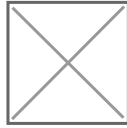


Q&A

VEXU 2020-2021: Change Up



Welcome to the official VEX Robotics Competition Question & Answer system, where all registered teams have the opportunity to ask for official rules interpretations and clarifications. This Q&A system is the only source for official VRC Change Up rules clarifications, and the clarifications made here from the Game Design Committee (GDC) are considered as official and binding as the written [Game Manual](#) itself.

Please review the [Q&A Usage Guidelines](#) before posting. This system is only intended for specific VRC Change Up rules questions.

- For event, registration, or other competition support questions, please contact your [REC Foundation Regional Support Manager](#).
 - For VEX technical support, contact support@vex.com or sales@vex.com.
- For game questions, suggestions, or concerns outside of specific and official rules questions, contact GDC@vex.com.

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708: <VUR6> Clarification

7-Dec-2020

R6 R7 R8 R10 R12 R20 R22 VUR2 VUR3 VUR5 VUR6 VUR8

In this previous ruling, it was determined that <VUR5> takes priority over <VUR6>:

<https://events.vex.com/VEXU/2020-2021/QA/674>

However, this is contradictory to every other instance of past rulings regarding <VUR6> and the wording of <VUR6> in the game manual.

?

For example, consider a typical custom sensor such as the pixy camera:

<https://www.robotshop.com/en/charmed-labs-pixy-2-cmucam5-image-sensor.html>

This sensor violates <R6>, <R7>, <R8>, <R10>, <R12>, <R20>, <R22>, as well as <VUR3> and <VUR8>.

VUR3 restricts the materials allowed, but this sensor violates the allowed materials.

VUR8 restricts the screw sizes allowed, but this sensor may have smaller screws than the allowed limit.

As another example, consider a vex IQ sensor: <https://www.vexrobotics.com/228-3014.html>

This sensor would violate <R6>, <R7>, <R8>, <R10>, <R12>, <R20>, <R22>, as well as <VUR3> and <VUR2b>.

<VUR2b> restricts teams from using any vex IQ electronics, which would include this sensor.

?

Because <VUR6> specifically states "There is no restriction on sensors and other additional electronics that Robots may use for sensing and processing" it has been understood by most VexU teams that <VUR6> takes priority over all the other rules in the game manual. Logically this would also mean <VUR6> would take priority over <VUR5>.

?

Several other Q/As over the years have verified this as correct as the wording on <VUR6> has not significantly changed since these rulings:

<https://www.vexforum.com/t/answered-vexu-speakers-as-part-of-custom-sensor/42312>

<https://www.vexforum.com/t/answered-vex-u-old-college-q-a-updates/23810>

<https://www.vexforum.com/t/answered-custom-sensor-housing/19582/2>

These three Q/As verify that <VUR6> would take priority over <VUR3> and <VUR8> as well as all the regular game manual rules mentioned above.

Furthermore, the following Q/A shows that <VUR6> would also take priority over <VUR5>:

<https://www.vexforum.com/t/answered-vex-u-non-vex-servo-motors-for-a-custom-sensor/35538>

This allowed external non vex motors used solely for manipulating custom sensors.

If this were the case, it would agree with the wording of <VUR6>. There are numerous sensors and processing boards that rely on motors to operate.

For example, many full field lidar systems such as:

<https://www.robotshop.com/en/rplidar-a1m8-360-degree-laser-scanner-development-kit.html>

rely on an integrated motor to spin the lidar enabling it to map the field. VexU teams have legally used similar lidar systems in the past and may plan to do so again this season.

Another example would be the Nvidia Jetson Xavier NX listed below:

<https://www.nvidia.com/en-us/autonomous-machines/embedded-systems/jetson-xavier-nx/>

This processing board has a built-in fan on its heatsink that is critical to its function as a processing unit.

A third example is the pixy tilt and pan kit: <https://pixycam.com/pixy2-pan-tilt-kit/> (ruled legal in the above Q/A linked).

Without these integrated motors, none of these sensors or processing units could function as intended.

?

Therefore, which rules, if any, restrict the "no restriction" clause of <VUR6>?

Furthermore, if <VUR5> does not apply to <VUR6>, then was the previous ruling in QA#674 an error?

