

Essential Team Toolkit

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The sites provided here are just examples of what you can buy. It's a good idea to look at a couple of different hardware stores if possible to compare prices.

If possible, avoid buying very cheap items. These might not be manufactured as well, and can cost you later on if the sizes are inaccurate or the tool breaks during use. Better to buy a more expensive tool that is reliable and will last for years.

Stick with U.S. Customary Units (inches, feet). It might seem silly, but check that you aren't buying metric items (tools, bolts, nuts, etc.). Never use metric tools while working with customary unit parts or vice versa; you can ruin nuts and bolts if the tool used on them is not a perfect fit.

It's a good idea to buy a couple of extra 7-1/16" wrenches and nut drivers, and extra 1/4" drill bits and the like. You'll find that the most common fastening device you use is a 1/4-20 bolt, so it's good to have a few tools that correspond to this size on hand.

1. Combination wrench/ratchet- Our team hasn't tried these, but it seems that you can avoid purchasing a ratcheting kit this way
<http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100026224>
2. Standard combination wrench set- I would advise buying two or three of whichever wrench set you choose. Wrenches are helpful when working with things that are inconvenient to access or are difficult to loosen/tighten (as you have more torque at your disposal with a wrench)
<http://www.harborfreight.com/cpi/ctaf/Displayitem.taf?itemnumber=551>
3. Socket Wrench Set- Informally known as a ratchet set. Try to buy a kit with an extender (a long bar that fits into the socket wrench itself and whatever bit you choose), and an additional nut driver-esque handle (called a spinner handle). There are short and deep sockets <http://www.acehardware.com/product/index.jsp?productId=3055904>
4. Crescent Wrench- Adjustable, good for getting a grip in awkward spots
<http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100045998>
5. Nut Drivers- As with the wrenches, I'd buy two sets of these
http://www.amazon.com/Xcelite-HS-6-18-Xcelite%C2%AE-Hs-6-18/dp/B000B6045E/ref=sr_1_34?ie=UTF8&s=hi&qid=1218994402&sr=1-34
6. Diagonal Pliers- For cutting and trimming; I've seen 8" and 6" handles but I don't see much of a difference
<http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100090896>
7. Tongue and Groove Pliers- Adjustable pliers
http://www.channellock.com/acb/stores/1/category.cfm?SID=1&Category_ID=3

8. Slip Joint Pliers- Adjustable pliers
http://www.channellock.com/acb/stores/1/category.cfm?SID=1&Category_ID=3
9. Long Nose Pliers- Informally needlenose pliers. Invest in both the large and small pair
http://www.channellock.com/acb/stores/1/3017_-8_inch_Long_Nose_Plier_P60C11.cfm
10. Lineman's Pliers- Also for cutting and grabbing
http://www.channellock.com/acb/stores/1/3047_-7_inch_Linemen_s_Plier_P99C8.cfm
11. Locking Pliers- Adjustable, and like the name suggests, they hold their position when you grip them. They have a few different sizes (5", 7" 10") and it would be good to get a small and large pair, and a long nose. Also known as vise grips
<http://www.irwin.com/irwin/consumer/jhtml/detail.jhtml;jsessionid=OZCGPGBABHKIQCOIUBSCHPQKBCQHJCK?prodId=IrwinProd100304&search=false>
12. Wire Cutter/Crimper- I'd recommend getting the style shown here, which has wire cutters, strippers, and crimpers all in one tool http://www.amazon.com/8-4-Way-Crimping-Tool/dp/B000NY326W/ref=sr_1_25?ie=UTF8&s=hi&qid=1218998241&sr=1-25
13. Hex Keys- Also known as Allen keys, Allen wrenches, hex head, etc. Get a large and a small folding set (large and small referring to the size of the keys) <http://hand-tools.hardwarestore.com/22-413-allen-wrench-sets-folding/gorilla-grip-hex-key-set-255471.aspx>
14. Ball Peen Hammer- You rarely, if ever, use nails in robot construction, so a ball peen hammer is a better bet than a claw hammer (the one with the forked end). The hemisphere half can be used to make a hole smaller http://www.amazon.com/Vaughan-S308-8-Ounce-Hickory-Handle/dp/B0002IGHBG/ref=sr_1_4?ie=UTF8&s=hi&qid=1218999254&sr=1-4
15. Mallet- Unlike a hammer, a mallet deforms when you strike an object. Good for knocking things into place http://www.amazon.com/Malco-WM502-Wood-Mallet/dp/B000E242QW/ref=sr_1_1?ie=UTF8&s=hi&qid=1218999713&sr=1-1
16. Flex Steel Rule- A 12" rule should be fine <http://www.amazon.com/General-Tools-1216-12-Inch-Stainless/dp/B00004T7SR>
17. Tape Measure- A handy measuring tool http://www.amazon.com/Stanley-33-425-Powerlock-25-Foot-Measuring/dp/B00002X2GQ/ref=sr_1_1?ie=UTF8&s=hi&qid=1219000103&sr=1-1
18. Dial Caliper- For very accurate measurements, a dial caliper can be used to both measure and mark pieces using the sharp jaws
http://www.kurtworkholding.com/precision/dial_calipers.php
19. Scriber- Not necessary, but it's helpful for marking metal
<http://www.amazon.com/gp/offer-listing/B001C6RMLQ?ie=UTF8&condition=new&tag=nexttag-tools-tier4-20&creative=380345&creativeASIN=B001C6RMLQ&linkCode=asm>

