

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

5 KIT OF PARTS

Please check the FIRST web site and Team Updates for changes to the Kit of Parts list.

Kit of Parts

Bearings			
<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Flange, Two Bolt Self-Aligning, 40MST	Fits 1/2" Bearing	8	The Torrington Company
Radial Ball Bearing, S7KDD, with Shields	5/8" I.D. - 1.375 OD - .344 Width	12	The Torrington Company
Radial Ball Bearing With Spherical O.D., RA008RRB	1/2" I.D., Self Locking Collar	4	The Torrington Company

Control System			
<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Optical Sensor		3	Banner Engineering Corporation
Yaw Rate Sensor		1	BEI Systron Donner Inertial Division
Connector for Yaw Rate Sensor	3 pin, 24 AWG x 12" cable	1	Delphi Packard Electric Systems
15-Pin Molded Cable	DB15 pin M-M, 6 feet	2	Innovation First, Inc
9-Pin Cable	DB9 Male to Female, 6', Shielded	4	Innovation First, Inc
Flightstick Joystick	7" Cable with Male DB15	2	Innovation First, Inc
Operator Interface		1	Innovation First, Inc
Power Supply for Operator Interface	9 Vdc	1	Innovation First, Inc

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

PWM/Relay Cable	Hitec/JR-style, 36" Long	8	Innovation First, Inc
PWM/Relay Y Cable	Hitec/JR-style, 24" Long	2	Innovation First, Inc
Radio Modem for Operator Interface	RS-422, 9 pin F, metal antenna	1	Innovation First, Inc
Radio Modem for Robot Controller	RS-422, 9 pin F, rubber antenna	1	Innovation First, Inc
Relay Module (Spike)	12V, 20A Max	4	Innovation First, Inc
Robot Controller		1	Innovation First, Inc
Servo	42 oz./in. peak torque, 0.19 sec./60°	2	Innovation First, Inc
Speed Controller (Victor 884)		4	Innovation First, Inc
15-Pin Solder Cup Connector	DB15 Female	2	TYCO Electronics Foundation
25-Pin Solder Cup Connector	DB25 Male	2	TYCO Electronics Foundation
Plastic Shield for 25-Pin Connector	fits DB25 Connector	2	TYCO Electronics Foundation

Documentation

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty Kit</u>	<u>Product Supplier</u>
Anderson Power Products Catalog	Catalog	1	Anderson Power Products

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

FedEx Airbills		3	FedEx
FedEx Envelope - Introduction Letter		1	FedEx
Manual - 2003 FIRST Robotics Competition		1	FIRST
Video, Compilation of Past Competitions	Video	1	FIRST
McNichols, Catalog, Stickers, Rulers	Catalog and trinkets	1	McNichols Company
Magazine, Nut and Volts		1	Nuts and Volts

Electrical

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty Kit</u>	<u>Product Supplier</u>
Quick-Disconnect Power Connector (with 1' leads)	#6 AWG Red/Black Wire, pair	2	Anderson Power Products
1 Conductor Wire	35', #10 AWG, Red	1	BICC General
1 Conductor Wire	35', #10 AWG, Black	1	BICC General
2 Conductor Jacketed Wire	35', #16 AWG	1	BICC General
2 Conductor Jacketed Wire	30', #24 AWG	1	BICC General
3 Conductor Shielded Wire	30', #24 AWG	1	BICC General

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

3 Conductor Shielded Wire	20', #24 AWG	1	BICC General
LED, Panel Mount	Green, 12V	2	Chicago Miniature Lamp, Inc.
1 Conductor Wire	10', #6 AWG, Black	1	Delphi Connection Systems
1 Conductor Wire	10', #6 AWG, Red	1	Delphi Connection Systems
Maxi Block, Base, 1 of 4 pieces	Use maxi-style circuit breakers only; base, insert, fuse block, bolt	1	Delphi Connection Systems
Maxi Block, Fuse Block, 8 Position; With 4 Wires; 1 of 4 pieces	Use maxi-style circuit breakers only; base, insert, fuse block, bolt	1	Delphi Connection Systems
Maxi Block, Insert, 8 Position, 1 of 4 pieces	Use maxi-style circuit breakers only; base, insert, fuse block, bolt	1	Delphi Connection Systems
Muffin Fan (Large)	12 Vdc	1	EBM Industries
Muffin Fan (Tiny)	12 Vdc	5	EBM Industries
Battery	12 volt, 18 AH Deep Cycle Non-Spillable	2	Exide Technologies
Maxi Block, Bolt, 20mm Flanged, With Yellow Zinc Plating, 1 of 4 pieces	Use maxi-style circuit breakers only; base, insert, fuse block, bolt; 20mm flanged, with yellow zinc plating	1	Fastenal
Helical Plastic Wire Wrap	1/4" Ø x 24"	1	Helleman Tyton
Helical Plastic Wire Wrap	1/2" Ø x 24"	1	Helleman Tyton