If <VUR5> is applicable, are 360-degree Lidar sensors and the Nvidia Jetson processing boards also illegal? If all VexU appendix rules also apply to <VUR6>, then does that mean that there are no legal VexU custom sensors?

Answered by Game Design Committee

If all VexU appendix rules also apply to <VUR6>, then does that mean that there are no legal VexU custom sensors?

Please see rule G3:

<G3> Use common sense. When reading and applying the various rules in this document, please remember that common sense always applies in the VEX Robotics Competition.

The intent of the answer in the linked Q&A was to prohibit using VUR6 as a loophole to install cooling fans on a Robot.

Sensors containing an internal motor which is integral to their operation, such as a LIDAR or pan-tilt Pixy, would be permissible. It would not be feasible for an inspector to take apart a LIDAR module to see if there is a motor inside of it. It is, however, feasible for an inspector to check if a fan is being used to cool a V5 Smart Motor.

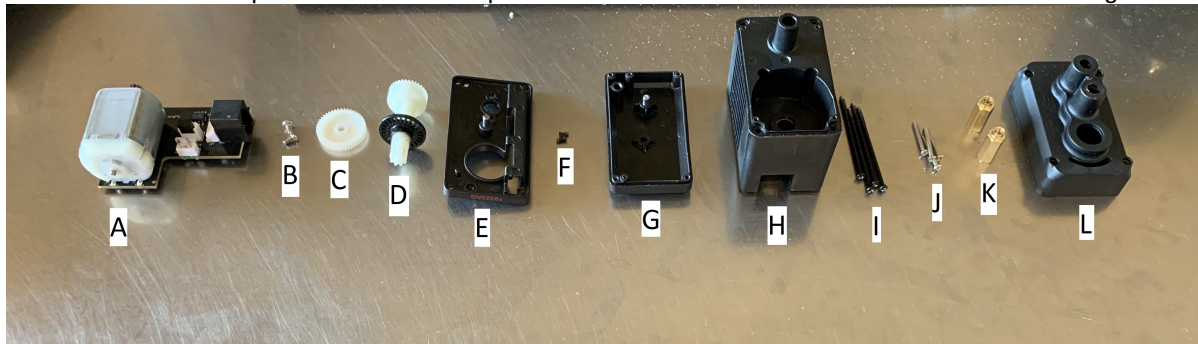
To prevent confusion, we would advise Teams with external processors that require thermal protection to utilize a [passive heat sink](#) instead of an active cooling fan.

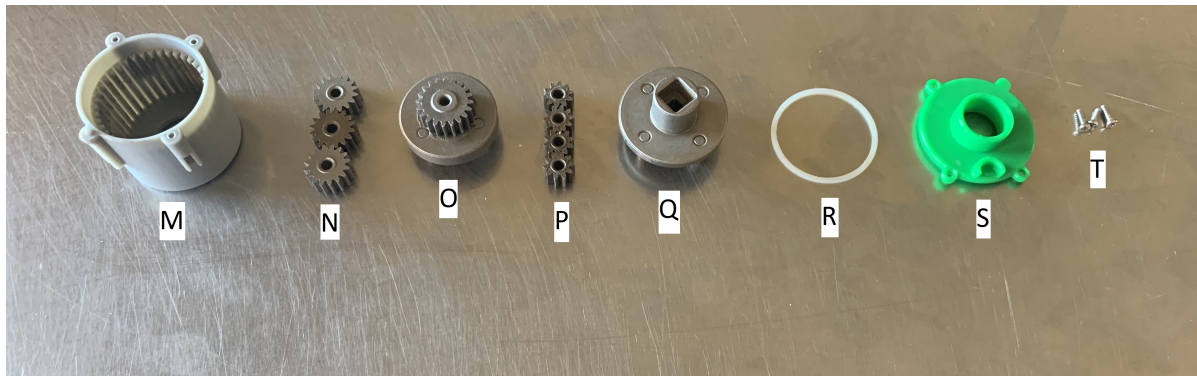
672: What parts of the motor and motor cartridge can VEXU teams modify?

