Bill of Materials (BOM)

TEAM 8027



What is a BOM?

- BOM refers to a Bill of Materials. There is a link to the file from inside the Game Manual.
- Every team must submit one to their Inspector at each event.
- It is a spreadsheet that documents all the expenses on your robot
- The total cost of all items on the robot cannot exceed \$5000
- No individual item may also exceed \$500
- There are detailed rules about how to account for fabrication
- Read the rules in Section 9.4 of the Game Manual
 (https://firstfrc.blob.core.windows.net/frc2020/Manual/2020FRCGameSeasonManual.pdf)
- [Rookie Tip] It is unlikely that a rookie team using the Kit of Parts is likely to exceed the \$5000 limit, but be sure you still have the BOM filled out before Inspection

BOM Template from FIRST

| This is a sample Bill of Material (BOM) for use in the FIRST ^(R) Robotics Competition. All parts required by 16 should be entered into the BOM. The BOM helps Inspectors verify part use and | | | | | | | | | | | |
|---|--|-------------------------|---|-----------------|-------------------|--------------------|------------------|--|--|--|--|
| legality on robots. Teams do not have to report individual COTS items that are less than \$5 USD each, are 2020 Kit of Parts items, or a re a specific exempt item (see R11). 2020 FIRST Robotics Competition Bill of Materials | | | | | | | | | | | |
| Team Name: Event: | | Team #: City: | | Date: State: | | | | | | | |
| <u>Item</u> | <u>Description</u> | <u>Material</u> | Source | Quantity | Measurement | Unit Price | Total Price | | | | |
| Major System Names Here | Describe the Part (Axle, Bearing, Lifter, Solenoid) | What is it made from | Where did you buy it (Home Depot, AndyMark, Supply House, Etc.) | How Many | Piece, Inch, Etc. | Cost Per Unit (\$) | | | | | |
| Subsystem 1: | | | | | | | #0.00 | | | | |
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| | | | | | | Subtotals: | \$0.00 \$0.00 | | | | |
| Subsystem 3: | | | | | | Subtotais. | \$0.00 | | | | |
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| | | | | | | Subtotals: | \$0.00 | | | | |
| Subsystem 4: | | | | | | | 10.00 | | | | |
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| | | | | | | Totals: | \$0.00 | | | | |

- Download the BOM template from FIRST
- 2020: https://firstfrc.blob.core. windows.net/frc2020/Aux Files/2020BillofMaterial-Template.xlsx
- [Rookie Tip] The BOM
 requires a fair bit of
 detail. It is important for
 the team to remember
 where you purchased
 the parts and the cost.
 Don't wait until the last
 day.

