

# THE KIT OF PARTS

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## 10. THE KIT OF PARTS

### 10.1 THE KIT OF PARTS - GENERAL

*FIRST* provides a Kit of Parts (KoP) to each FRC team. The exact parts provided in the KoP (or their exact replacement), plus the *FIRST* IR board sent out as a game hint are considered Kit Parts. Some Kit Parts may legally be used in additional quantities as described in Section 8 of the Manual. Additional quantities of these parts are considered to be “Additional Parts” and not “Kit Parts”.

Section 10 is dedicated to important information about certain specific kit items. For instructional tips, please refer to the *2008 Tips & Good Practices* document posted on the *FIRST* website off of the manual landing page, <http://www.usfirst.org/frc/2008/manual>

Some of the exciting and important additions found in the 2008 KoP include the following items:

- AndyMark Toughbox gearbox
- Automation Direct direct mount terminal strips
- Automation Direct rotary limit switch
- BaneBots RS-540 motor
- BaneBots RS-550 motor
- BishopWisecarver aluminum extrusion
- FCI BURNDY Products compression lugs
- FCI BURNDY Products large tie wraps
- *FIRST* IR board
- Gates Corporation rubber belts
- Gates Corporation sprockets
- Innovation First, Inc. Toughbox mounting plates (with the Kitbot)
- Mabuchi RS-385 motors
- MSC Direct sprockets
- Sample bumper pool noodle
- Sample bumper fabric
- Taigene motor
- Trackball shell
- Trackball bladder

The *FIRST* 2008 KoP is provided in multiple containers. They consist of the following packages:

- 1 – *FIRST* large black plastic tote for pickup at Kickoff
- 1 – *FIRST* large grey plastic tote for pickup at Kickoff
- 1 – Innovation First, Inc. KitBot box for pickup at Kickoff
- 1 – Innovation First, Inc. Electronics Kit for pickup at Kickoff
- 2 – BaneBots motors for pickup at Kickoff (RS540 & RS550)
- 1 – FedEx envelope for pickup at Kickoff

#### 10.1.1 Replacement Parts Requests

Use the *2008 Kit of Parts Checklist* provided at [www.usfirst.org/frc/2008/manual](http://www.usfirst.org/frc/2008/manual) to inventory your KoP. The inventory must be completed within 48 hours of receiving the kit in order to determine that all items are present.

The first column on the checklist should be marked when the item and quantities are correct. Photos are included in the checklist in case you are not sure what a particular part looks like.

If you find that certain Kit Parts are missing or damaged, you will need to submit a "Replacement Parts Request" by 11:59pm (EST), January 9, 2008. The Replacement Parts Request link will be

posted on the Team Information Management System (TIMS) after the Kickoff event. Replacement parts will be shipped only via this online request system.

The steps required to submit a Replacement Parts Request (after the kickoff) are as follows:

- Log into TIMS with your Logon ID and Password
- Click on the "Submit a Replacement Parts Request" link on right side of the Team Summary page
- Follow TIMS instructions to complete a Replacement Parts Request. Please be specific when describing the issue with the part (missing, damaged, etc).

Please remember that this is a **time limited, one-time only** opportunity to submit your Replacement Parts Request. Make sure that your request is both accurate and complete prior to pressing the "Submit Request" button. Once the request is submitted you cannot make any changes to it. Please note that the system will not allow teams to request a quantity of parts higher than the number originally sent with the kit. This system is also not to be used to order additional and/or purchased parts.

**Any kit irregularities must be reported by 11:59pm (EST),  
Wednesday, January 9, 2008 per the instructions here.**

Replacement Parts Requests will be processed daily and shipped during the next open shipping window. Items will be shipped to the shipping contact listed in your team's TIMS record.

### 10.1.2 Obtaining Additional or Spare Parts

Depending on what parts are left over after kitting and replacement parts shipments, we will provide spare parts at the Regional events. The items included in this limited group will be listed during the build season. If your robot uses parts that are not included on this list, and there is a reasonable possibility that the part could be damaged or broken during competition, it is recommended that you bring the appropriate SPARE PARTS with you to events in accordance with Section 8.

If, at any event, your team needs to borrow a Robot Controller, Operator Interface, Victor Speed Controller, Spike Relay, Radio, or AC Adapter, your team must provide Credit Card information to ensure proper return of the items immediately upon completion of the event. If the borrowed part is not returned by the end of the event, *FIRST* retains the right to bill the provided credit card number for the item(s). All "loan" items will be available on a first-come, first-served basis.