20. Phillips Screwdriver- Has a plus-sign like point. Our team has a small, medium, and large (stubby, #1, #2) <http://www.sjgreatdeals.com/sty60002.html>
21. Flathead Screwdriver- Has a wedge point. We also have a small, medium, and large <http://www.home-technology-store.com/detail.aspx?ID=1100> (you might be best off buying a set of Phillips and flathead screwdrivers)
22. Files- This is a good guide to files http://www.cooperhandtools.com/brands/nicholson_files/Nicholson%20Guide%20To%20Filing%202006.pdf, the basic levels of coarseness are rough, bastard/second-cut, and smooth. There are half round files and flat files <http://www.pferdusa.com/products/201/20112/index.html>
23. Deburring Tool- For removing burrs and cleaning holes. A countersink deburrer is used for holes, while one with a swivel blade can be used for holes and edges <http://www.deburringtools.com/deburringtoolswithhandles.html> (swivel blade) <http://www.blueskyaviation.net/countersink.html> (countersink)
24. Tin Snips- Good for cutting through sheet metal and trimming things <http://www.klenktools.com/Main/Products/SmoothBladeSnipsNew.asp>
25. Digital Multimeter- Testing the voltage of certain things (like batteries) and the continuity of wires. This is the model we use <http://www.multimeterwarehouse.com/mas830lf.htm>
26. T-Handle Reamer- For making holes smoother and larger <http://www.kk.org/cooltools/archives/000632.php>
27. Center Punch- Center punching a piece of metal helps to guide a drill bit into the exact spot where you want a hole. It's important to try and do this before drilling any piece of metal <http://www.widgetsupply.com/page/WS/PROD/center-punch/BCX33>
28. Bench Vise- Holds materials while you drill into them, file them, etc. Really useful and important to have; the best ones bolt onto a table, but a portable one works fine http://www.northerntool.com/webapp/wcs/stores/servlet/product_6970_23993_23993
29. Adjustable C-Clamp- For holding things together, to a work surface, or in place. I'd get two or three of these <http://www.acehardware.com/product/index.jsp?productId=2813029&cp=2568450.2628092.2628095&parentPage=family> (this is a six pack)
30. Soldering Iron- Solder provides both a physical and electrical connection for wires, and it's a necessary tool for wiring certain motors <http://www.amazon.com/Weller-WLC100-Soldering-Station-Hobbyist/dp/B000AS28UC>
31. Two-speed Drill- One of the most useful power tools around. Bosch drills are pretty reliable. Cordless drills are more convenient for most jobs, but they require buying batteries and battery chargers <http://bosch.cpotools.com/drills/3-8- and 1-2- drills/cordless 3-8- and 1-2- drills/34612.html>
32. Drill Bits- For your first build season, two packs of common drill sizes like these should suffice