21-Oct-2020

R22

Attached is a labeled picture of all the components of a VEX V5 Smart Motor and its Gear Cartridge:





For *each* individual labeled part, is it legal for VEXU Teams to do one or multiple of the following:

- Modify the part using legal modification techniques.
- Replace the part with a legally manufactured part.
- Remove the part.
- Use the part for other purposes outside of the motor (e.g. using the J type screws elsewhere in the robot construction).

I understand that the legality of modifying/replacing/removing/using elsewhere of some of these parts has previously been ruled upon in the following Q&As: <https://events.vex.com/VEXU/2020-2021/QA/611>

<https://events.vex.com/VEXU/2020-2021/QA/612>

<https://events.vex.com/VEXU/2020-2021/QA/650>

<https://events.vex.com/VEXU/2020-2021/QA/652>

However, my goal with this Q&A is to remove any ambiguity as to the legality of modifications made to V5 Smart Motors or the Motor Cartridge.

Answered by Game Design Committee

Please see the response in this similar Q&A post:

<https://events.vex.com/VRC/2020-2021/QA/673>

The same response provided there applies to this question as well. The only difference is that in VEX U, any part which is "user-serviceable" may be replaced, modified, or custom-fabricated within the rules set forth by VUR3.

As noted in one of the Q&A posts that you have linked:

The primary motor case, internal components, etc are still considered "electronics" under R23, and may not be modified.

612: Modifying V5 Smart Motor Cartridges

22-May-2020

R23

It was previously ruled during Tower Takeover that v5 motor cartridges could be used externally as hardware components. [See for reference](#). Under <R23> modifications of non-electrical hardware components is allowed. Therefore, when using a cartridge externally as hardware, would modification of the v5 motor cartridges be legal under <R23>? If so would the following scenarios be permitted:

- Opening the cartridge and removing its internal gears and using them externally.
- Drilling holes or slots in the cartridge to help mount it externally.

C) Fabricating custom gears out of legal material and replacing the gears within the cartridge with them.

Furthermore, It was recently ruled that vexU could replace the motor cap portion of the motor. [see for reference](#) However the stipulation was that “The primary motor case, internal components, etc are still considered ‘electronics’ under R23, and may not be modified.” Since the motor cartridge lies halfway between the motor cap and the internal side of the motor, is the cartridge considered an internal part of the motor or an external part like the cap?

Specifically, would the following situations be legal:

D) Removing the motor cartridge completely in addition to the cap so the smart motor may interface directly with a legally fabricated component. This was previously allowed for the internal gears of 393 motors. [see for reference](#)

E) If Situations A, B, and C are legal, insert a legally modified cartridge into a v5 smart motor.

Answered by Game Design Committee

These would all be legal, in VEX U only. These would not be legal in VRC.

650: Follow up to question 611

14-Sep-2020

R23

Hello, I wanted to make ask for clarification regarding this QnA: [Q611](#) Here, it is asked whether making a custom motor cap to reduce the profile of the motor is legal, as shown here: [image](#) The response says yes, this is legal, and includes this caveat: “The primary motor case, internal components, etc are still considered “electronics” under R23, and may not be modified.” The main question I have here is this: does the other cap of the motor, opposite the one which was explicitly ruled legal to replace, included in this list of things which cannot be replaced? Or is replacing this cap also allowed in the same way that replacing the bottom one is. To ensure there is no confusion regarding this question, here is an example of what I am asking about: [image](#) In summary, would this motor be legal in VexU?

Answered by Game Design Committee

No, this would not be legal.

The V5 Smart Motor was designed with removable / replaceable Smart Motor Caps and external gear cartridges in mind. Further modification to the primary motor case or internal components could cause unintended behavior, and would probably violate your VEX Robotics warranty (in addition to being a violation of rule R23).

652: Follow up to question 612

17-Sep-2020

R23

In this QnA, [link](#), some questions are asked about what is legal in regards to motor cartridge modification in VexU. However, it is not directly asked if replacing the casing of the cartridge with a custom casing is legal. It is only asked if making custom internals and modifying the original case would be allowed. Would a cartridge that uses fully custom parts, including the casing, be legal as well?

