

VEX ROBOTICS COMPETITION



2020 - 2021
Appendix C - VEX U

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VEX U

Introduction

While many colleges and universities already use the VEX V5 system in their academic classes, many more have extensive manufacturing capabilities beyond the standard "VEX metal" library. Fabrication techniques like machining and 3D printing are more common than ever in collegiate engineering programs, and we can't wait to see what VEX U teams from around the world are able to create under these more advanced rules.

As in past years, there will be a culminating VEX U event at the VEX Robotics World Championship, along with regional tournaments across the world. Participating schools will get the chance to prove their abilities in front of thousands of future engineers and show off what truly makes their school remarkable. VEX U is the perfect project-based supplement to many university level engineering programs, and will give students the unique opportunity to demonstrate their real-world skills to potential employers (such as VEX competition sponsors).

Event Information

Several of the University partners participating in VEX U will be holding tournament events in addition to the capstone competition at the 2021 VEX Robotics World Championship. For more information on VEX U events refer to <https://www.robotevents.com> to find event details, pricing, and registration info.

Game, Robot, and Tournament Rules

VEX U uses the VEX Robotics Competition Change Up field with no modifications. Anyone that already has a VEX Robotics Competition Change Up field can use it for a VEX U event or team. Please consult the VEX Robotics Competition Change Up Game Manual for the foundation set of competition details. All of the standard Game, Robot, & Tournament rules apply, except for the modifications listed in this document. In the event of a rules conflict, the rules listed in this document and rulings on the VEX U Q&A take precedence.

Rule Modifications: Game, Tournament

<VUG1> Instead of a 2-Team *Alliance* format, VEX U Matches will be played 1-Team vs. 1-Team. Each Team will use two (2) Robots in each Match.

- a. Teams are allowed to build as many Robots as they would like, but only two (2) – one of each size – may be brought from the pit to the playing field for any Match.
- b. All Robots must pass inspection before they are allowed to compete.

<VUG2> Qualification Matches will be conducted like normal, in the 1 v 1 format described above.

<VUG3> An elimination tournament will be conducted similar to the Middle School & High School tournament. At the end of the competition, one Team will emerge as the event champion.

<VUG4> The Autonomous Period at the beginning of every Match will be 45 seconds (0:45).

- a. All interaction with Robots during the Autonomous Period, including via the Vision Sensor, is strictly prohibited. The intent of this rule is to encourage collegiate Teams to develop advanced autonomous routines.
- b. If both Teams complete their routines before 45 seconds (0:45) has elapsed, they have the option to signal that they wish to end the Autonomous Period early. Both Teams and the Head Referee must all agree on the "early stop". This is not a requirement, and the option must have been established for all Teams at the event, such as during the driver's meeting.

<VUG5> The Driver Controlled Period is shortened to 75 seconds (1:15) and immediately follows the Autonomous Period.

<VUG6> Each Robot is allowed up to three (3) Drive Team Members in the Alliance Station during a Match, as stated in <G7>.

<VUG7> VEX U Student eligibility.

- a. All VEX U Team members MUST be matriculated in a post-secondary school.
- b. Professionals not enrolled in post-secondary education are not eligible to participate on a VEX U Team.
- c. Students that are dual-enrolled in both a secondary school and in post-secondary courses are not eligible to participate on a VEX U Team.
- d. VEX U Team members may only be on exactly one (1) VEX U Team for the season, see <G6>.

Rule Modifications: Robot

<VUR1> Teams must build two (2) *Robots*, subject to the following size restrictions at the start of the Match:

- a. Robot A must be smaller than 24" x 24" x 24".
- b. Robot B must be smaller than 15" x 15" x 15".

<VUR2> Teams may use any official VEX Robotics product, other than the exceptions noted below, to construct their *Robot*. This includes those from the VEXpro, VEX V5, and VEX IQ product lines. To figure out if a product is "official" or not, refer to the www.vexrobotics.com website.

The following products are not permitted under this rule:

- a. Products intended for competition event use, such as trophies, field perimeters, or game objects.
 - i. Screws, nuts, and other small hardware found in VRC field kits are permitted.
- b. VEX IQ electronics, found on this page: www.vexrobotics.com/vexiq/products/electronics
- c. Products not intended for *Robot* construction, such as apparel, tools, safety glasses, etc.
- d. VEXpro electronics from the following list:

SKU	Description
217-8080	Talon SRX
217-9191	Victor SPX
217-9090	Victor SP
217-4243	Pneumatic Control Module
217-4244	Power Distribution Panel
217-4245	Voltage Regulator Module
217-4347	775pro
217-2000	CIM Motor
217-3371	Mini CIM Motor
217-3351	BAG Motor
217-6515	Falcon 500

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<VUR3> Teams are allowed to fabricate their own unique components for each of their *Robots* from the following additional raw materials. These parts may be fabricated using techniques that may otherwise be prohibited in VRC, such as welding, brazing, casting, forging, hot/cold rolling, tempering, or gluing.