Sample BOM: FRC 2363

| | | | 2020 | D FIRST Robotics Compet | ition | | | | | | |
|--|-------------------|--|-------------------------------|--|------------|-------------------------------|------------|------------|-------------|-----------------------------|------------------------------|
| | | | 2020 | Bill of Materials | | | | | | | |
| Team Name: | | Triple Helix | Team #: | 2363 | | | | Date: | 2/28 | /2019 | |
| Event: 2020 FIRST Chesapeake District - Haymarket VA event | | City: | Newport News | • | | | State: | | /A | | |
| | | | | | | | | | | | |
| Major Subsystem | Component | Describe the Part | What is it made from | Where did you buy it (Home Depot, AndyMark, | | Actually | КОР | ВОМ | Piece, | Cost Per | |
| Names Here | Туре | (Axle, Bearing, Lifter, Solenoid) | | Supply House, Etc.) | | used | quantity | quantity | Inch, Etc. | Unit (\$) | |
| Subsystem | Туре | <u>Description</u> | <u>Material</u> | Source | Part # | Qty <u>Use</u> <u>d</u> | Qty KOP | Qty BOM | <u>Unit</u> | <u>Unit</u> <u>Price</u> | <u>Total</u> <u>Price</u> |
| General materials | Aluminum stock | Drive rails, telescope upright | Tube 2x1-1/2x1/8" 6061-T6 | OnlineMetals | - | 6.8 | 0.0 | 7.0 | FT | \$ 6.65 | \$ 46.52 |
| General materials | Aluminum stock | Intake pivot uprights | Tube 2x1x1/8" 6061-T6 | OnlineMetals | - | 0.7 | 0.0 | 1.0 | FT | \$ 5.37 | \$ 5.37 |
| General materials | Aluminum stock | Inntake pivot reinforcements | Tube 2x2x1/8" 6061-T6 | OnlineMetals | - | 0.7 | 0.0 | 1.0 | FT | \$ 9.07 | \$ 9.07 |
| General materials | Aluminum stock | Ladder bars, intake torsion bar | Tube 2x1x1/16" 6061-T6 | OnlineMetals | - | 6.8 | 0.0 | 7.0 | FT | \$ 2.61 | \$ 18.28 |
| General materials | Aluminum stock | Shooter tube axle | be 1" OD x 0.065" wall 6061- | OnlineMetals | - | 0.4 | 0.0 | 1.0 | FT | \$ 7.43 | \$ 7.43 |
| General materials | Aluminum stock | Bumper corner angle | ngle 1-1/2x1-1/2x1/8" 6061-T | OnlineMetals | - | 2.0 | 0.0 | 3.0 | FT | \$ 3.01 | \$ 9.04 |
| General materials | Aluminum stock | Bumper latch bracket | Angle 1x1x1/8" 6061-T6 | OnlineMetals | - | 1.5 | 0.0 | 2.0 | FT | \$ 1.81 | \$ - |
| General materials | Aluminum stock | Telescope upright support angle | Angle 1x1x1/16" 6061-T6 | McMaster-Carr | 8982K39 | 1.6 | 0.0 | 2.0 | FT | \$ 1.64 | \$ - |
| General materials | Aluminum stock | | Angle 3/4x3/4x1/16" 6061-T6 | | 8982K56 | 0.5 | 0.0 | 1.0 | FT | \$ 1.56 | \$ - |
| General materials | Aluminum stock | | Angle 1/2x1/2x1/16" 6061-T6 | McMaster-Carr | 8982K54 | 0.2 | 0.0 | 1.0 | FT | \$ 1.04 | \$ - |
| General materials | Aluminum stock | Intake cylinder pivot plates | Bar 3 wide x 1/8 thk 6061-T6 | OnlineMetals | - | 0.8 | 0.0 | 1.0 | FT | \$ 3.64 | \$ - |
| General materials | Aluminum stock | Hex shaft 1/2" | 7075-T6 | VexPro | 217-2753 | 2.4 | 0.0 | 3.0 | FT | \$ 5.00 | \$ 14.99 |
