

Q&A

VEXU 2020-2021: Change Up

Tagged: VUR6



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.

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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.

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.

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.

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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.

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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>.

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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.

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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.

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).

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.

184: <VUR5> <VUR6> Legality of CPU Cooling Fans

15-Dec-2018

VEX U VUR5 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." <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. 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."

With these rules in mind, would a CPU cooling fan be legal in VEX U? The fan motor, which is not used for any physical robot mechanism actuation, would be attached to and powered off of a single board computer. The computer would be connected to and receive power from the V5 Robot Brain via an externally accessible port.

Answered by Game Design Committee

No, this would not be legal.

1471: VUR6, VUR4, Belts

21-Feb-2023

VUR4 VUR6

Under VUR6, it's stated that a spring is "any device used for storing and releasing elastic potential energy". Under the definition, would COTS rubber and polyurethane timing belts fall under the category of springs, since their primary function is power transmission via the use of elastic tension? Additionally, would COTS rubber and polyurethane belt extrusion be legal under VUR4? Other legal materials - such as surgical tubing and aluminum extrusion - go about the same manufacturing process, so it would make sense that extruded rubber and polyurethane belt would fall under that rule as well. Thanks!

Answered by Game Design Committee

Yes, rubber and polyurethane timing belts are legal.

1383: Q&A 1341 Follow up

13-Jan-2023

VUR4 VUR6 VUR7 VUR10 R7

Previously, in [Q&A 1341](#) the GDC has ruled:

Per rule &R7e&, all rope/string (or string-like material) on a Spin Up Robot must measure at least 3mm in diameter at its narrowest point, regardless of how it is used on the Robot. This is an intentional change from the rules regarding string in previous competition seasons, and applies to both VRC & VEX U Robots.

R7e:

An unlimited amount of non-elastic rope / string, with a thickness / diameter between 1/8" (imperial standard) / 3mm (metric standard) and 1/4" (6.35mm). String must measure at least 1/8" / 3mm in diameter at its narrowest point while on the Robot under no load.

VUR4:

Fabricated Parts must be made from raw materials. For the purpose of this rule, a "raw material" is any material that would not be considered a "pre-fabricated" part (i.e., has not undergone any of the fabrication techniques listed in VUR3). Standard raw material finishing processes, such as extrusion, heat treating, or anodizing, are not considered pre-fabrication.

VUR6:

Teams may use commercially-available springs on their Robots. For the purposes of this rule, a "spring" is any device used for storing and releasing elastic potential energy. Examples include, but are not limited to:

- Compression, tension, torsion, constant force, or conical springs made from spring steel.
- Springs made from elastic thread or rubber, such as surgical tubing, bungee cords, or stretchable braided rope.
- Closed-loop (pneumatic) gas shocks

VUR7:

Teams may use any commercially available fastener on their Robot. Examples include (but are not limited to) screws, nuts, washers, rivets, hinges, pins, rod ends, threaded rods, hose clamps, bushings, spacers, or standoffs. To be considered a legal "fastener" in the context of this rule, the primary function of the part must be to join or fasten together two otherwise legal parts.

VUR10:

There is no restriction on sensors and other Additional Electronics that Robots may use for sensing and processing, except as follows:

1. Does the maximum sizing restriction of 1/4" also apply for string-like materials in VEXU?
2. Does R7e take precedence over VUR4? If so, does this mean that any Fabricated Part which could be considered "string-like" must abide by the sizing restrictions in R7e?
3. Does R7e take precedence over VUR6? If so, does this mean that any spring which could be considered "string-like", such as elastic thread, rubber, surgical tubing, bungee cords, or stretchable braided rope, must abide by the sizing restrictions in R7e? If so, should measurements be taken when the spring is stretched or unstretched?
4. Does R7e take precedence over VUR7? If so, does this mean that any Fastener which could be considered "string-like" must abide by the sizing restrictions in R7e?
5. Does R7e take precedence over VUR10? If so, does this mean that any Additional Electronics which could be considered "string-like", such as thin and flexible wires, must abide by the sizing restrictions in R7e?
6. If the answer to #5 is Yes, would thicker (but still thinner than 1/8") wires, solid or stranded, be restricted in size under R7e? Previously in [Tipping Point Q&A 1027](#) the GDC has said that single strand wire of 1/8" in size should be considered rope/string.

Overall, I believe the GDC's intention in answering Q&A 1341 in the manner they did was to prevent teams from using small diameter rope and string-like material as part of end game mechanisms. I agree with this intention. However, the ruling itself goes far beyond this and potentially restricts VEXU teams' exercise of many VEXU rules. To prevent this, I ask that the GDC modify its ruling for Q&A 1341 to only restrict other VEXU rules when legal materials under those rules are then used as part of an end game mechanism.

Answered by Game Design Committee

1. Does the maximum sizing restriction of 1/4" also apply for string-like materials in VEXU?

Yes.

2. Does R7e take precedence over VUR4? If so, does this mean that any Fabricated Part which could be considered "string-like" must abide by the sizing restrictions in R7e?

R7e takes precedence. All string-like materials must comply with R7e.

3. Does R7e take precedence over VUR6? If so, does this mean that any spring which could be considered "string-like", such as elastic thread, rubber, surgical tubing, bungee cords, or stretchable braided rope, must abide by the sizing restrictions in R7e? If so, should measurements be taken when the spring is stretched or unstretched?

R7e takes precedence. It would be measured unstretched.

4. Does R7e take precedence over VUR7? If so, does this mean that any Fastener which could be considered "string-like" must abide by the sizing restrictions in R7e?

R7e takes precedence. All string-like materials must comply with R7e.

5. Does R7e take precedence over VUR10? If so, does this mean that any Additional Electronics which could be considered "string-like", such as thin and flexible wires, must abide by the sizing restrictions in R7e?

Wiring to additional electronics does not fall under R7e.

6. If the answer to #5 is Yes, would thicker (but still thinner than 1/8") wires, solid or stranded, be restricted in size under R7e? Previously in [Tipping Point Q&A 1027](#) the GDC has said that single strand wire of 1/8" in size should be considered rope/string.

Q&As from prior seasons do not apply to this season. Wire that is used for any purpose other than wiring to the additional electronics specified in VUR10 should be considered string, and must comply with R7e.