

Q&A

VEXU 2022-2023: Spin 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 VEX U Spin 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](#) (including the VEX U Appendix C) itself.

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

- For event, registration, or other competition support questions, please contact your [REC Foundation 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.

Index

[Is tape allowed to have less friction?](#)

[R21c V5 Smart Cables + VEXU Custom Electronics](#)

[String in VEXU](#)

[Q&A 1341 Follow up](#)

[T21 VEX GPS Field Code Strips - VEXU World Championship](#)

[VUR3 And VUR4 Clarification](#)

[VUR3 and VUR4 Follow Up \(COTS Gears\)](#)

[15" Robot Expansion](#)

[Powering Commercial Solenoids](#)

[Follow up to Powering Commercial Pneumatics](#)

[Follow up to Q&A 1131](#)

[Follow up Q&A 1106 and 1146](#)

[Carbon Fiber](#)

[VUR3 and VUR4 Differing Standards](#)

[Bearing Balls](#)

[Follow-up to VUR-4 questions from last season regarding the legality of T-slotted aluminum extrusion.](#)

[VUR6, VUR4, Belts](#)

[Requirements for proof of fabrication by team member](#)

[Window of VEXU Student Eligibility](#)

[VUR7 Bushings and Similar Components](#)

[VUR7 Belts](#)

[Modification of Motor Cartridges](#)

Is tape allowed to have less friction?

30-Dec-2022

VUR3 R10

Is it legal to use Scotch tape to cover sheets of plastic? The purpose would be to allow the discs to slide easier along the plastic. R10 states that tape can't be used in this way, but interpreting VUR3 e, attaching tape to the plastic falls under this rule.

Answered by committee

Yes. This would be legal under rule <VUR3e>.

R21c V5 Smart Cables + VEXU Custom Electronics

8-Feb-2023

VUR10 R21

In the 3.0 Game manual update, R21c was added which says the following:

V5 Smart Cables may only be used for connecting legal electronic devices to the V5 Robot Brain.

From our understanding, R21c was added to prevent teams from using V5 smart cable stock as "string" for endgame extension. We believe our use of V5 smart cable and cable stock is within the legal intention of VUR10 and R21c, but clarity would be appreciated.

Our robot makes use of V5 smart cable stock and V5 smart cables to connect some of our VUR10 custom electronics to the V5 brain. Is this legal?

Our robot also makes use of V5 smart cable stock and V5 smart cables to connect some of our custom electronics to each other (said electronics are themselves connected to the V5 brain in accordance to VUR10). Is this legal?

Answered by committee

Yes, both of those uses for V5 Smart Cable would be legal.

String in VEXU

11-Dec-2022

VUR4 VUR7 R7

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.