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Breaker, Buss, Ckt Breaker / Disconnect Switch	120A , automotive style	1	Innovation First, Inc
Breaker Panel	ATC, 100A, max	2	Innovation First, Inc
Snap-Action Circuit Breaker	30 amp, 12 volt, Auto-Resetting	7	Innovation First, Inc
Snap-Action Circuit Breaker	20 amp, 12 volt, Auto-Resetting	5	Innovation First, Inc
Snap-Action Circuit Breaker	40 amp, 12 volt, Auto-Resetting	4	Innovation First, Inc
Revolving Light, Taiwan	with red and blue lenses	1	Juluen Enterprise Co., Ltd (Taiwan)
Battery Charger, Automatic	6A.	1	Midtronics (Exide spinoff)

Fasteners

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Velcro grip tie (2 in a pack)	6"x 1"	1	Helleman Tyton
Velcro Grip Ties	8" x 1.75"	2	Helleman Tyton
Velcro 18" One Wrap grip tie	1"x18" grip tie White	2	Velcro USA, Inc.

Field Components

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Ramp Surface Material, Kit Sample, 12" x 18"	Carbon steel wire cloth, 1" mesh, .118 wire diameter	1	McNichols Co.

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

High-Density Polyethylene (HDPE)	6" x 6" x 1/4" kit sample; this is thinner than the platform material but is to demonstrate the surface	1	Plastic Supply
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Motors & Pumps

Part Name/Description	Dimensions	Qty/Kit	Product Supplier
Screw, Left-Hand for Bosch 1/2" Drill Drive Assembly		2	ADM Tool
(MM) Spacer, Steel	Spacer for 2" x 4" material; 0.277 ID; 0.375 OD; 1.75" long	4	AM Industries
Motor, Van Door, Bosch	12 Vdc, 75 RPM	1	Bosch Automotive
Motor, CIM (aka Chiaphua or Atwood), 8mm keyed output shaft	8mm keyed output shaft	2	CCL Industrial Motor, LTD
Coupler to Nippon-Denso Motor Gear	Injection molded	2	DEKA
Nippon-Denso Motor, Window, Right		2	Denso International America, Inc.
(MM), Bolt, Motor Mount, 1/4-20 x 1"; 307AHB 1/4-20 x 1Z	Bolt	1	Fastenal
(MM), Bolt, Motor Mount, 1/4-20 x 2.5"; 307AHB 1/4-20 x 2-1/2Z	Bolt	1	Fastenal
(MM), Bolt, Motor Mount, 10-32 x 2"; SHCS 10-32 x 2	Bolt	1	Fastenal
(MM), Nut, Motor Mount, 1/4-20; NYLOCK NE 1/4-20Z	Nuts	1	Fastenal
(MM), Nut, Motor Mount, 10-32; NYLOCK NM 10-32Z	Nuts	1	Fastenal

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

(MM), Washer, Motor Mount, 1/4-20; SAE F/W 1/4Z	Washers; washer under bolt head and nut	1	Fastenal
(MM), Washer, Motor Mount, 10-32; SAE F/W (#10) Z	Washers, washer under bolt head and nut	1	Fastenal
Fisher-Price 10 Web Jeep Driver	Black	2	Fisher-Price, Inc.
Motor/Gearbox, Fisher-Price	12 Vdc stall torque (mNm) 532.19+/- 10% 21T #7 Gearbox	2	Fisher-Price, Inc.
Motor, Globe, with Drive Assembly	12Vdc	2	Globe Motors
Mount for 1/2" Drill Motor	Injection molded	2	NYPRO, Inc
Drill Drive Assembly (Transmission), 1/2"	2 Speed -12.07:1 & 42.62:1 Gear Ratios	2	S-B Power Tool
Motor Assembly, 1/2"	0.87Nm @ 127A stall, 19670RPM No-Load	2	S-B power Tool Co.