<http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100520893&N=10000003+90401> Or, you could go for a complete set http://www.wttool.com/product-exec/product_id/23841/nm/115_Piece_Jobber_Drill_Set_USA

33. Jig Saw- Cuts through metal
http://www.northerntool.com/webapp/wcs/stores/servlet/product_6970_200205674_200205674
34. Dremel + Dremel Kit- A great multi-purpose tool for cutting, sanding, drilling, etc.
<http://www.dremel.com/en-us/Tools/Pages/ToolDetail.aspx?pid=Variable+Speed+MultiPro>
<http://www.dremel.com/en-us/AttachmentsAndAccessories/Pages/AttachmentsDetail.aspx?pid=707-03> (there are a couple of dremel accessory kits, your choice on the kind of attachments you want)
35. Chain Puller- You'll likely be using chain to transfer power from your motors to your wheels, and this is one of the tools you need to work with chain
http://www.alibaba.com/product-free/11678878/Chain_Puller.html
36. Chain Breaker- The other main tool you need to work with chain
<http://www.mfgsupply.com/m/c/32-1733.html?id=8FhNqFwz>
37. Hacksaw- With some effort, you can cut through nearly every kind of metal. For things like this (jig saw, dremel, other cutting tools, reciprocating saw), it might be good to buy a replacement blade or two <http://www.mkmorse.com/hackf.html>
38. Reciprocating Saw- Informally known as the "sawzall" because it can cut through most anything, this is a great tool to have both in your lab and at competition
http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&productId=100041044&langId=-1&catalogId=10053&ci_sku=100041044&ci_src=14110944&cm_mmc=1hd.com2froogle_-product_feed_-D25X_-100041044
39. Angle Grinder- Another heavy-duty cutter like the reciprocating saw, this cuts through steel easily, which is good when outfitting your robot with axels (wear gloves with this)
<http://www.amazon.com/Makita-9557PB-2-Inch-Grinder-Paddle/dp/B0009OR8XO>
40. Sawhorse- It's good to have two of these around, that way, you can test out your robot's drivetrain safely by elevating the chassis off of the ground. If it's too much to spend, a couple of wooden planks also work
<http://www.acehardware.com/product/index.jsp?productId=1443104&cp=2568450.2628084.1259459&parentPage=family>
41. Goggles- The ones you have in your chemistry lab should be fine. Just be sure that you have pairs that you can take with you to competition, as you are required to have your own goggles in the pits
42. Masking tape, electrical tape, duct tape

43. Though the Kit of Parts varies from season to season, many of the things you'll find in this list will be present in the 2009 kit
http://www.usfirst.org/uploadedFiles/Community/FRC/FRC_Documents_and_Updates/2008_Assets/Manual/10%20-The%20Kit%20of%20Parts-RevB.pdf
44. Tap/Die Set- Taps are used to make threads on the inside of a hole, while dies are used to put threads onto a rod or axel
<http://www.toolking.com/products/3110104.aspx?googlebase=53305>
45. Tap Ease- When using a tap or a die, it's important to lubricate the piece you're cutting
http://www.wttool.com/product-exec/product_id/6181/nm/Tap_Ease
46. Combination Square- Good for measuring and checking if edges you've cut are square
http://www.wttool.com/product-exec/product_id/6181/nm/Tap_Ease
47. Pry Bar- A handy tool to have around the lab for removing parts that just won't come out
http://www.wttool.com/product-exec/product_id/9605/nm/Pry_or_Jimmy_Bar
48. Pop Riveter- Permanently fastens thin pieces of metal to each other
<http://www.emhart.com/pdf/manuals/PS15%20manual.pdf> (you need to buy some blind rivets)