- a. An unlimited amount of non-shattering plastic from the following list: polycarbonate, acetal monopolymer (Delrin), acetal copolymer (Acetron GP), POM (acetal), ABS, PEEK, PET, HDPE, LDPE, Nylon (all grades), Polypropylene, FEP.
- b. An unlimited amount of silicone, polyurethane, or other rubber.
- c. An unlimited amount of composite materials, such as G10 (Garolite), FR-4, or carbon fiber.
- d. An unlimited number of plastic 3D printed parts.
- e. An unlimited amount of steel, aluminum, brass & bronze.

The intent of <VUR3> is to encourage *Teams* to explore fabrication techniques like milling, 3D printing, injection molding, sheet metal punching, etc., to develop their own new robotic components in addition to the "standard" set of VEX components permitted by <VUR2>. To utilize these techniques, raw materials from the list provided in <VUR3> may be used.

However, the intent of <VUR3> is not to legalize all commercially available items made from these materials. The only commercial components (other than pneumatic components) that may be used are those purchased from VEX Robotics, as specified in <VUR2>.

For example, aluminum billet may be used to machine a custom bracket. However, purchasing a custom aluminum bracket is not within the spirit of this rule. Similarly, pre-drilled or extruded metal, such as angle aluminum, is not permitted, unless it can be found on www.vexrobotics.com.

<VUR4> Each *Robot* must utilize exactly one (1) V5 Robot Brain microcontroller and exactly one (1) V5 Robot Radio connected to a V5 Controller. No other types of VEX microcontrollers or wireless communication protocols are permitted.

- a. *Teams* must abide by the power rules noted in <R20> and <VUR6>.

<VUR5> There is no restriction on the number of V5 Smart Motors that *Robots* may use. No other motors, servos, or actuators are permitted, including those sold by VEX (e.g. the 2-Wire 393 Motor).

Note: Pneumatic actuators are permitted within the guidelines of <VUR9>.

<VUR6> There is no restriction on sensors and other additional electronics that *Robots* may use for sensing and processing, except as follows:

- a. Sensors and electronics MUST be connected to the V5 Robot Brain via any of the externally accessible ports (i.e. without any modification to the microcontroller). A sensor may be connected to a processing unit which then connects to the V5 Robot Brain.
- b. Sensors and electronics CANNOT directly electrically interface with VEX motors or solenoids.
- c. The additional sensors and electronics may only receive power from any of the following:
 - i. Directly from the V5 Robot Brain via any externally accessible port.
 - ii. From an additional lithium ion, lithium iron or nickel metal hydride battery pack (only one (1) additional battery can be used for sensor/processing power). Battery pack must operate at a maximum of 12 volts nominal.
- d. Only the V5 Battery can power the V5 Brain.

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<VUR7> No radio communication is allowed between *Robots*. However, other non-radio forms of communication are permitted (i.e. IR, ultrasonic, etc).

<VUR8> *Teams* may use the following fasteners on their *Robot*:

- a. Any commercially available #4, #6, #8, #10, M2, M2.5, M3, M4, or 1/4-20 screw (of any length), and any commercially available nut, washer and/or spacer to fit these screws.
- b. Any commercially available aluminum or steel rivet, up to 1/4" nominal diameter.

<VUR9> *Teams* may utilize an unlimited amount of the following commercially available pneumatic components: Cylinders, actuators, valves, gauges, storage tanks, regulators, manifolds, and solenoids.