| General materials | Aluminum stock | Thunderhex shaft 1/2" | 7075-T6 | VexPro | 217-4017 | 4.3 | 0.0 | 6.0 | FT | \$ 5.33 | \$ 31.98 |
| General materials | Plastic stock | Bellypan | olycarbonate, 1/8", perforate | AndyMark | am-0836 | 1 | 0 | 1 | EA | \$ 69.00 | \$ 69.00 |
| General materials | Plastic stock | Gearbox | Acetal copolymer 1/4" | McMaster-Carr | 8492K233 | 1.4 | 0.0 | 2.0 | SQ FT | \$ 23.73 | \$ 47.45 |
| General materials | Plastic stock | Magazine sides, bumper backer plates, i | Polycarbonate 1/4" | ePlastics | - | 14.6 | 0.0 | 24.0 | SQ FT | \$ 8.91 | \$ 213.78 |
| General materials | Plastic stock | Wing walls, serializer ramps, magazine | Polycarbonate 1/8" | ePlastics | - | 6.1 | 0.0 | 8.0 | SQ FT | \$ 4.92 | \$ 39.35 |
| General materials | Plastic stock | Hook latch plate, RSL mount, vent valve | | McMaster-Carr | 8574K24 | 0.1 | 0.0 | 1.0 | SQ FT | \$ 4.56 | \$ - |
| General materials | Plastic stock | Intake roller | Tube 1-1/2 OD x 1-1/4 ID PC | McMaster-Carr | 8585K206 | 5.7 | 0.0 | 8.0 | FT | \$ 4.12 | \$ 32.96 |
| General materials | Plastic stock | Magazine rollers, sorter roller | Tube 1-1/4 OD x 1-1/8 ID PC | Amazon | - | 3.1 | 0.0 | 4.0 | FT | \$ 3.66 | \$ 14.65 |
| General materials | Plastic stock | Intake roller hubs, shooter-climber hubs | | Amazon | - | 2.0 | 0.0 | 2.0 | KG | \$ 19.99 | \$ 39.98 |
| General materials | Plastic stock | Telescope outer tube | Square tube 1-3/8" PVC | McMaster-Carr | 85095K76 | 2.4 | 0.0 | 5.0 | FT | \$ 5.17 | \$ 25.85 |
| General materials | Plastic stock | Telescope inner tube | Square tube 3/4" PVC | McMaster-Carr | 85095K67 | 2.2 | 0.0 | 5.0 | FT | \$ 2.32 | \$ 11.59 |
| General materials | Miscellaneous | Plywood 23/32" | Plywood | Lowes | - | 9.1 | 0.0 | 16.0 | SQ FT | \$ 1.41 | \$ 22.48 |
| General materials | Miscellaneous | | Closed-cell polyethylene foam | AndyMark | am-0837 | 25.7 | 18.0 | 7.7 | FT | \$ 0.43 | \$ - |
| General materials | Miscellaneous | Webbing 1 wide | Nylon | Amazon | - | 0.5 | 0.0 | 10.0 | YD | \$ 1.17 | \$ 11.67 |
| General materials | Miscellaneous | Climber one way bearing inner races | Tube 1 OD x 1/2 ID 4130 stee | | 89955K801 | 0.1 | 0.0 | 1.0 | | \$ 25.35 | \$ 25.35 |
| General materials | Power transmissic | Chain #25 | Steel | Diamond Chain Company | X-1189-010 | 8.8 | 0.0 | 10.0 | FT | \$ 13.99 | \$ 139.90 |
| General materials | Power transmissic | Chain 25H | Steel | VexPro | 217-2775 | 0.8 | 0.0 | 20.0 | FT | \$ 1.20 | \$ 23.98 |
| General materials | Power transmissic | Flat belting 3/32 thk x 1 wide | Polyurethane | McMaster-Carr | 6075K15 | 5.2 | 0.0 | 6.0 | FT | \$ 4.08 | \$ 24.48 |
| Drivetrain | Electronic | Talon SRX | - | VexPro | 217-8080 | 2 | 2 | 0 | EA | \$ 89.99 | \$ - |