Other

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Reflexite, retroreflective, 1" wide x 6" long	This was bought in 2002 and we have enough for 2003	1	Reflexite

Pneumatics

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Pneumatics Kit, 0-160psi Gauge for Norgren Regulator, Norgren		3	Various
Pneumatics Kit, 1/4" OD Tubing, SMC	20 meters	1	Various

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Pneumatics Kit, Adaptor 1/4" Female to 1/8" Male, Parker		6	Various
Pneumatics Kit, Bushing 1/8" Female to 1/4" Male, Parker		12	Various
Pneumatics Kit, Compressor, Thomas		1	Various
Pneumatics Kit, Cylinder, Parker	1.5" bore x 8" stroke, rear pivot mount	1	Various
Pneumatics Kit, Double Solenoid Base Ported Valve, SMC		2	Various
Pneumatics Kit, Fitting, 90 Elbow 1/4" Tube, SMC		20	Various
Pneumatics Kit, Fitting, Male Run T 1/8 NPT ~ 1/4" Tube, SMC		5	Various
Pneumatics Kit, Fitting, Straight 1/4" Tube, SMC		20	Various
Pneumatics Kit, Fitting, Tee Union 1/4" Tube, SMC		5	Various
Pneumatics Kit, Flow Control, SMC		6	Various
Pneumatics Kit, Hex Nipple 1/8" NPT, Parker		6	Various
Pneumatics Kit, Main Regulator with 60psi Max Output, Norgren		1	Various
Pneumatics Kit, Manual 2-Way Plug Valve, Parker		1	Various

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Pneumatics Kit, Pivot Bracket Set, Cylinder, Parker		1	Various
Pneumatics Kit, Plug 1/4", Parker		6	Various
Pneumatics Kit, Plug 1/8", Parker		6	Various
Pneumatics Kit, Pressure Switch Opens @ 115psi; Closes @ 95psi, Nason		1	Various
Pneumatics Kit, Regulator Mounting Bracket and Nut, Monnier		1	Various
Pneumatics Kit, Regulator Mounting Bracket and Nut, Norgren		1	Various
Pneumatics Kit, Relief Valve, 120psi, Norgren	120psi	1	Various
Pneumatics Kit, Rod Clevis, Cylinder, Parker		1	Various
Pneumatics Kit, Secondary Pneumatic Regulator, Monnier		1	Various
Pneumatics Kit, Teflon Tape, 1/4" x 100'		1	Various
Pneumatics Kit, Union Tee, Parker		4	Various
Pneumatics Kit, Valve Kit, Solenoid, With Fittings, Festo		1	Various
Pneumatics Kit, Vibration Isolators for Compressor, Lord Corp		1	Various

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Pneumatics Kit, Volume Tank, Clippard	16 cu. in., 2" x 8"	2	Various
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Rods & Shafts

Part Name/Description	Dimensions	Qty Kit	Product Supplier
(GB) Spacer, Steel	Spacer for 2" x 4" material; 0.277 ID; 0.375 OD; 1.75" long	8	AM Industries
Gear, 1" Helical, 5/8" Keyed Bore, Right Hand		2	Boston Gear
Gear, 2" Helical, 5/8" Keyed Bore, Right Hand		2	Boston Gear
Key Stock, Metric	Metric key stock; fits the shaft on the Chiaphua motor only; 0.079" x 0.094" x 1"	2	CCL Industrial (Chiaphua)
Coupling, 1/2" Drill Motor, Aluminum, accepts 1/2" Drill Shaft, 1" Hex OD	Fabricated for FIRST; aluminum; part of a 3-piece assembly for 1/2" Skil-Bosch	2	ComTech
Coupling, 1/2" Drill Motor, Aluminum, accepts 5/8" Keyed Shaft, 1" Hex OD	Fabricated for FIRST; aluminum; part of a 3-piece assembly for 1/2" Skil-Bosch	2	ComTech
Coupling, Aluminum, accepts 8mm Chiaphua Shaft, 1" Hex OD	Fabricated for FIRST; aluminum; part of a 3-piece assembly for 8mm Chiaphua shaft	2	ComTech
Pillow Block	Manufactured for FIRST, aluminum, accepts bearing for 5/8" shaft	4	ComTech
Coupling, Plastic, Round, 1/2" Skil-Bosch, Accepts 1" Hex Both Sides	Fabricated for FIRST; plastic; part of a 3-piece assembly for 1/2" Skil-Bosch	2	DEKA
Coupling, Plastic, Round, Chiaphua, Accepts 1" Hex Both Sides	Fabricated for FIRST; plastic; part of a 3-piece assembly for 8mm Chiaphua shaft	2	DEKA
Flexible Shaft Coupling	Black	2	DEKA