Innovation First, Inc. hosts the *FIRST* Store on behalf of *FIRST* on the Innovation First, Inc. website. The purpose is to assist teams with the ability to procure additional Kit of Parts items from *FIRST*. Only *FIRST* teams will be authorized to purchase the listed parts. *FIRST* establishes the pricing for all parts, which will be inclusive of handling charges, but exclusive of shipping charges.

Some additional Kit Parts and all Innovation First, Inc. parts are available and may be purchased by visiting the IFI Store at [www.ifirobotics.com/](http://www.ifirobotics.com/) The Innovation First, Inc. contact for *FIRST* Store matters is Tom Watson at 903-453-0800, extension 204.

The table below includes information about where to get additional kit part items.

Item	Supplier	Where to get more...
Toughbox gearbox	AndyMark, Inc.	<a href="http://www.andymark.biz/">www.andymark.biz/</a>
Battery connector safety plug		
Wheels		
Joysticks	American Anko	<a href="http://www.avbusa.com/">www.avbusa.com/</a>
Quick disconnect battery connectors	Terminal Supply Co.	<a href="http://www.terminalsupplyco.com/">www.terminalsupplyco.com/</a>
Rotary limit switch	AutomationDirect	<a href="http://support.automationdirect.com/FIRST">http://support.automationdirect.com/FIRST</a>
Direct mount terminal switch		
RS540 12VDC motor	BaneBots	<a href="http://www.banebots.com/">www.banebots.com/</a>
RS550 12VDC motor		
Aluminum framing	BishopWisecarver	<a href="http://www.bwc.com/">www.bwc.com/</a>
Accumulators	Clippard	<a href="http://www.clippard.com/">www.clippard.com/</a>
Keyang terminals	Delphi	<a href="http://www.powerandsignal.com/">www.powerandsignal.com/</a>
Keyang connector housing		<a href="http://www.powerandsignal.com/">www.powerandsignal.com/</a>
6AWG wire (red & black)		Please do not contact Delphi for additional wire - it is available commercially.
Denso motors	DENSO International	These were overstock items. Please do not contact DENSO to request additional motors
Battery lugs	FCI BURNDY Products	Find distributors online at <a href="http://www.fciconnect.com/">www.fciconnect.com/</a>
FESTO solenoid valve	FESTO Corporation	<a href="http://www.festo.com/">www.festo.com/</a>
FIRST IR Board & ribbon cable	FIRST Store	<a href="http://www.ifirobotics.com/first-store.shtml">http://www.ifirobotics.com/first-store.shtml</a> (availability TBD)
Pneumatic tubing	Freelin-Wade	<a href="http://www.freelin-wade.com/">www.freelin-wade.com/</a> (but call 888-373-9233 with your order to take advantage of the discount offered to FRC Teams)
Compressor	Thomas Products	Find distributors online at <a href="http://www.thomaspumps.com/">www.thomaspumps.com/</a>
Belt sprockets	Gates Corporation	<a href="http://www.gates.com/">www.gates.com/</a>
PowerGrip belts		
igus parts	igus	<a href="http://www.igus.com/yesprogram/FIRST2007_request.asp">www.igus.com/yesprogram/FIRST2007_request.asp</a> or contact Courtney Toomey at (800) 521-2747 ext. 146 or <a href="mailto:ctoomey@igus.com">ctoomey@igus.com</a> .
Control system components	Innovation First, Inc.	<a href="http://www.ifirobotics.com/">www.ifirobotics.com/</a>
Kitbot chassis components		
12V Batteries	MK Battery	1-800-372-9253, Jason Smith ( <a href="mailto:Jasons@mkbattery.com">Jasons@mkbattery.com</a> ) Please identify yourself as a FIRST team and provide your team number.
Terminal block components	Rockwell Automation	Kendall Electric, Michael Hunt, 269.963.5585 (There will be a limited number in stock, and teams will be limited to four of each color. This will be cash sales only requiring a credit card.)
Trackball shell	Sportogo	<a href="http://www.sportogo.com/">www.sportogo.com/</a>
Trackball bladder		
IR sensor	Vishay	<a href="http://www.vishay.com/">www.vishay.com/</a> , <a href="http://www.arrow.com/">www.arrow.com/</a> , <a href="http://www.avnet.com/">www.avnet.com/</a> , <a href="http://www.future.com/">www.future.com/</a> , <a href="http://www.newark.com/">www.newark.com/</a>

## 10.2 PART INFORMATION

This section of the manual provides additional information about *some* of the parts included in your KoP. For a complete list of the 2008 KoP contents, please refer to the 2008 KoP Checklist located on the FIRST homepage ([www.usfirst.org/community/frc/content.aspx?id=452](http://www.usfirst.org/community/frc/content.aspx?id=452)).

