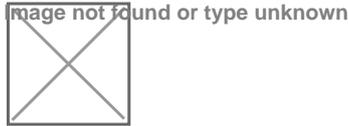


Q&A

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.

Modifying V5 Smart Motor Cartridges

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:

- A) Opening the cartridge and removing its internal gears and using them externally.
- B) 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.

Follow up to Q&A question 607 and VUR3

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.

Robot Skills Starting Position

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.

Carbon Fiber

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.

Custom Motor Caps

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.