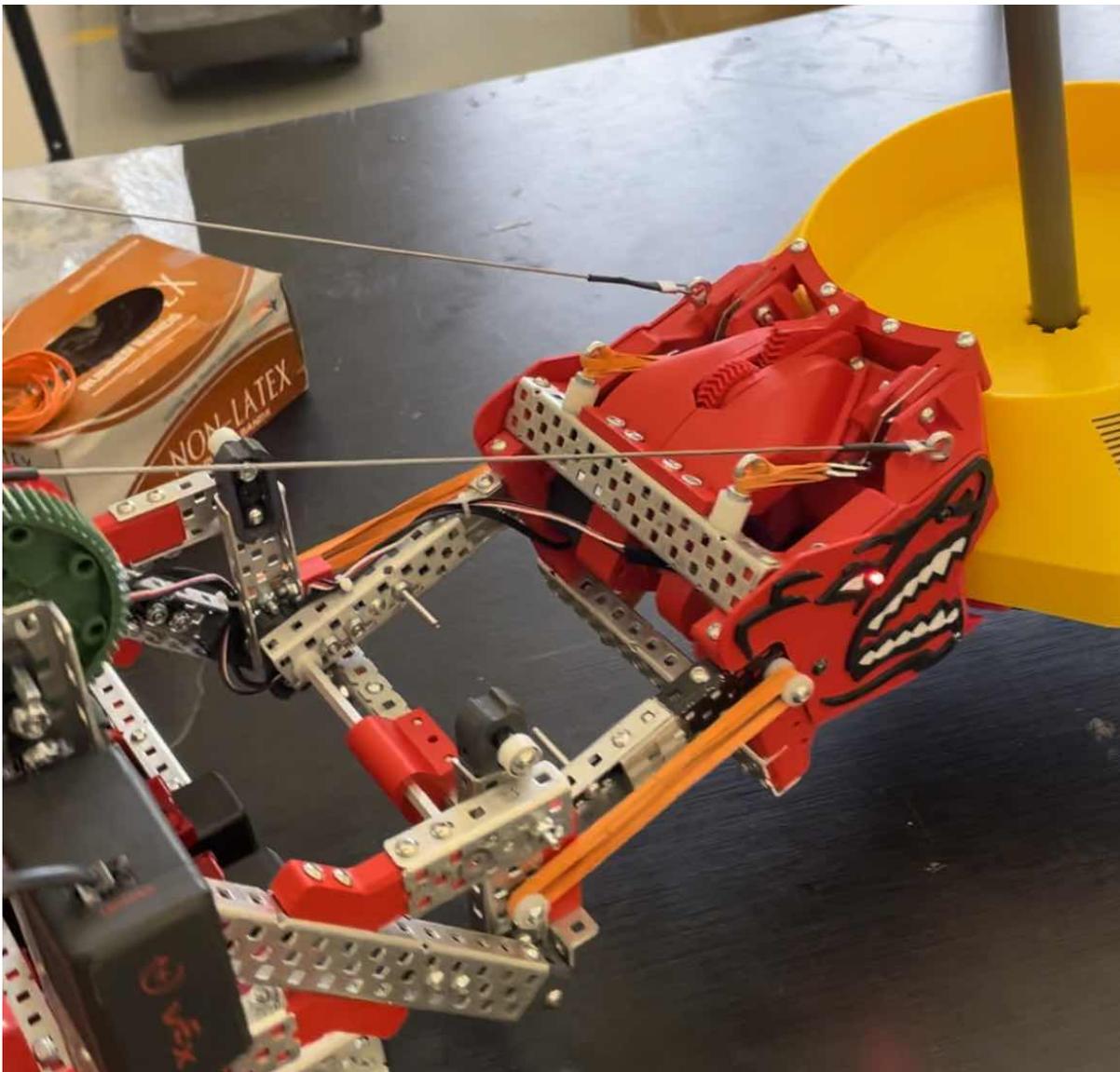
VUR7:

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.

Recently, the game manual was updated to require all string be at least 3 millimeters in diameter. This raises a couple questions in regard to VEXU:

1. Does string, regardless of diameter or material, qualify as a fastener by VUR7 if being used to connect two objects together?

For an example, steel cable with a diameter less than 3 millimeters was used in this fashion on one of our VEXU Tipping Point robots, as shown in the attached image.



Regardless of the answer to the above question, there are other extruded raw materials that would be legal under VUR4. For example: fishing line, TPU 3D printing filament, or metal wire, can all act like string and fulfill the same purpose. These materials are often less than 3 millimeters in diameter. Additionally, if the unstated intent of rule R7e is to make endgame mechanisms easier to score, then string size restrictions could vary based on its application on the robot. Therefore, the follow-up question is:

2. Can string or string-like materials with a diameter smaller than 3 millimeters be used for endgame mechanisms on VEXU robots?

Answered by committee

Thank you for your questions. 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.

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: a. Compression, tension, torsion, constant force, or conical springs made from spring steel. b. Springs made from elastic thread or rubber, such as surgical tubing, bungee cords, or stretchable braided rope. c. 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 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.

VEX GPS Field Code Strips are required for Programming Skills Matches as per Appendix B. T21 notes VEX GPS Field Code Strips on Head-to-Head competition fields as an example of permissible modification.

VEXU Autonomous period is 45 seconds. Programming Skills is 60 seconds. Given Autonomous period is 75% of the Programming Skills duration VEXU teams are likely to utilize more advanced sensing, such as VEX GPS. Can GDC/RECF make a decision if Head-to-Head competition fields at VEXU World Championship will have GPS Field Code Strips present.

Thank you.