Answered by Game Design Committee

Yes, this would be legal, as it is essentially just a specific application of the following two points from the linked Q&A:

C) Fabricating custom gears out of legal material and replacing the gears within the cartridge with them.

D) Removing the motor cartridge completely in addition to the cap so the smart motor may interface directly with a legally fabricated component.

627: Question on <VUG7>: Student Eligibility

15-Jul-2020

VUG7

I'm recruiting to start a VEXU team. The following student-eligibility question arose. Is a student enrolled in a certificate program at a community college considered "matriculated in a post-secondary school" for student eligibility under rule VUG7a ?

Answered by Game Design Committee

When there is no VRC-specific definition available, a dictionary definition should be used. The Merriam-Webster definition of "matriculated" is "*to be enrolled at a college or university*".

Under this definition, non-traditional education paths such as community colleges, technical certificates, trade schools, or vocational programs would be permissible, if the enrolling institution is a college or university.

Although there are no specific requirements regarding the type of enrollment, such as "minimum credit hours", the intent of VUG7 is to ensure that VEX U team members are generally of collegiate age and education level. Points "b" and "c" of VUG7 further clarify the specific edge cases that are prohibited:

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.

Some unofficial/informal thought experiments to determine if an individual meets these requirements could be:

- How would the individual list their "occupation" on a census survey? Would they say "student" with a part-time job to help pay for college, or "engineer" who is taking night classes?
- Does the individual have a high school diploma (or equivalent) that was submitted to their college as part of the admissions process?

722: Remote, Live Skills?Only Events: Adult for VEX U Teams

7-Jan-2021

VUG7

[Appendix B: Robot Skills Challenge](#), in the 'Skills?Only Event: Remote, Live' section, states:

<RSE5> The *Team's* Primary Contact, or another designated *Adult Team* contact (over the age of 18), must be present in the remote meeting environment throughout the duration of the scheduled time for that *Team*. The *Team's* Primary Contact will be responsible for providing the *Adult* representative's contact information to the *Event Partner* prior to the event.

The [Game Manual](#) defines *Adult* as:

Adult — Anyone who is not a *Student*.

[Appendix C: VEX U](#) provides the definition of *Student* for VEX U:

<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>.

For VRC, the [Game Manual](#) defines *Student* as:

Student — A person is considered a *Student* if he or she meets both of the following criteria:

1. Anyone who is earning or has earned credit toward a high school diploma/certificate or its equivalent during the six (6) months preceding the VEX Robotics World Championship. Courses earning credits leading up to high school would satisfy this requirement.
2. Anyone born after May 1, 2001 (i.e. who will be 19 or younger at VEX Worlds 2021). Eligibility may also be granted based on a disability that has delayed education by at least one year.

Is it a correct interpretation that VEXU *Teams* need to be accompanied by an individual over the age of 18, **who is not a *Student on the Team***, while participating in Remote, Live Skills?Only Events?

Interpreting <RSE5> with <G3> in mind suggests that a *Student* on the VEXU *Team* who is over the age of 18 would satisfy the intent of this rule.

Does the interpretation clarified in this Q&A extend to the case of VRC *Students* who are over the age of 18?

Answered by Game Design Committee

Is it a correct interpretation that VEXU *Teams* need to be accompanied by an individual over the age of 18, **who is not a *Student on the Team***, while participating in Remote, Live Skills?Only Events?

Interpreting <RSE5> with <G3> in mind suggests that a *Student* on the VEXU *Team* who is over the age of 18 would satisfy the intent of this rule.

Yes. VEX U *Students* who are over the age of 18 would satisfy the intent of this rule.

Does the interpretation clarified in this Q&A extend to the case of VRC *Students* who are over the age of 18?

No. VRC *Students* who are over the age of 18 must still be accompanied by an adult *Team* member who is over the age of 18.

If you have further questions or want to clarify a specific edge-case scenario, please contact your REC Foundation Regional Support Manager.

767: VIQ Game Objects

22-Mar-2021

VUR2

Quick question about the using VIQ game objects.

VIQ Legal Parts Appendix <https://content.vexrobotics.com/docs/viqc-rise-above/LegalPartsAppendix06032020.pdf>

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.