## 10.2.1 Control System Components

### 10.2.1.1 Innovation First, Inc. Control System

The control system provided in the 2008 KoP is from Innovation First, Inc. Innovation First, Inc. has published much information and instruction on their website at [www.ifrobotics.com/frc-robot-control-system-overview.shtml](http://www.ifrobotics.com/frc-robot-control-system-overview.shtml).

### 10.2.1.2 Backup Battery

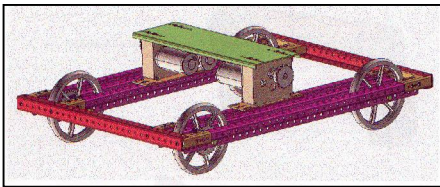
Innovation First, Inc. provides a 7.2V backup battery for use with your control system. Please note that batteries will perform best for your competition season if they are charged for at least 24 hours before the first use.

### 10.2.1.3 Joysticks

The analog joysticks provided in the 2008 KoP use serial connections. Details can be found online at [www.avbusa.com/gc1000fr.htm](http://www.avbusa.com/gc1000fr.htm).

## 10.2.2 Chassis

### 10.2.2.1 Innovation First, Inc. Kitbot Chassis



The 2008 KoP includes Innovation First, Inc.'s Kitbot Chassis. The Kitbot provides a lightweight, rugged, and adaptable solution for constructing a serviceable robot frame quickly and efficiently.

There are a number of ways that Kitbot components can be configured to form a chassis. The actual assembly is contingent on the design decisions defined by your team's game strategy. Once the basic chassis style is determined and has been assembled, the motor and transmission assemblies can be mounted and the drive wheels added.

The *2008 Chassis Kit Manual* can be found on the Innovation First, Inc. web site at [www.ifrobotics.com/kitbot.shtml](http://www.ifrobotics.com/kitbot.shtml). Some robot styles and strategies are not permitted in the competitions. Please read Section 8 carefully before you begin your chassis design and/or assembly.

### 10.2.2.2 Bishop-Wisecarver MCS Profile Aluminum Machine Framing

The 2008 KoP includes two (2) 20mm x 20mm pieces of aluminum extrusion that can be used for mounting additional components, adding structural support, etc. Detailed specifications for the extrusion provided in the 2008 KoP can be found in the online catalog found at [www.bwc.com/pdf/catalog/MCS\\_Catalog.pdf](http://www.bwc.com/pdf/catalog/MCS_Catalog.pdf).



## 10.2.3 Motors

### 10.2.3.1 Denso window motors

The Kit includes one Denso window motor. Either a left hand version OR a right hand version of the motor is supplied.



### 10.2.3.2 FisherPrice Motors



The FisherPrice motors are provided separately from the plastic gearboxes in the 2008 KoP. Assembly screws are included in the kit if you decide to use the gearboxes with the motors. For the motor curve, please refer to

[www.usfirst.org/community/frc/content.aspx?id=482](http://www.usfirst.org/community/frc/content.aspx?id=482).

### 10.2.3.3 BaneBots RS-540 & RS-550

The BaneBots motors were supplied separately at the kit pickup locations. More information about the motors and their performance can be found on the BaneBots website at <http://banebots.com/pc/MOTOR-BRUSH/M2-RS540-120> and <http://banebots.com/pc/MOTOR-BRUSH/M1-RS550-120>.



### 10.2.3.4 Taigene van door motor

Taigene has donated a van door motor to the 2008 KoP. The specifications are not posted on their website, but are posted on the FIRST website at [www.usfirst.org/community/frc/content.aspx?id=482](http://www.usfirst.org/community/frc/content.aspx?id=482).