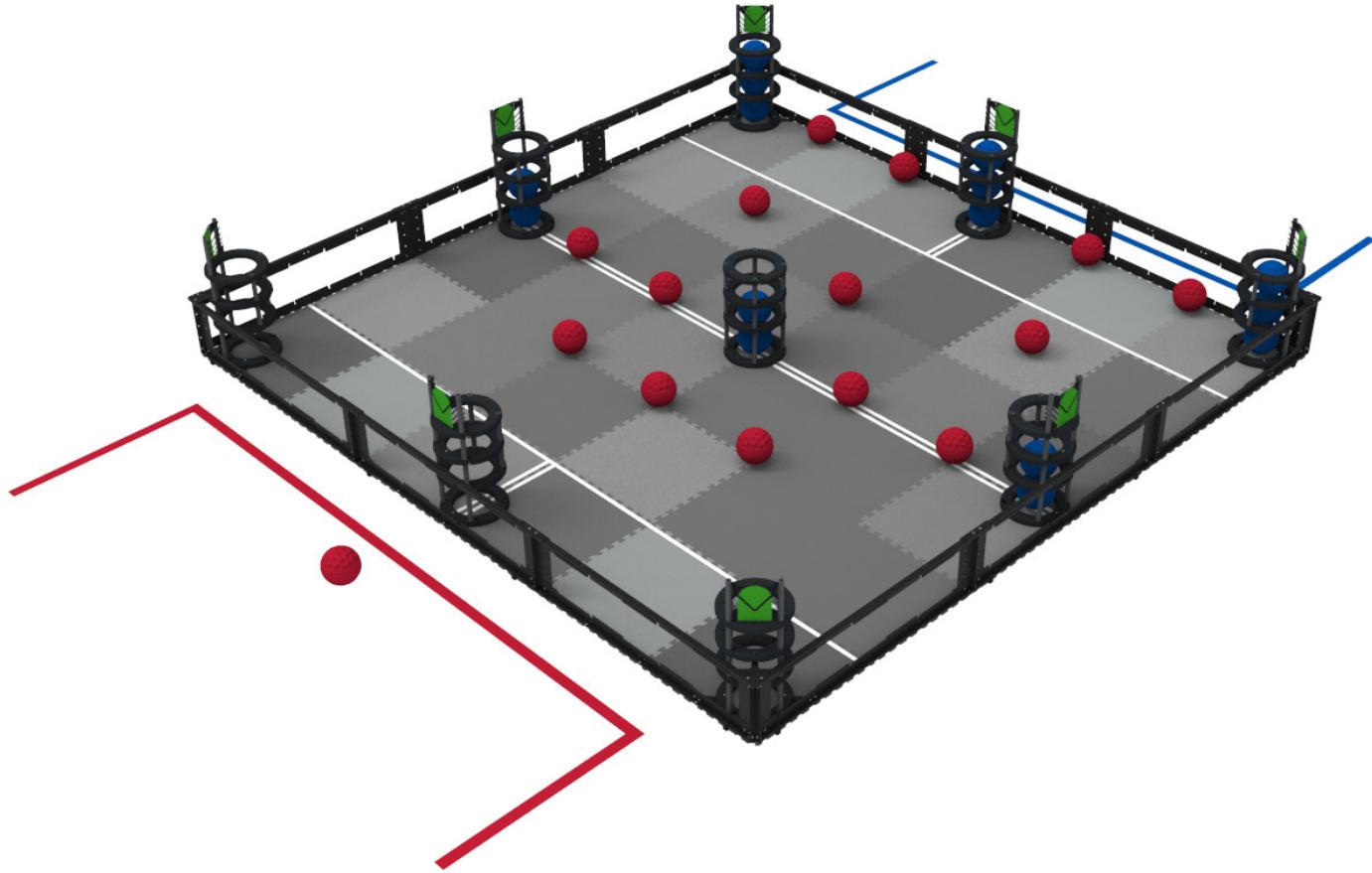
- a. Pneumatic devices may only be charged to a maximum of 100 psi.
- b. Compressors or any other forms of "on-Robot" charging are not permitted.
- c. All commercial components must be rated for 100 psi or higher. *Teams* should be prepared to provide documentation that verifies these ratings to inspectors if requested.
- d. Components must not be modified from their original state, other than the following exceptions:
 - iv. Cutting pneumatic tubing or wiring to length, assembling components using pre-existing threads, brackets, or fittings, or minor cosmetic labels.

Robot Skills Challenge

All rules apply from VRC Appendix B - Robot Skills Challenge, unless otherwise modified / noted in this section.

<**VURS1**> VEX U Teams are only permitted to use one (1) 15" x 15" x 15" Robot, i.e. Robot B as defined by <**VUR1**>.

- a. RSC1 and <**VUG6**> apply as written, regarding Drive Team Members, Alliance Stations, and Preloads.



Team Composition

We want to see Universities face off in a global head-to-head competition. Schools are not limited to one *Team*, and a *Team* may consist of multiple colleges, but we hope that each *Team* identifies with and proudly represents one (1) post-secondary institution. (e.g. "Clarkson University" vs. "UC Santa Barbara"). Of course, college-level "club" *Teams* and mixed composition *Teams* are encouraged to join! However, as noted in <**VUG7**>, Students that have not yet graduated secondary school are not eligible to participate in VEX U, even if they are "dual-enrolled" or taking post-secondary courses.