VUR2-a

The following products are not permitted under this rule: a. Products intended for competition event use, such as trophies, field perimeters, or game objects

Part 228-2500-1381 (the image attached) is a VIQ game object for this season, making it illegal according to VUR2-a. But, this part is also allowed in the VIQ parts appendix, making it legal according to VUR2.

My question is the following:

1. Can VEXU teams use current VIQ game objects if they are listed in the Legal Parts Appendix?
2. Can VEXU teams use previous VIQ game objects if they were listed in that season's Legal parts Appendix?

Thank you for your time



Answered by Game Design Committee

My question is the following:

1. Can VEXU teams use current VIQ game objects if they are listed in the Legal Parts Appendix?
2. Can VEXU teams use previous VIQ game objects if they were listed in that season's Legal parts Appendix?

Yes, VIQC game objects that are also intended to be construction elements (i.e. are listed in the VIQC Legal Parts Appendix) are legal for use in VEX U.

The intent of VUR2-a is to prohibit the use of VRC game objects, due to the potential for confusion between the game object on a Robot vs a game object on the field.

613: Follow up to Q&A question 607 and VUR3

22-May-2020

VUR3

In a previous Q&A in regards to VUR3 [link](#), it was mentioned that, "tubing, sheet, plate, angle, etc" are examples of raw materials that are legal for use. What I am wondering is exactly where to draw the line. For example, if you take a look here [link](#), McMaster-Carr lists quite a few things under their Aluminum Stock section. You mention that angle is legal, this would lead me to assume the same for C/U channel [link](#) and rectangular tube [link](#), but what about more complex things

like balls [link](#), double-wall round tube [link](#), honeycomb cores [link](#) and wire [link](#)? What about things like V-Slot aluminum extrusion [link](#)?

In addition, just to clarify, theoretically could one buy a raw material like an aluminum plate and place it on their robot without modification if they so desired? While I don't see many cases where someone would want to do this, the previously used working could lead someone to believe some amount of modification is required to make a raw material legal for use.

Answered by Game Design Committee

Before diving in, we need to note that the answer previously posted to Q&A 607 incorrectly listed "angle" as a legal material type. This is in direct conflict with the last sentence of VUR3, and has been edited to reflect this correction. We apologize for this error and the confusion that it caused.

With that in mind, hopefully your question becomes more straightforward to understand. The full text of VUR3 reads as follows:

<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.

The bottom three paragraphs, i.e. the "red box" in the manual, comprehensively explain the intent and spirit of VUR3. It would be impossible to provide a blanket answer that concisely defines all hypothetical materials that can or cannot be used.

If you have a specific item you are concerned about, we are happy to clarify via the Q&A. However, this is an inefficient way to determine component legality in a way that can be consistently applied across all teams, events, and regions; we would prefer to utilize the intent and spirit conveyed in VUR3's red box.

When determining if a given design option is legal, try to ask the following "thought experiment" questions:

"Am I making a brand-new custom part, or am I taking advantage of a feature on a component that I have purchased?"

- Milling slots into a piece of aluminum bar stock would be legal, but buying pre-slotted aluminum would not. The goal of VUR3 is to encourage Teams to explore fabrication techniques of their own.

"Would another team with access to our same fabrication resources (3D printer / CNC mill / manual lathe / metalworking forge / etc) be able to replicate the same custom part with a different commercially available raw material?"

- A tube that is lathed into a custom spacer would likely be functionally similar to another, regardless of whether it was aluminum or steel, or whether you purchased it from McMaster or from a hardware store. A pre-made honeycomb lattice will likely rely on a specific manufacturer in order to be functionally equivalent.

"Can I explain how this part was made in our Engineering Notebook or in a judged interview, or is the answer 'we bought it that way'?"

- We are not going to request that teams submit a piece-by-piece bill of materials to "prove" that items were purchased as raw materials; we are much more interested in the engineering design process and fabrication techniques that you learned and applied to make the part.

617: Follow up to Q&A questions 607 and 613 and VUR3

29-May-2020

VUR3

In Q&A 607 [link](#) it was stated that "tubing, sheet, plate, angle, etc" are examples of raw materials that are legal for use. This was later corrected in Q&A 613 [link](#) to clarify that Angle is not a legal type of stock material due to the last paragraph of VUR3, which states:

Similarly, pre-drilled or extruded metal, such as angle aluminum, is not permitted, unless it can be found on www.vexrobotics.com.

