

Appendix E – VEX U



Introduction

We are thrilled to continue the exciting VEX U program for another year, with some new twists for the 2018-2019 season. 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 the new 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 2019 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.

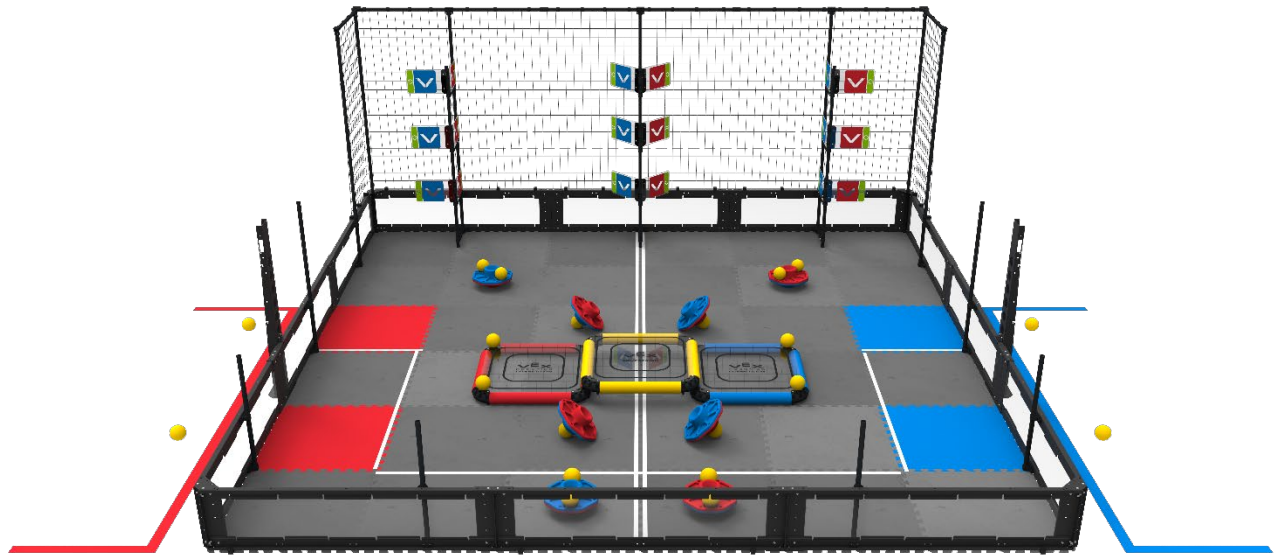
Game, Robot, and Tournament Rules

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

Please consult the *VEX Robotics Competition Turning Point* 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.



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Note: This appendix only details changes and additions specific to VEX U.

Please make sure you refer to the official VEX Robotics Competition Turning Point Game Manual for full game rules and descriptions.

Game and Tournament Rule Modifications

<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.

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<VUG5> The *Driver Control Period* is shortened to 75 seconds and immediately follows the *Autonomous Period*.

<VUG6> The VRC rule <SG2> applies in VEX U, adjusted for the starting height of each *Robot*.

- a. The *Robot* which starts 24" tall must return to 24" once it is no longer contacting the *Expansion Zone*. The *Robot* which starts 15" tall must return to 15" once it is no longer contacting the *Expansion Zone*.
- b. The 36" horizontal expansion limit applies to both *Robots*.

A *Robot* which interferes with gameplay as a result of violating this rule, such as *Toggling a High Flag* or blocking a launched *Ball* while outside of the *Expansion Zone*, will result in a *Disqualification*, whether the interference is *Match Affecting* or not.

<VUG7> 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.

Robot Rule Modifications

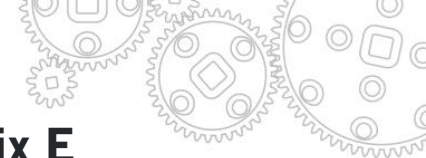
<VUR1> Teams must build two (2) Robots, subject to the following size restrictions at the start of the match:

- c. Robot A must be smaller than 24" x 24" x 24".
- d. 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:

- a. 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>
 - i. Screws, nuts, and other small hardware found in VRC field kits are permitted.
- b. VEXpro electronics from the following list:



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

- c. VEX IQ electronics, found on this page:
<https://www.vexrobotics.com/vexiq/products/accessories/electronics>
- d. Products not intended for robot construction, such as apparel, tools, safety glasses, etc.

<VUR3> Teams are allowed to fabricate their own unique components from the following additional raw materials for each of their robots:

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

The intent of <VUR3> 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 <R14b>.

<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 <VUR10>.



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<VUR6> There is no restriction on sensors and other additional electronics that are used 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 the 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 and/or washer to fit these screws
- b. Any commercially available aluminum or steel rivet, up to 1/4" nominal diameter.

<VUR9> Teams must display their team identification letters (e.g. "IFI", "ABCD") in two visible locations on opposing sides of the Robot, per <R20>. Teams must use the official VEX Robotics License Plate Kit (276-3938) for this identification. The identification must clearly display which alliance color the Robots belong to in that Match (i.e. red or blue).

<VUR10> Teams may utilize commercially available pneumatic components from the following list: Cylinders, actuators, valves, gauges, storage tanks, regulators, manifolds, and solenoids.

- c. Pneumatic devices may only be charged to a maximum of 100 psi.
 - i. Compressors or any other forms of "on-Robot" charging are not permitted.
- d. 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.
- e. Components must not be modified from their original state as purchased from a commercial vendor, 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.



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Robot Skills Challenge

All rules apply from the VRC Appendix B – Robot Skills Challenge, with one additional rule.

<VUS1> VEX U teams may only use one (1) Robot in the Robot Skills Challenge. This Robot must start within a 15" x 15" x 15" cube (i.e. Robot B from <VUR1>).

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" or mixed composition teams are encouraged to join! However, as noted in <VUR8>, 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.