## 10.2.4 The Drive Train

### 10.2.4.1 The Toughbox gearbox

The 2008 KoP includes two Toughbox gearbox kits for use in your drive train. For assembly instructions and further details please refer to the Toughbox User Guide found at [www.andymark.biz/](http://www.andymark.biz/)



### 10.2.4.2 Wheels



The wheels supplied in the 2008 KoP are very similar to the 2007 KoP wheels, but with minor differences. The hubs have been reinforced with more material and the tread material has a slightly higher durometer (75A compared to 60A in 2007). The “driving” coefficient of friction is 0.60 and the “sideways” coefficient of friction is 0.95.

## 10.2.5 Electrical Components

### 10.2.5.1 Batteries

The batteries supplied in the 2008 KoP are the same as those provided in 2007 KoP. The part number is ES17-12, and they are 12V, 18AH batteries. Battery ES17-12s are the only permitted batteries in the *FIRST* Robotics Competition.



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**Please remember that if you plan to ship your batteries in your crate, it's important to save the box and the rest of the packaging for further transport!**

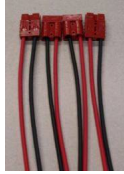
### 10.2.5.2 FCI Burndy Battery terminal lugs

FCI Burndy Products has donated two types of lugs for connecting your quick-disconnect battery connectors to your battery terminals. The mechanical lugs, PN YA6C, should only be used if you have the appropriate crimp tool. Lugs with part number KPA4C are screw lugs, and no crimp tool is required. For details about these parts and information about recommended crimp tools, please visit the FCI Burndy Products website at [http://portal.fciconnect.com/portal/page/portal/FcicntPublic/ComergentConnect?appname=cat&DisplayStyle\\$domProductQueryName=KPA4C\\*\\$OP=search](http://portal.fciconnect.com/portal/page/portal/FcicntPublic/ComergentConnect?appname=cat&DisplayStyle$domProductQueryName=KPA4C*$OP=search) and

[http://portal.fciconnect.com/portal/page/portal/FcicntPublic/ComergentConnect?appname=cat&DisplayStyle\\$domProductQueryName=YA6C\\*\\$OP=search](http://portal.fciconnect.com/portal/page/portal/FcicntPublic/ComergentConnect?appname=cat&DisplayStyle$domProductQueryName=YA6C*$OP=search).



### 10.2.5.3 Quick Disconnect Battery Connector



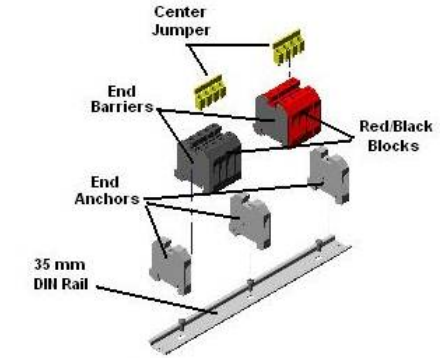
Each 2008 KoP contains four quick-disconnect battery connectors. They are assembled from Delphi red and black 6 AWG wire and Anderson Power Products quick-disconnect connector, SB-50. The datasheet for the connector can be found on Anderson Power Products website at [www.andersonpower.com/products/multipole-sb.html](http://www.andersonpower.com/products/multipole-sb.html).

### 10.2.5.4 Rockwell Automation Power Distribution Block

In the Kit of Parts you will find a ½ meter rail, most commonly known as DIN Rail. It is steel hat-shaped rails 35 mm wide and supplied to *FIRST* teams 18” in length.

DIN is an acronym from an old German national standard (Deutsches Institut für Normung). You often hear DIN referenced to various electronic components, particularly for audio connectors.

The DIN rails are primarily intended to mount the red and black terminal blocks found in the Power Distribution Block bag. The Power distribution block is used and featured in the 12 V Power System section of this chapter.



DIN Power Distribution Block Assembly

Typically the DIN rail is cut to the length required for the termination devices. In this case the block assembly shown below is 5 inches wide and the DIN rail has been cut to about 7 inches length to expose the mounting slots on each side of the block assembly.

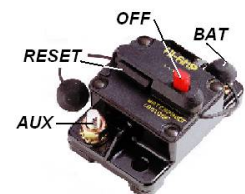
In the bag you should find 4 Red and 4 Black Feed-thru Connector blocks, 3 ea. - End anchor blocks, 2 ea. - Center jumpers, and 2 ea. - End barriers. These parts are illustrated in the diagram above and shown in the typical order in which, and where they are assembled (each piece is slid onto on the DIN rail in sequence. The end anchors lock the assemblies in place on the rail. The bank of four black blocks are linked together with a center jumper. The second center jumper links the red blocks. Use an end barrier to cover the “open” end of each connection block as indicated in the assembly figure.