Source: https://docs.google.com/spreadsheets/d/le-QDjoLRXIUStmRFy4l8-R2gZZbercMC_56jADxp0fc/edit#gid=1234046063

Sample BOM: FRC 2363

| Drivetrain | Electronic | Talon SRX | - | VexPro | 217-8080 | 2 | 2 | 0 | l EA | \$ 89.99 \$ - |
|------------|--------------------|--|----------------------|--------------------------|-----------------|---|---|---|------|---------------------|
| Drivetrain | Electronic | Victor SPX | - | VexPro | 217-9191 | 4 | 4 | 0 | EA | \$ 49.99 \$ - |
| Drivetrain | Electronic | Talon SRX Universal Breakout | - | AndyMark | am-3281 | 2 | 0 | 2 | EA | \$ 15.00 \$ 30.00 |
| Drivetrain | Motor | Mini CIM | - | VexPro | 217-3371 | 6 | 1 | 6 | EA | \$ 29.99 \$ 179.94 |
| Drivetrain | Sensor | Optical encoder | - | US Digital | S4T-100-250-S-B | 2 | 0 | 2 | EA | \$ 70.80 \$ 141.60 |
| Drivetrain | Wheel | Pneumatic wheel hub | Aluminum | WestCoast Products | WCP-0049 | 6 | 0 | 6 | EA | \$ 29.99 \$ 179.94 |
| Drivetrain | Wheel | Pneumatic tire, 6 OD, centipede tread a | Rubber | WestCoast Products | WCP-0047 | 2 | 0 | 2 | EA | \$ 14.99 \$ 29.98 |
| Drivetrain | Wheel | Pneumatic tire, 6 OD, street tread | Rubber | ElectricScooterParts.com | TIR-6X1.25P | 4 | 0 | 4 | EA | \$ 14.95 \$ 59.80 |
| Drivetrain | Wheel | Inner tube for tire | Rubber | ElectricScooterParts.com | TUB-6X1.25 | 4 | 0 | 4 | EA | \$ 7.95 \$ 31.80 |
| Drivetrain | Power transmissic | VersaBlock | 6061-T6 | VexPro | 217-5852 | 4 | 0 | 4 | EA | \$ 24.99 \$ 99.96 |
| Drivetrain | Power transmissic | WCP Cam | Sintered steel | VexPro | 217-3431 | 4 | 0 | 4 | EA | \$ 4.99 \$ - |
| Drivetrain | Power transmissic | Sprocket 16T #25 1/2 hex bore | 7075-T6 | VexPro | 217-5833 | 8 | 0 | 8 | EA | \$ 12.99 \$ 103.92 |
| Drivetrain | Power transmissic | Pinion 20DP 12T 8mm keyed bore | Steel | VexPro | 217-3099 | 6 | 0 | 6 | EA | \$ 9.99 \$ 59.94 |
| Drivetrain | Power transmission | Gear 20DP 72T 1/2 hex bore | 7075-T6 | VexPro | 217-3576 | 2 | 0 | 2 | EA | \$ 24.99 \$ 49.98 |
| Drivetrain | Power transmissic | Gear 20DP 28T 1/2 hex bore | Steel | VexPro | 217-5468 | 2 | 0 | 2 | EA | \$ 11.99 \$ 23.98 |
| Drivetrain | Power transmissic | Gear 20DP 56T 1/2 hex bore | 7075-T6 | VexPro | 217-5474 | 2 | 0 | 2 | EA | \$ 19.99 \$ 39.98 |
| Drivetrain | Power transmissic | Clamping shaft collar 1/2 hex, thin | 6061-T6 | VexPro | 217-2737 | 2 | 0 | 2 | EA | \$ 4.99 \$ - |
| Drivetrain | Power transmissic | Flanged bearing 1/2 hex ID x 1-1/8 OD | - | VexPro | 217-3875 | 8 | 0 | 8 | EA | \$ 4.99 \$ - |
| Drivetrain | Power transmissic | Flanged bearing 13.75mm ID x 1-1/8 OI | - | VexPro | 217-4006 | 4 | 0 | 4 | EA | \$ 4.99 \$ - |
| Drivetrain | Power transmissic | Radial bearing 13.75mm ID x 1-1/8 OD | - | VexPro | 217-4270 | 2 | 0 | 2 | EA | \$ 4.99 \$ - |
| Drivetrain | Miscellaneous | VersaFrame T gusset | 5052 | VexPro | 217-3547 | 8 | 0 | 8 | EA | \$ 3.50 \$ - |
| Bumper | Miscellaneous | Snap slide latch | - | Pegasus Auto Racing | 3009 | 8 | 0 | 8 | EA | \$ 2.77 \$ - |
| Bumper | Miscellaneous | Bumper fabric | - | Robopromo | RP-2001.5 | 2 | 0 | 2 | EA | \$ 16.00 \$ - |
| Bumper | Miscellaneous | Bumper numbers | - | Robopromo | RP-2014 | 8 | 0 | 8 | EA | \$ 10.00 \$ 80.00 |