However, tubing was noted to still be legal, as it was said that parts manufactured from tube stock are legal. However, tubes made from materials such as aluminum and steel are often manufactured using some form of extrusion. Even billet aluminum is extruded into its block shape. Since many of the materials that may be considered "stock", and even ones that are explicitly legal, are manufactured through extrusion, will the GDC please clarify the intent of VUR3? Specifically, is VUR3 intended to be based on seemingly arbitrary requirements such as the exact manufacturing process of the stock material, or is it intended to prevent teams from simply purchasing parts that they may not otherwise have been able to manufacture?

Answered by Game Design Committee

This question will be addressed in the August 14, 2020 Game Manual Update.

656: Is wood a legal material under <VUR3c>?

22-Sep-2020

VUR3

<VUR3c> allows "composite materials, such as G10 (Garolite), FR-4, or carbon fiber" to be used in robot construction.

"Composite material" is not further defined in the game manual or any appendices. Wikipedia [defines a composite material](#) as "a material made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components."

Although naturally occurring, wood [meets this definition](#) - it is composed of cellulose fibers bound together by lignin. Neither cellulose nor lignin individually have similar physical properties to wood, but when combined they form a much stronger substance.

So, is wood a legal material for robot construction under <VUR3c>?

If wood is not deemed legal under <VUR3c>, what about plywood? Plywood is itself a composite material consisting of layers of wood bonded by adhesive. This bonding significantly changes the material properties of the wood (for example, the individual sheets of wood will shrink and expand in one dimension with changes in temperature and humidity, but the composite plywood will not, due to the alternating grain direction).

(Edit to add: And, since <AIR3c> is worded exactly the same as <VUR3c>, would the same answer apply to VAIC as well?)

Answered by Game Design Committee

Yes, wood is a legal material for robot construction within VUR3-c.

758: <VUR5> <VUR6> Usage of Jetson fan from VAIC in VEX U

5-Mar-2021

VUR5 VUR6

<https://events.vex.com/VAIC-HS/2020-2021/QA/675>

The Jetson cooling fan included in the VAIC kit is an explicitly permissible exception to this rule for **VAIC** Robots. Teams may not modify or replace this fan (or any electronics in the VAIC kit unless otherwise specifically noted).

VUR5 and AIR 5 both states:

<AIR5> 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).

<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).

Is the same fan illegal to use in VEX U? If it is, does this mean that any teams competing in both VAIC and VEX U would need to remove the fan prior to VEX U competition?

Answered by Game Design Committee

The exception listed in the linked Q&A would also be permissible for use in VEX U. Teams competing in both VAIC and VEX U do not need to remove the fan in question prior to competition.

625: Question on VUR6

1-Jul-2020

VUR6

VUR6 c. ii. states that you may power sensors and additional electronics 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."

Would it be possible to expand this to allow for a 4s lithium iron battery (the same as the V5 battery) which has a nominal voltage of 12.8 volts?

Answered by Game Design Committee

The word "nominal" was intentionally chosen, to account for the fact that the "operating" voltage of power sources tend to vary depending on the source and the load. That is to say, a 12V nominal battery will usually likely operate at some other voltage than 12V.

4x 3.2V Li-iron battery cells wired in series will read 12.8V on a multimeter, but is still often described as a "12V nominal" battery. A lead-acid car battery will read 13.7-14.7V while the car is running, but is typically labeled as 12.6V nominal.

One additional intent of this rule is to provide a guardrail for what third-party sensors and processors are permitted in VEX U and the VEX AI Challenge. Sensors that operate on a far different nominal voltage than the V5 system, such as 24V automotive sensors, are prohibited by this rule. It is much easier for an inspector to review a battery label than to request sensor documentation (or for us to provide a comprehensive list of legal and illegal sensors).

Would it be possible to expand this to allow for a 4s lithium iron battery (the same as the V5 battery) which has a nominal voltage of 12.8 volts?