Answered by committee

Thank you for your question. All competition fields at the VEX U (and VRC) World Championship will include GPS Field Code Strips based on the current event plan, which is not expected to change. Any Worlds-specific updates or clarifications will be included in the April 4, 2023, game manual update.

VUR3 And VUR4 Clarification

13-Oct-2022

VUG3 VUG4

VUR3:

Fabricated Parts may be made using the following processes: a. Adding material, such as 3D printing. b. Removing material, such as cutting, drilling, or machining. c. Bending material, such as sheet metal breaking or thermoforming. d. Casting or molding material, such as injection molding or sand casting. e. Attaching materials to one another, such as welding or chemically bonding (e.g., epoxy).

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>

Because casting is a fabrication process listed under VUR3, any material that has undergone casting is not a raw material under VUR4. However, metal billets are cast, and sheet metal and plastic is cast before being rolled. Are billets and sheets of material considered raw material? If so, how does that square with the definition of a raw material given in VUR4?

Thank you!

Answered by committee

Are billets and sheets of material considered raw material? If so, how does that square with the definition of a raw material given in VUR4?

As stated in <VUR4>, "For the purposes of this rule, a "raw material" is any material that would not be considered a "pre-fabricated" part." Most billets and sheets of material are made legal under <VUR4a>, as they are finished through standard raw material finishing processes.

If this answer is unsatisfactory and you'd like us to reconsider, please feel free to rephrase and resubmit your question.

VUR3 and VUR4 Follow Up (COTS Gears)

1-Nov-2022

VUG3 VUG4

Thank you for your clarification in [Q and A entry 1235!](#) To summarize, billets and sheets of material are classified as raw materials and considered legal, because even though they undergo some of the fabrication techniques listed in VUR3, they also undergo some of the finishing processes listed in VUR4. We would like to ask a follow up question, but first, here are rules VUR3 and VUR4 again.

VUR3:

Fabricated Parts may be made using the following processes: a. Adding material, such as 3D printing. b. Removing material, such as cutting, drilling, or machining. c. Bending material, such as sheet metal breaking or thermoforming. d. Casting or molding material, such as injection molding or sand casting. e. Attaching materials to one another, such as welding or chemically bonding (e.g., epoxy).

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). a. Standard raw material finishing processes, such as extrusion, heat treating, or anodizing, are not considered pre-fabrication.

Our question is whether other parts that have undergone the listed finishing processes are also considered raw materials. For example, most COTS gears are cast, hobbed, or broached, all of which would be considered prefabrication techniques under VUR3. However, COTS gears are then heat treated and / or anodized, which are both considered raw material finishing processes in VUR4. Are COTS gears therefore raw materials?

If not, what is the distinction between aluminum billets and (for instance) COTS cast aluminum gears? Both parts are cast and then heat treated.

Thank you for your time!

Answered by committee

Our question is whether other parts that have undergone the listed finishing processes are also considered raw materials. [trimmed] Are COTS gears therefore raw materials?

If not, what is the distinction between aluminum billets and (for instance) COTS cast aluminum gears? Both parts are cast and then heat treated.

No. COTS gears are not raw materials, and are disallowed by rule <VUR4>.

As to the distinction, an aluminum billet is a block of metal—a raw material that is designed to be fabricated into something else (for example, a gear); the other **is a gear**, which was fabricated for the sole purpose of being used as a gear.

We encourage you to consider rule <G3> and apply common sense when attempting to differentiate between raw materials and fabricated parts. If an item is generally intended to be used in the exact state in which it is sold & purchased, it is unlikely to qualify as a raw material under the VEX U competition rules.

15" Robot Expansion

2-Jun-2022

VUR1

SG4 states:

Horizontal expansion is limited until the Endgame. Robots may not expand beyond a horizontal area of 18" x 18" at any point during the Match prior to the Endgame.

SG5 states:

Vertical expansion is limited. Robots may expand vertically within the following conditions:

- a. The Robot must not be contacting the gray field tiles in either Low Goal.
- b. No part of the Robot may exceed an overall height of 24". This height limit is a "virtual ceiling," meaning that no part of any Robot may ever exceed 24" above the foam tiles, regardless of Robot orientation.
- c. Any extensions or combinations of extensions above 18" must fit within a vertical cylinder 2" in diameter.