Tighten all the anchoring and linking screws securely. The *2008 Power Distribution wiring diagram*, and the discussions that follow will guide you in making proper power connections for your robot.

### 10.2.5.5 120A Circuit Breaker

The 120A main circuit breaker/disconnect switch functions as the Main Power **ON/OFF** switch for the robot and as a Safety current overload protection device.

To power down the robot power manually, push the Red **OFF** button on the breaker. To reset Robot Power to ON, push the **RESET** lever back into its nested position.



120 Amp CB Layout

The Positive (Red) wire on the output side of the Anderson connector should have a ¼” Ring lug crimped/soldered on and then be connected directly to the **BAT** post of the 120A main circuit breaker. Tighten the nut. Finish by fully pushing the rubber-insulating cap back down over the nut. This will assure that all power from the 12v battery now flows directly to the 120A breaker. Do not connect anything other than the 120A main circuit breaker/disconnect switch directly to the 12v battery’s positive (+) terminal.

A fully charged 12Vdc battery can deliver current in excess of 200 Amps for a sustained period of time (minutes) in a short circuit situation. This amount of current can make wires smoke,

melt through insulation in a fraction of a second, start a fire, cause the battery to leak highly corrosive acid or explode, and result in serious burns or other injuries. Always make sure that the 120A main circuit breaker/disconnect switch is wired in series with the 12v battery positive (+) terminal and can break the circuit when necessary.

#### 10.2.5.6 The ATC Fuse Panels

The Positive 12Vdc output of the 120 Amp Circuit Breaker typically is fed from the **AUX** terminal to the DIN Power Distribution block via a length of # 6 AWG (Red) wire. The output wiring (#12 AWG) is connected to the + Plus connection on the ATC panels. The battery negative connection from the ATC panel connects to the battery negative post on the power distribution block.



The 6 and 12-way ATC panels can hold a population of 30A, and 20A Snap-Action re-settable circuit breakers. The 20 and 30 Amp circuit breakers can be plugged into any available socket running the length of the panel. The Positive load wires are attached to the panel male tabs at the desired circuit breaker using the slip-on terminals provided in the Terminal Bag.

The Negative (Black) # 6 AWG wire on the output side of the Anderson connector must be connected to the GND Distribution block.

The battery negative connection must **NOT be connected** to chassis ground.

#### 10.2.5.7 Maxi Style Fuse Block

The Maxi fuse block is used to support the 40 Amp service requirements of the larger drive motors. Up to four 40 Amp Snap Action circuit breakers can be fitted into the clips on the single Maxi fuse block shown here. If necessary, teams could use a second Maxi block for added 40-amp service. One end of the Maxi, the +12V feed block (top end in this photo), accepts up to three #6 AWG wires to distribute the +12V.



The load end of the Maxi provides 4 independent circuit feeds to the Victor 884 speed controllers. The negative wires of each load should be attached to the Battery negative side of the Power Distribution block.

Current ratings of the circuit breakers are the *maximum ratings* allowed. The AWG wire sizes to be connected to the different sized breakers are specified by the Rules as the *minimum AWG gauge* allowed.

#### 10.2.5.8 Quick Disconnect Battery Connector - Plugs

The battery plugs included in your kit are to help protect the contacts of the Anderson connectors when not in use. They can also be used to indicate the charge state of a battery.

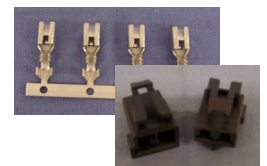
#### 10.2.5.9 Direct Mount Terminal Strips



Specifications for the AutomationDirect Direct Mount Terminal Strips provided in the 2008 KoP were included with the part, but can also be found online at [http://web4.automationdirect.com/adc/Shopping/Catalog/Terminal\\_Blocks\\_-\\_Wiring\\_Solutions/Standard\\_DIN-Rail\\_Terminal\\_Blocks\\_\(order\\_by\\_Component\\_Type\)/Direct\\_Mount\\_Terminal\\_Blocks/BM-M092CS](http://web4.automationdirect.com/adc/Shopping/Catalog/Terminal_Blocks_-_Wiring_Solutions/Standard_DIN-Rail_Terminal_Blocks_(order_by_Component_Type)/Direct_Mount_Terminal_Blocks/BM-M092CS)

#### 10.2.5.10 Keyang motor terminals & housing

The 2008 KoP includes terminals and housing compatible with the connector on the 16627961 Keyang motor. You must crimp the terminals to your wire and then assemble them to the connector housing.