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Worm Gear Actuator-Left Hand	2 inch linear movement	1	Excellence Manufacturing, Inc.
Worm Gear Actuator-Right Hand	2 inch linear movement	1	Excellence Manufacturing, Inc.
(GB), Bolt, 307AHB 1/4-20 x 6.5Z, Hex Head	For gear box	1	Fastenal
(GB), Nut, NYLOCK NE 1/4-20Z	For gear box bolts	1	Fastenal
(GB), Washer, Belleville (Disc Spring)	1.250 x 0.630 x 0.0400; for preloading in the gear box; Gardiner Spring 800-331-3263; come in pkg of 12	5	Fastenal
(GB), Washer, Flat, 1/4" Hole, USS F/W 1/4Z	Washer for gearbox fastening bolts	1	Fastenal
Retaining Rings for 5/8" Keyed Shaft		1	Fastenal
Fisher-Price Axle	7/16" \varnothing x 26"	1	Fisher-Price, Inc.
Shaft, 5/8" Keyed	5/8" keyed x 36"	1	G & G
Flexible Motor Shaft	13.5" Long, Fits Seat Motor	2	Grand Rapids Controls
Key Stock, 3/16" x 12"	3/16" key stock; fits 5/8" shaft but not the 1" or 2" gears	1	ITW Bee Leitzke
Key Stock, Step, 1/8"+3/16" x 12"	1/8" and 3/16" step key stock; the 1/8" side fits the 1" and 2" gears; the 3/16" side fits the 5/8" shaft; 12" piece	1	ITW Bee Leitzke
Lead Screw w/ Nut	12" Long	1	Kerk Motion Products, Inc.

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Coupling, Aluminum, Solid, 1" Hex OD, 3" Long	Commercially available; aluminum; part of a 3-piece assembly for 8mm Chiaphua shaft	2	Northstar Steel and Aluminum, Inc
Shaft, DGP (drawn, ground, polished)	5/16" Ø x 18" TGP	1	Northstar Steel and Aluminum, Inc
Shaft, DGP (drawn, ground, polished)	1/2" Ø x 18" TGP	1	Northstar Steel and Aluminum, Inc.
(GB), Gearbox, Clamping Plate for 2" x 4" Frame (can be used on smaller stock)	Injection Molded	2	Nypro
(GB), Gearbox, Pillow Block Half	Injection Molded	8	Nypro
(GB), Gearbox, Pillow Block Mounting Plate, Used in Pairs	Injection Molded	4	Nypro
(GB), Spacer, Pipe, for Gear Box	0.652 ID; 0.75 OD; 0.049 wall x 24"; teams can cut it into lengths of their choice	1	Yarde Metals

Software

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty Kit</u>	<u>Product Supplier</u>
3D Studio Max 5, Autodesk	Includes Character Studio - see separate record	1	Autodesk
Animations from 2002 Season, Autodesk	1 DVD	1	Autodesk
Character Studio, Autodesk	Included with 3D Studio Max 5	1	Autodesk
Inventor Series 6, Autodesk	Includes Mechanical Desktop - see separate record	1	Autodesk
Manufacturing Education Curriculum 2002 for Autodesk 5.3 and Autodesk Streamline, Autodesk	1 CD	1	Autodesk

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Mechanical Desktop, Autodesk	Included with Inventor Series 6	1	Autodesk
Training Booklet and CD, Inventor Series 6, Autodesk	1 CD	1	Autodesk
FileMaker Pro		1	FileMaker
Microsoft, Front Page		1	Microsoft
Microsoft, Project		1	Microsoft
Microsoft, Visual Studio Net		1	Microsoft