Knowing nothing other than what is stated in the question (i.e. that this is a 4-cell lithium iron battery with a nominal voltage of 12.8 volts), this does not seem to violate the intent of VUR6-c-ii, provided that no other rules are violated by its use. However, it is impossible to issue a blanket ruling on all hypothetical batteries beyond what is already stated in the manual. If you have questions about the legality of a specific battery example, please re-post with a link to the battery's product specifications and we would be happy to provide a clarifying ruling.

674: Cooling Fans For Custom Electronics

21-Oct-2020

VUR6

VUR6 states:

<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. 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.

Is it legal to use a fan for the sole purpose of cooling custom electronics? A common example where this would be useful is a CPU cooling fan for a compact external processor, such as an Nvidia Jetson or Raspberry Pi.

If this is ruled as legal, would it also be legal to use a fan for the purpose of cooling non-custom electrical components, such as V5 Smart Motors?

In the past <https://events.vex.com/VEXU/2018-2019/QA/184> this was ruled as illegal, however, in light of the wording of VUR6, and of the history of ruling in the past allowing similar "accessory" electronics <https://www.vexforum.com/t/answered-vex-u-non-vex-servo-motors-for-a-custom-sensor/35538>, I ask that the GDC reconsider here and make this legal.

Answered by Game Design Committee

No, using a fan that is powered by a separate motor would be considered a violation of <VUR5>.

<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).

759: Batteries for Custom Electronics

7-Mar-2021

VUR6

On VUR6 ii it states that an additional lithium ion, lithium iron, or nickel metal hydride battery is a legal way to power custom electronics. Would a lithium polymer battery also fall into this list as they are safer version of a lithium ion battery?

Answered by Game Design Committee

Yes; Lithium Polymer batteries fall under the category of being a type of Lithium Ion battery, and would be legal.

600: Robot Skills Starting Position

13-May-2020

In the VexU appendix I did not find anything about skills starting position. Last season it was asked if VexU teams are able to start Robot Skills on opposite sides of the field and that was granted. Are VexU teams allowed to start the 2 robots on opposite sides of the field this season for skills?

Answered by Game Design Committee

This will be addressed in the May 25th Game Manual Update.

607: Carbon Fiber

13-May-2020

In VUR3 c, it states that we are allowed to use composite materials such as carbon fiber. What specifically does this allow? In the red box after it says that this is not for teams to use pre fabricated components, so what is the line for materials such as carbon fiber? a: would sheets of carbon that teams lay into a mold be legal? b: would pre made sheets of carbon fiber ready for teams to cut to their desired shapes be legal? c: would pre made carbon fiber tubes be allowed?

Answered by Game Design Committee

Please remember to quote the relevant rule in your question. VUR3 reads as follows, with a portion bolded for emphasis:

<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.

In the context of VUR3, commercially available "products" are not the same as commercially available "raw materials". Tubing, sheet, plate, etc are examples of commercially available carbon fiber raw material that could then be modified. Bike seats, wheels, drone chassis, spoilers, brackets, props, etc would be considered carbon fiber commercially available products that would not be legal for use.

To that end, creating a custom carbon fiber mold / layup for a unique VEX U part would be an example of a fabrication process that is permitted (and encouraged) via VUR3.

We would encourage teams to document their fabrication processes thoroughly for inclusion in the Engineering Notebooks, to avoid any concerns or suspicions regarding custom-fabricated vs commercially-purchased parts.

EDIT: This response was edited on June 1, 2020, to clarify that "angle" is not a permissible example of commercially available raw material that can be used.

611: Custom Motor Caps

15-May-2020

I wanted to ask about making custom motor casings via 3D printers for VEXU. In the past, 393 motors were legalized for making custom motor casings from this [QNA](#)

Now with glorious V5 Smart Motors and the size of this seasons game objects, I wanted to ask if it would be legal to create custom V5 Smart Motor Caps for VEXU. The goal with this would be for teams to be able to 3D print the smart motor caps into custom motor caps. I personally see how this would actually been more legal than in the past as VEXU gets unlimited motors as part of <VUR5> . I also understand that making a completely new casing for the entire V5 motor may not be legal for cooling reasons as previously ruled. It has also been previously ruled that the motor cap is not considered part of the motor in terms of using it as a quick swap.