VUR1c states:

One Robot must be smaller than 15" x 15" x 15" at the start of the Match.

Given these rules, is it legal for the 15" robot to expand horizontally to a maximum of an area of 18" x 18" according to SG4, as well as vertically according to the limitations in SG5?

Answered by committee

Given these rules, is it legal for the 15" robot to expand horizontally to a maximum of an area of 18" x 18" according to SG4, as well as vertically according to the limitations in SG5?

Yes, this is legal.

Powering Commercial Solenoids

1-Jun-2022

VUR10

Last season Q&A 990 (<https://www.robotevents.com/VEXU/2021-2022/QA/990>) was asked but never answered regarding the legality of driving non-vex solenoids. This question is similar to that question.

VUR10b states:

Sensors and electronics CANNOT directly electrically interface with VEX motors or solenoids.

There are 2 ways that VUR10b can be interpreted. Either, it applies to "VEX (motors or solenoids)" or it applies to "(VEX motors) or (solenoids)" The former interpretation would allow custom electronics to interface directly with non-vex solenoids. This would be useful, as most commercially available solenoids do not function of of the 5v provided by the V5 brain, and instead require 12v power which can be provided by custom electronics. If this is not legal, then it is not possible to use most commercial solenoids.

Historically, the GDC has ruled this to be legal, as it did in Q&A 93:

<https://www.robotevents.com/VRC/2018-2019/QA/93>

Is it still legal to power commercial solenoids using custom electronics?

Answered by committee

Is it still legal to power commercial solenoids using custom electronics?

Yes, this is legal, provided that no other rules are violated (i.e. all portions of VUR10 and VUR12).

Follow up to Powering Commercial Pneumatics

11-Jun-2022

VUR10 VUR12

Hello, upon reading the reply to this Q&A question <https://www.robotevents.com/VEXU/2022-2023/QA/1111> the legality of powering non vex solenoids is ruled legal as long as they are meeting VUR10 and VUR12 however reading the wording and the answer

There are 2 ways that VUR10b can be interpreted. Either, it applies to "VEX (motors or solenoids)" or it applies to "(VEX motors) or (solenoids)" The former interpretation would allow custom electronics to interface directly with non-vex solenoids. This would be useful, as most commercially available solenoids do not function of the 5v provided by the V5 brain, and instead require 12v power which can be provided by custom electronics. If this is not legal, then it is not possible to use most commercial solenoids.

Is it still legal to power commercial solenoids using custom electronics?

Yes, this is legal, provided that no other rules are violated (i.e. all portions of VUR10 and VUR12).

The portion in question means that VUR10B only applies to vex solenoids and not commercially available solenoids as extra componentry to power the solenoid externally not from the brain.

b. Sensors and electronics CANNOT directly electrically interface with VEX motors or solenoids.

My questions are as follows:

- 1: Could we get a firm clarification on if VUR10B is referring only to specifically vex solenoids or whether it is referring to solenoids in general as this is still ambiguous?
- 2: If solenoids in general are included in VUR10B does this mean the external electronics to allow to power solenoids at higher voltages than 5 volts are an exception to VUR10B
- 3: Based on the interpretation of the previous Q&A and from Q1 would it then be legal to interface commercially available solenoids through a processor used for sensor processing rather than directly through the V5 brain as this is powering the solenoid?
- 4: Additionally would having a non-programmatic solenoid activation be allowed e.g a circuit powered through the press of a bumper or other sensor foregoing the processor entirely hardwiring the circuit independent of the V5 brain other than providing power to the solenoid (disabling the solenoid on power disable)

Answered by committee

Thank you for the detailed question and quoted references. Rules <VUR9>, <VUR10>, and <VUR12> were updated in version 2.1 of the Spin Up Game Manual to clarify these points.

Follow up to Q&A 1131

2-Aug-2022

VUR10 VUR12

Almost 2 months ago [Q&A 1131](#) was asked. The answer to that Q&A was the following:

Thank you for the detailed question and quoted references. This question requires additional consideration time in order to provide a thorough and accurate response, and will not be resolved in the June 28 Game Manual update. We will provide a second unscheduled Game Manual update to the VEX U Appendix, and update this response, once a clarification has been reached.