## 10.2.6 Sensor Modules

### 10.2.6.1 Sensor Strip

The 2008 Kit of Parts contains a sensor strip including two gear tooth sensors, a yaw rate gyro, and a dual axis accelerometer. For details about these devices, please reference the 2008 Sensors Manual posted on the *FIRST* website at [www.usfirst.org/frc/2008/manual](http://www.usfirst.org/frc/2008/manual)

### 10.2.6.2 FIRST IR Board

The FIRST IR board is considered a 2008 KoP item, however it was shipped to paid teams before Kickoff. More information about the FIRST IR board can be found online at [www.usfirst.org/frc\\_decgift](http://www.usfirst.org/frc_decgift)

### 10.2.6.3 IEC Rotary Limit Switch



Specifications for the AutomationDirect rotary limit switch provided in the KoP were included with the part, but can also be found online at <http://web4.automationdirect.com/static/specs/limitaap.pdf>.

### 10.2.6.4 Microswitch



Details for the microswitch, also known as a limit switch, can be found on the Honeywell website at [http://sensing.honeywell.com/index.cfm?ci\\_id=140301&la\\_id=1&pn=V7%2D2B17D8%2D048](http://sensing.honeywell.com/index.cfm?ci_id=140301&la_id=1&pn=V7%2D2B17D8%2D048).

## 10.2.7 Pneumatic Components

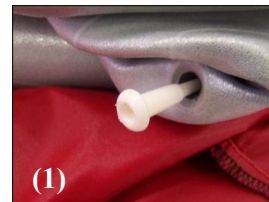
Please refer to the 2008 Pneumatics Manual posted on the *FIRST* website at [www.usfirst.org/frc/2008/manual](http://www.usfirst.org/frc/2008/manual) for details about the 2008 pneumatic kit items.

## 10.2.8 Game Pieces

### 10.2.8.1 Trackball Inflation

The 2008 Trackballs require some care in assembly and inflation. Each Trackball consists of two parts: a Bladder and a Cover. The bladder has a 120cm diameter and is made of 2500g PVC. These are shown here in un-inflated, as-shipped condition. The Cover is shipped inside out but don't hurry to correct this just yet.

Unfold both parts and lay them on a table or the ground. Inserted into the fill-spout of the Bladder (the light-colored vinyl part on top) is a small plastic Stopper. Using a fingernail or dull prying tool, remove the Stopper and put it aside safely: DO NOT LOSE IT! The Stopper is as shown here partly removed from the Bladder (1).



As you unfold your Cover (but not yet inverting it), you need to find the zipper. As shipped, there is a possibility that the Slider (the part of the zipper that moves) may inadvertently come off the Trackball cover and get lost. The following corrective procedure will ensure that this does not happen:



Position the zipper as shown in (2). The “pocket” is the square-shaped piece of colored nylon fabric that is stitched in place to cover the end of the zipper.

*Safety first: When using a hot melt glue gun, always observe the manufacturer’s warnings about how to protect yourself!*

Using a hot melt glue gun to dispense glue under the end of the pocket as shown (3). Use enough glue to ensure full adhesion between the underside of the pocket with the top of the zipper and its white edging, but not so much that it will ooze out of the pocket when it is squeezed together.

Taking care not to get burned, press gently to flatten the pocket as shown (4). If you get glue on your skin, remove the glue immediately. Place the Cover carefully aside to allow the glue to cool and set for at least five minutes. If you don’t have access to a hot-glue gun you may substitute an air-dry rubber based glue instead, being sure to allow adequate time for drying. Another option is to stitch this section of the pocket shut.