As for the actual question. I wanted to confirm if the ruling from the previously mentioned post is still legal. I am specifically referring to this past ruling: [link](#) Is this still legal for 2020-2021 and V5? Provided as the only change is replacing the V5 Smart Motor Cap (part number 276-6780) with a 3D printed custom motor caps and no other changes to the rest of the motor internally or externally. Below is an example of what I am trying to describe: [link](#)

Answered by Game Design Committee

Provided as the only change is replacing the V5 Smart Motor Cap (part number 276-6780) with a 3D printed custom motor caps and no other changes to the rest of the motor internally or externally.

Provided that the 276-6780 V5 Smart Motor Cap is the only part that is removed, replaced, or modified, this is legal. The primary motor case, internal components, etc are still considered "electronics" under R23, and may not be modified.

This answer only applies to VEX U. Modifying, removing, or custom-fabricating (such as via 3D printing) V5 Smart Motor Caps would not be legal in VRC.

620: VUR6 B and VRU9

21-Jun-2020

Rule VUR6 B states that electronics cannot interface with VEX solenoids but VUR9 states we are allowed to buy commercially available pneumatics. Are we allowed to interface the commercially available pneumatic solenoids we purchase with custom electronics. Some commercially available pneumatic solenoids may exceed the current limit of the V5 3 wire ports. There is no competitive advantage to using the custom electronics.

Answered by Game Design Committee

Yes, this would be permissible. We will clarify VUR5 and VUR6 in the August 14th Game Manual update accordingly.

660: Alliance Selection in VEXU Live Remote Tournaments?

1-Oct-2020

<LRT8> In a VEX U Live Remote Match, each Team plays with two Robots per <VUG1> and <VUR1>. The two Robots play on one field at the same time. Each Alliance is still made up of two Teams. Therefore, there are eight Robots, four Teams, and four fields in each Match.

Does this mean that live remote VEXU tournaments will include an alliance selection procedure before the elimination rounds, as in VRC?

Answered by Game Design Committee

Yes, this is correct. VEX U Alliance selection for elimination rounds will follow the same process / rules as VRC Alliance selection.

668: Brass Inserts

12-Oct-2020

Are Brass Inserts legal under <VUR8>

<VUR8> states that "Teams may use... any commercially available nut, washer, or spacer to fit [previously listed screws]"

Given that nut isn't further defined in the manual, would brass inserts be legal? under the dictionary definition of nut, it says "a small flat piece of metal or other material, typically square or hexagonal, with a threaded hole through it for screwing on to a bolt as a fastener.", Would a brass insert not fit this description?

Another Distinction to be noted is that as compared to the VRC based rules, which give an addendum that it must be functionally identical, there isn't an addendum that states so within the vexu section.

The intention in mind is with placing a brass insert within a 3d printed part, for better structural integrity of connecting the 3d printed part with other pieces.

If the issue is with having the equivalent of a larger screw through external threading on the insert, would a heat-set or press fit insert work, given that there's no external threading?

Attached below is an example of a screw insert, heat set insert, and press fit insert.

<https://assets.leevalley.com/Size4/10008/00M9401-5-16-18-insert-nuts-pkg-of-10-f-01.jpg>

https://sc01.alicdn.com/kf/HTB1sFdL0pXXXXbdXFXq6xXFXXY.jpg_350x350.jpg

<https://s9352.pcdn.co/wp-content/uploads/2017/11/101543-TAZ-4-5-6-Mini-Brass-Insert-M5x0.8x6.7-1p>

Answered by Game Design Committee

Yes, using threaded inserts to assemble fabricated parts (as defined by VUR3) would be legal.

This answer is a specific exception being permitted to encourage industry-standard fabrication techniques, and should not be interpreted as a blanket opening to broadly open up the definition of "nut". We will update VUR8 in the future to clearly state this allowance.

688: VexU teams running skills at virtual VRC skills only events

3-Nov-2020

Are VexU teams still allowed to run skills at virtual VRC skills only events if the team gets permission from the event partner. Previously VexU teams were allowed to run skills at VRC in person competitions, does it still apply for virtual events?

Answered by Game Design Committee

Yes. Please contact your [REC Foundation Regional Support Manager](#) for more information.