Since that answer was posted three game manual updates have been published, on June 28th, July 19th, and August 2nd. I understand that this particular question might need extra consideration, however the continued uncertainty that not answering the question for nearly two months causes for VEXU teams is significant. Does the GDC have an estimate for when Q&A 1131 will be answered?

Answered by committee

The questions posed by Q&A 1131 have been answered in the October 4, 2022 Game Manual Update, via updates to rules VUR9, VUR10, and VUR12.

Follow up Q&A 1106 and 1146

6-Dec-2022

VUR10

<R20> Reads, "No modifications to electronic or pneumatic components are allowed. Motors (including the internal PTC or V5 Smart Motor firmware), microcontrollers (including V5 Robot Brain firmware), cables, sensors, controllers, battery packs, reservoirs, solenoids, pneumatic cylinders, and any other electrical or pneumatics component of the VEX platform may NOT be altered from their original state in ANY way.

d. For the purposes of this rule, the gear cartridges found within the V5 Smart Motor are considered "part of the motor". Therefore, any physical or functional modifications to official gear cartridges is not permitted."

In [Q&A 1106](#) from this season it was ruled that the removal of the back plate on the V5 optical and distance sensor was not allowed. However the precedent of <R20> in VEXU has already been disregarded with [Q&A 1146 / Q&A 612](#) where it has been made legal for VEXU teams to modify the internals of the motor cartridges as long as the electronics of the motors were not interfered with.

Given the precedent set by the ruling on motor gear cartridges would it be legal for VEXU teams to manufacture custom back plates(a non electronic component) for the V5 Optical and Distance sensors out of permitted materials and methods, as long as the electronics of the sensors were kept intact and unmodified in the same way V5 motors are?

Answered by committee

Given the precedent set by the ruling on motor gear cartridges would it be legal for VEXU teams to manufacture custom back plates(a non electronic component) for the V5 Optical and Distance sensors out of permitted materials and methods, as long as the electronics of the sensors were kept intact and unmodified in the same way V5 motors are?

Thank you for your question. Yes, VEX U teams may manufacture custom back plates for the V5 Optical and Distance sensors using permitted materials and methods, providing the electronics of the sensors are not modified.

Carbon Fiber

6-Jul-2022

VUR3 VUR4

VUR3 states:

Fabricated Parts may be made using the following processes:

- a. Adding material, such as 3D printing.
- b. Removing material, such as cutting, drilling, or machining.
- c. Bending material, such as sheet metal breaking or thermoforming.
- d. Casting or molding material, such as injection molding or sand casting.
- e. Attaching materials to one another, such as welding or chemically bonding (e.g., epoxy).

VUR4 states:

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).

- a. Standard raw material finishing processes, such as extrusion, heat treating, or anodizing, are not considered pre-fabrication.
- b. Fabricated Parts may not be made from raw materials which pose a safety or damage risk to the event, other Teams, Field Elements, or Discs. Examples of prohibited materials include, but are not limited to:
 - i. Any material intended to produce flames or pyrotechnic effects.
 - ii. Any material that is liquid at the time of the Match (e.g., hydraulic fluids, oils, liquid mercury, tire sealant, etc.).
 1. Fabrication processes that include the use of liquids, such as milling coolant or resin which has been cast into a solid part, are not considered a Violation of this rule.

Is carbon fiber stock a legal raw material under VUR4? Here are a couple examples of commonly available carbon fiber stock:

<https://www.mcmaster.com/5287T78/>

<https://www.mcmaster.com/8194K111/>

Given that the team performs one or more of the manufacturing processes in VUR3 in order to turn the raw carbon fiber into a Fabricated Part, would it be legal for use?

Answered by committee

VUR4 does not include a specific list of permitted or prohibited materials, other than point "b" (i.e. the materials do not pose any safety or damage risks to the event).

So, in general, the use of carbon fiber is not prohibited as a blanket rule, but we would *strongly* advise researching any applicable safety precautions and protocols involved, and including these as part of a Team's VUR5 documentation (as should be done when working with any exotic materials).

Ultimately, the decision whether a given material poses a safety risk is at the discretion of the Head Referee and the Event Partner, taking into account the context of the material's usage and application. For example, we would not recommend using carbon fiber for a Fabricated Part that has a high likelihood of snapping during a match, or require additional drilling / cutting in the pit areas (i.e. around other Teams who may not be familiar with proper safety precautions involved).

