroke that would be a legal piston in the competition as a way to store extra compressed air. We are worried about the length of the piston in its extended position and were wondering if we could cut the piston down due to the fact we are not using the rod that extends and contracts. Is that allowed?

A175. Cutting the piston rod would constitute an illegal modification of the pneumatics and violate Rule M15. Therefore, it is not allowed.