Springs

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product Supplier</u>
Spring, Compression	Yellow	6	Associated Spring Raymond
Spring, Compression	Silver	6	Associated Spring Raymond
Spring, Compression	Blue	1	Associated Spring Raymond
Spring, Compression	Small Silver	8	Associated Spring Raymond
Spring, Compression	Small Brass	4	Associated Spring Raymond
Spring, Compression	Med. Brass	7	Associated Spring Raymond

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Spring, Compression	Med. silver	6	Associated Spring Raymond
Spring, Extension	Black	3	Associated Spring Raymond
Spring, Extension	Small Silver	6	Associated Spring Raymond
Latex Tubing	1/4" I.D., 3/8" O.D., 5'	2	Kent Elastomer

Structural

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product/Supplier</u>
(TR) Spacer, Steel	Spacer for 2" x 4" material; 0.495 ID; 0.625 OD; 1.75" long	4	AM Industries
(TR), Nut, NYLOCK NE 3/8-16Z	3/8" nut for threaded rod	1	Fastenal
(TR), Washer, Flat, 3/8" Hole, USS F/W 3/8Z	Flat washer for 3/8" threaded rod	1	Fastenal
Frame, 2" x 4" Extruded Aluminum	2" x 4" x 36"	2	Hadco
Pipe, 1" Aluminum	1" x 24" schedule 40	2	Hadco
(TR), Threaded Rod, 3/8"	3/8" Ø x 36", 20 Pitch Coarse Thread	2	Northstar

Wheels

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Qty/Kit</u>	<u>Product/Supplier</u>
Wheel, 9", Skyway	5/8" keyed hub	2	Skyway Recreation Products

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Kit of Parts

Wheel, Wheelchair, 6"	6" Ø, 5/16" I.D. Bearings, 1-1/2" Wide Flange	2	Skyway Recreation Products
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THE 2003 FIRST ROBOTICS COMPETITION MANUAL

6 RESTRICTED PARTS LIST

Electronics	
Additional Electronic Components	Up to \$200 (U.S.) worth from Future FAI or Digi-Key. No individual part cost > \$100.
DB15 M-M Cable	6' Length, Up to 2
Diode for Double Solenoid Valves	P/N: 1N4001, 1A Max, up to 4
Insulated Electrical Connectors	Any amount/size, off-the-shelf, proper gauge/current rating
Joystick, Steering Wheel, or Pedals	15 pin (not USB) PC interface, up to 6
Optical Sensor	Banner Engineering part # QS18VN6LV, any quantity
Potentiometer	Any amount, 100k Ohms, linear taper
PWM/Relay Cable	Hitec/JR-style, 36" Long, Any Amount
PWM/Relay Y Cable	Hitec/JR-style, Any Amount
Relay Module (Spike)	Any amount - when used per rules
Snap-Action Circuit Breaker	30 amp, 12 volt, Auto-Resetting, Any Amount - when used with Speed Controller
Snap-Action Circuit Breaker	20 amp, 12 volt, Auto-Resetting, Any Amount
Speed Controller (Victor 883)	Any amount - when used with motor
Speed Controller (Victor 884)	Any amount - when used with motor
Switches	Any amount, off-the-shelf, non-powered
Terminal Blocks	Any amount, off-the-shelf, proper gauge/current rating
Wire	Proper gauge, color & insulated
Wire Nuts	Any amount
Energy Sources	
None	See Rule M11

THE 2003 FIRST ROBOTICS COMPETITION MANUAL

Exotic Materials	
Beryllium	None allowed
Carbon-Fiber	None allowed
Ceramics not used as electrical insulators (Ceramics as insulators are ok)	None allowed
Semi-Precious Jewels	None allowed
Titanium	None allowed

Pneumatics/Hydraulics	
Air Cylinder	From Custom Cylinder Order Form, up to 3
Suction Cup	Off-the-shelf or custom, any manufacturer, any quantity, any size

Springs	
Latex Tubing used as a spring (latex tubing not used as a spring is not restricted)	Off-the-shelf, any manufacturer, any quantity, 1/4" ID x 3/8" OD, see Rule S9 in the Game section
Springs	Off-the-shelf from MSC or Small Parts, any quantity, any size, see Rule S9 in the Game section

Traction Devices	
Belts used as treads (belts not used as treads are not "traction devices")	Any manufacturer, any quantity, any size, see Rule M17
Wheels	Any manufacturer, any quantity, any size, see Rule M17