VUR3 and VUR4 Differing Standards

Thank you for your clarification in Q&A 1269! We have another follow up question about VUR3 and VUR4. Again, here are the rules:

VUR3:

Fabricated Parts may be made using the following processes: a. Adding material, such as 3D printing. b. Removing material, such as cutting, drilling, or machining. c. Bending material, such as sheet metal breaking or thermoforming. d. Casting or molding material, such as injection molding or sand casting. e. Attaching materials to one another, such as welding or chemically bonding (e.g., epoxy).

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). a. Standard raw material finishing processes, such as extrusion, heat treating, or anodizing, are not considered pre-fabrication.

To summarize these two rules, fabricated parts are additively or subtractively manufactured, formed, cast, or attached together. Raw materials are materials that have not undergone these processes.

The problem is, by a literal reading of the rules, basically nothing is a raw material. Materials such as 3D printer filament, plastic sheets, and metal billets, despite meeting the common sense definition of a raw material, have all undergone some of the manufacturing processes listed in VUR3 and should therefore not be considered raw materials by the written rule.

To solve this problem, the GDC has introduced 3 new standards to determine whether a part is considered a raw material. Sometimes the standard is the [part's primary fabrication process](#), sometimes the standard is the [part's finishing process](#), and sometimes the standard is the [intention of the vendor who sold the part](#).

Each standard is fine on its own, but they are often in conflict with each other. When this happens, it's not clear when to apply which standard. We hope the GDC considers rewriting this rule in the future to make it less confusing. However, until then, we hope to gain some clarification by asking about a few specific parts. We have intentionally selected edge cases because we want to understand when to apply each standard.

1.) Are rubber bands that are not size 32 or 64 raw materials? Rubber bands are usually extruded and cut to length, which should make them raw materials by Q&A 1144, but they are also "intended to be used in the exact state in which it is (they are) sold & purchased," which should make them prefabricated by Q&A 1269.

If they are raw materials, how does that square with Q&A 1269, and if not, how does that square with Q&A 1144?

2.) Is gear stock a raw material? Many suppliers cast and heat treat their gear stock, and intend for it to be cut (subtractively manufactured) by the user, which should make it a raw material by Q&A 1235 and 1269. However, it seems like common sense that gear stock and normal gears are equally prefabricated / raw since the manufacturing processes and final geometry are very similar.

If gear stock is not a raw material, how does that square with Q&A 1235 and 1269?

3.) Is colored tape legal? In tape manufacturing, the backing and the glue of tape are attached together, which should make it a prefabricated part by VUR3 note e. Then the tape is dyed, which is a standard material finishing process and should make the tape a raw material by Q&A 1235. And, like an aluminum billet, tape is intended to be cut (subtractively manufactured) before use, so it should be a raw material (or at least shouldn't be disqualified from being a raw material) by Q&A 1269.

If colored tape is a raw material, how does that square with VUR3 note e? If not, how does that square with Q&A 1235?

Thank you for your time, and for your patience :) We know that these edge-cases are difficult to formalize rules around, and we appreciate your clarification and professionalism.

Answered by committee

Thank you for your questions.

1.) Are rubber bands that are not size 32 or 64 raw materials?

Acceptable usage of rubber bands is covered by rule <R7h>, unless you wish to fabricate your own rubber bands as permitted under rule <VUR3>.

2.) Is gear stock a raw material?

Commercial off-the-shelf gears are not allowed for use on VEX U Robots, which we believe is the question you're actually asking here and the one we're able to provide a definitive answer for.

Team-fabricated gears, machined from raw steel / aluminum round stock, would be legal.

3.) Is colored tape legal?

Acceptable usage of tape is covered by rules <R7f>and <R10>, unless you wish to fabricate your own tape as permitted under rule <VUR3>.

Generally speaking, we try to refrain from extending the logic of one rule into another. However, we believe that the red box note for rule <R11> is also pertinent to your string of questions regarding rules <VUR3> and <VUR4>, so we'll extend it here: If a key component of your Robot's design relies upon convincing an inspector that a specific material or part is "technically not prefabricated" or "technically a raw material," it is probably outside of the spirit and intent of these rules.