| Intake | Electronic | Talon SRX | - | VexPro | 217-8080 | 1 | 0 | 1 | EA | \$ 89.99 \$ 89.99 |
| Intake | Motor | 775pro | - | VexPro | 217-4347 | 1 | 1 | 0 | EA | \$ 19.99 \$ - |
| Intake | Power transmissic | VersaPlanetary v2 base kit, 1/2" hex out | - | VexPro | 217-4973 | 1 | 0 | 1 | EA | \$ 39.99 \$ 39.99 |
| Intake | Power transmissic | VersaPlanetary ring gear | - | VexPro | 217-2816 | 2 | 0 | 2 | EA | \$ 9.99 \$ 19.98 |
| Intake | Power transmissic | VersaPlanetary 4:1 gear stage | - | VexPro | 217-2818 | 2 | 0 | 2 | EA | \$ 14.99 \$ 29.98 |
| Intake | Power transmissic | Flanged bearing 3/8 ID x 1-1/8 OD | - | AndyMark | am-0573 | 2 | 0 | 2 | EA | \$ 3.00 \$ - |
| Intake | Power transmissic | Flanged bearing 1/2 hex ID x 1-1/8 OD | - | VexPro | 217-3875 | 6 | 0 | 6 | EA | \$ 4.99 \$ - |
| Intake | Power transmissic | Pulley HTD 24t 9mm width 1/2" hex bor | Polycarbonate | AndyMark | am-3403 | 6 | 0 | 6 | EA | \$ 9.00 \$ 54.00 |
| Intake | Power transmissic | Belt HTD 5mm pitch, 9mm width, 70 tee | Neoprene, fiberglass | V-Belt Guys | 350-5M-09 | 2 | 0 | 2 | EA | \$ 2.14 \$ - |
| Intake | Power transmissic | Belt HTD 5mm pitch, 9mm width, 56 tee | Neoprene, fiberglass | V-Belt Guys | 280-5M-09 | 2 | 0 | 2 | EA | \$ 1.84 \$ - |
| Intake | Miscellaneous | Shoulder screw, 3/8 shoulder dia, 1-3/8 | Alloy steel | McMaster-Carr | 91259A483 | 2 | 0 | 2 | EA | \$ 4.58 \$ - |
| Intake | Pneumatic | Cylinder, round body, 3/4" bore x 7" str | - | Bimba | 047-DP | 2 | 0 | 2 | EA | \$ 40.35 \$ 80.70 |
| Sorter | Electronic | Talon SRX | - | VexPro | 217-8080 | 1 | 0 | 1 | EA | \$ 89.99 \$ 89.99 |
| Sorter | Motor | 775pro | - | VexPro | 217-4347 | 1 | 0 | 1 | EA | \$ 19.99 \$ 19.99 |
| Sorter | Power transmission | VersaPlanetary v2 base kit, 1/2" hex out | - | VexPro | 217-4973 | 1 | 0 | 1 | EA | \$ 39.99 \$ 39.99 |
| Sorter | Power transmission | VersaPlanetary ring gear | - | VexPro | 217-2816 | 1 | 0 | 1 | EA | \$ 9.99 \$ 9.99 |
| Sorter | Power transmissic | VersaPlanetary 9:1 gear stage | - | VexPro | 217-3106 | 1 | 0 | 1 | EA | \$ 14.99 \$ 14.99 |
| Sorter | Power transmission | VersaRoller Hub | Glass filled nylon | VexPro | 217-5896 | 4 | 0 | 4 | EA | \$ 3.99 \$ - |
| Sorter | Power transmission | VersaRoller Hub insert. 5/16-18 tapped | 6061-T6 | VexPro | 217-5897 | 3 | 0 | 3 | EA | \$ 3.99 \$ - |

Source: https://docs.google.com/spreadsheets/d/1e-QDjoLRXIUStmRFy4l8-R2gZZbercMC_56jADxp0fc/edit#gid=1234046063

Exceptions

- Items from your Kit of Parts, including anything purchased with your FIRST Choice Credits do not count against your total
- Items that cost less than \$5 each also do not count against your total
- Also look for specific exemptions each year:
- Specific exempt items listed in the 2020 manual:
 - i. One (1) Inertial Measurement Unit (Note that R12 still applies)
 - ii. Rockwell Automation sensors available through FIRST Choice in any season
 - iii. tags used for location detection systems if provided by the event

Credits

- This lesson was written by FRC 8027 for FRCTutorials.com
- You can contact the author at team@droidsrobotics.org



More lessons for FIRST Robotics Competition are available at www.FRCtutorials.com



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