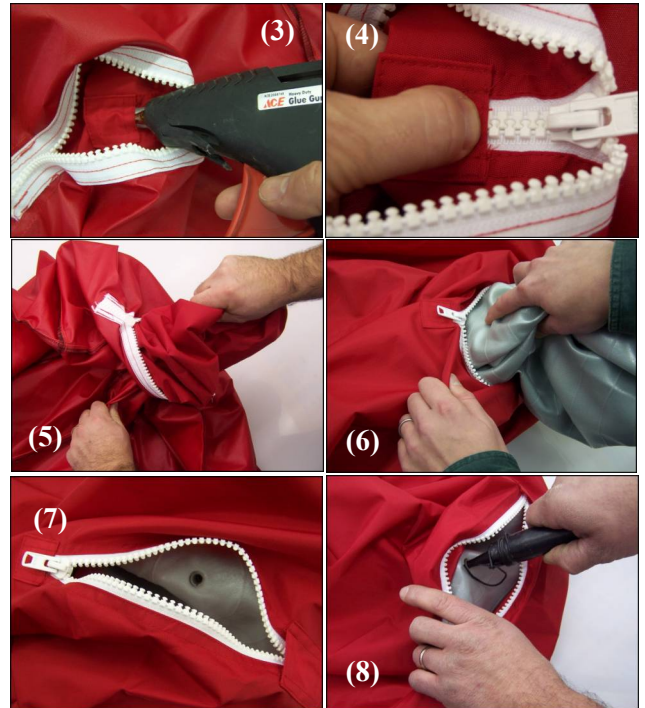
You are now ready to invert the Cover. As shown (5), pull it through the zipper opening until it is completely right side out.

Insert the Bladder into the zipper hole, keeping careful track of where the fill-spout is located. (6) It may take some fussing to insert the Bladder into the Cover; be careful not to tear the Bladder or exert excessive force on the zipper or any portion of the Cover.

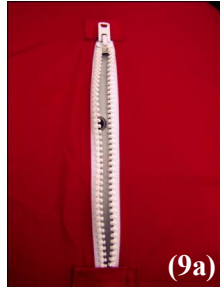
Because you have kept track of the fill-spout, you can now shift the Bladder and Cover as necessary to center the fill-spout in the zipper opening as shown. (7) It may be helpful to pick up the Cover and Bladder and shake downward to encourage the Bladder to spread out somewhat inside the Cover.

Insert the nozzle of your inflator/compressor and begin to inflate the Trackball. (8) As the Trackball enlarges, stop occasionally to ensure that the fill-spout continues to be well centered in the zipper opening.

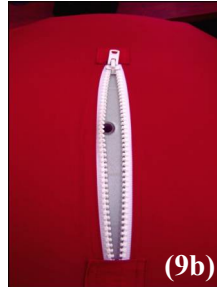
Inflate the Trackball so that the zipper appears as in the center photo. (9b) The Trackball on the left is under-inflated (9a), the Trackball on the right is over-inflated (9c). When properly inflated, the zipper will be able to be pulled and closed, not too hard, not too easy.



**Under-inflated**



**Just right**



**Over-inflated**



Another good clue as to when the Trackball is properly inflated is to examine the seams on the outside of the ball. If they appear generally wrinkled and loose, your Trackball is under-inflated (10a). If they appear taut but not about to bust at the seams, it's about right (10b). If the seams look stretched and overstressed, and if the Trackball feels quite hard to the touch, there's too much air (10c).

**Under-inflated**



**Just right**



**Over-inflated**



Once you arrive at a Trackball inflation that seems right, insert the Stopper all the way and pull the zipper slider closed. If the zipper seems really hard to pull, you may still have too much air, let some out.

It is important to insert the "tongue" of the slider as shown in the photo (11), to allow it to be opened more easily in the future.



### 10.2.8.2 Trackball Maintenance

The first time you inflate your Trackball the Nylon cover begins to slowly stretch out to its non-wrinkled condition. What you will probably see is that after a few hours the Trackball will slightly increase in size as the Nylon fabric relaxes, but the apparent hardness of the Trackball will decrease.

Should this happen, you can unzip the cover, pull out the Stopper and add some air. Using the methods described above, ensure that you are not over or under inflating the Trackball, then insert the Stopper and close the zipper.

The temperature of the surroundings can also affect the Trackball. For example, if you inflate in a cold area and then put the Trackball in a heated room, it will get harder as the air expands. The inverse is also true. In short, keep an eye on Trackball inflation and be prepared to adjust it up or down as required.

Note: Some teams may receive a blue Trackball instead of red. This is normal.