



Appendix E: VEX U

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Introduction

While many colleges and universities already use the VEX EDR 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 2020 VEX Robotics World Championship. For more information on VEX U events refer to <http://www.robotevents.com/> to find event details, pricing, and registration info.

Game, Robot, and Tournament Rules

VEX U uses the *VEX Robotics Competition Tower Takeover* field with no modifications. Anyone that already has a *VEX Robotics Competition Tower Takeover* field can use it for a VEX U event or team.

Please consult the *VEX Robotics Competition Tower Takeover* 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, per <VUR1>.

- 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.

- 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 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 Control Period* is shortened to 75 seconds and immediately follows the *Autonomous Period*.

<VUG6> Each *Robot* is allowed up to three (3) *Drive Team Members*, as stated in <G6>.

- a. *Drive Team Members* MUST be post-secondary school individuals. Any matriculated individual enrolled in post-secondary school is eligible to be a *Drive Team Member*.
- b. Professionals not enrolled in post-secondary education are not eligible to be *Drive Team Members* or 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 be *Drive Team Members* or participate on a VEX U *Team*.

Rule Modifications: Robot

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

- Robot A must be smaller than 24" x 24" x 24".
- 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 EDR, 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:

- Products intended for competition event use, such as trophies, field perimeters, or game objects. Any product listed on this page: <https://www.vexrobotics.com/event-partners>
 - Screws, nuts, and other small hardware found in VRC field kits are permitted.
- VEX IQ electronics, found on this page: <https://www.vexrobotics.com/vexiq/products/accessories/electronics>
- Products not intended for Robot construction, such as apparel, tools, safety glasses, etc.
- VEXpro electronics from the following list:

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

<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.

- 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.
- An unlimited amount of silicone, polurethane, or other rubber.
- An unlimited amount of composite materials, such as G10 (Garolite), FR-4, or carbon fiber.
- An unlimited number of plastic 3D printed parts.
- An unlimited amount of steel and aluminum.

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 one (1) V5 Robot Brain microcontroller and one (1) V5 Robot Radio. No other types of VEX microcontrollers or wireless communication protocols are permitted.

- a. *Teams* must abide by the power rules noted in <R19>.

<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).
- 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 VEX 7.2V Robot Battery or from a VEX 9.6V Transmitter Battery (only one (1) additional battery can be used for sensor power).

<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:
 - i. 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, with no modifications. VEX U *Teams* are permitted to use both *Robots* in their Robot Skills Challenge *Matches*, per <VUG1>, <VUG6>, and <VUR1>.

<VURS1> *Prior to the start of Robot Skills Matches, each Robot must use its one (1) Cube available as a Preload, per <SG1>. The other two (2) Preloads, and the two purple Match Loads are not used in a Robot Skills Match.*

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 <VUG6>, 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.