Thank you for your patience. Edge cases are, as you've stated, difficult to formalize rules around.

Bearing Balls

16-Feb-2023

VUR3 VUR4

<VUR3> Fabricated Parts may be made using the following processes: a. Adding material, such as 3D printing. b. Removing material, such as cutting, drilling, or machining. c. Bending material, such as sheet metal breaking or thermoforming. d. Casting or molding material, such as injection molding or sand casting. e. Attaching materials to one another, such as welding or chemically bonding (e.g., epoxy).

<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>).

According to your ruling on [Q&A 1235](#), billets and sheet plastic are considered stock materials although they are cast and rolled. In your ruling on [Q&A 1269](#), a cast gear is considered fabricated and is therefore not a stock material because a billet "is designed to be fabricated into something else," while the gear is "fabricated for the sole purpose of being used as a gear." Additionally, you stated that if "an item is generally intended to be used in the exact state in which it is sold & purchased, it is unlikely to qualify as a raw material under the VEX U competition rules."

From those rulings and the rules in the game manual, is a [ball bearing ball](#) considered a stock material or a prefabricated (therefore illegal). The [manufacturing process of a ball bearing ball](#) is as follows:

1. Wire rod is cut to length. (Although "cutting" is illegal in VUR3a, this should be legal in the same way that it is legal for a long bar of metal billet is cut to individual length. The cutting is not adding complexity, it is shortening the material or detaching it from the spool.)
2. The cut slug is forged to produce a cold-headed ball. (Some metal billets are forged.)
3. Flashing removes the "equator" and "poles" giving the ball a rough finish. (Flashing should be legal since it is not a fabrication technique that is listed in VUR3.)
4. The ball is heat treated (Heat treating is legal according to VUR4.)
5. The ball is ground to approximate size. (Grinding could be classified as "removing material," but it is not expressly illegal in VUR3, and metal billet is ground to remove surface defects, so grinding should be legal.)
6. The ball is polished through a lapping process. (Polishing and lapping should be legal since they are not deemed a fabrication technique in VUR3.)

Additionally, a ball bearing ball is "designed to be fabricated into something else" such as a linear slide, turntable, or gyroscope. It is not usable by itself in the same way a gear is.

With these rules and rulings in mind, is a ball bearing ball legal for use in VEXU?

Answered by committee

Yes, ball bearing balls are legal. This was also clarified in this previous Q&A post:
<https://www.robotevents.com/VEXU/2022-2023/QA/1208>

Follow-up to VUR-4 questions from last season regarding the legality of T-slotted aluminum extrusion.

30-Jun-2022

VUR4

At the end of last season, the GDC answer asked for a specific example of "extruded aluminum," such as this one:
8020.net/1010.html

T-slotted aluminum is available for many suppliers (80/20 is probably the most well known), and comes in a variety of sizes. Will these be legal in accordance with VUR4 section a, "Standard raw material finishing processes, such as extrusion. heat treating..."?



Answered by committee

Yes, this is legal.

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 committee

Yes, rubber and polyurethane timing belts are legal.

Requirements for proof of fabrication by team member

1-Jun-2022

VUR5

A similar question was asked last year in Q&A 1015, but the portion relating to documentation was never answered: <https://www.robotevents.com/VEXU/2021-2022/QA/1015>

VUR5 states:

Any Fabricated Parts must be accompanied by documentation that demonstrates the Team's design and construction process for that Fabricated Part.

b. Any Fabricated Parts must have been physically fabricated by Team members. For example, parts ordered by the Team and 3D printed by a third party would be prohibited.

What is the minimum documentation a team can be required to show in order to prove that a part was indeed physically manufactured by a member of the team?

Answered by committee

The full text of VUR5 reads as follows, with some portions bolded for emphasis:

<VUR5> Any Fabricated Parts must be accompanied by documentation that demonstrates the Team's design and construction process for that Fabricated Part.

a. **The minimum acceptable form of documentation is an engineering drawing with multiple views for the part in question.** These drawings may be included in a Team's Engineering Notebook or in a standalone appendix to the Engineering Notebook.

b. Any Fabricated Parts must have been physically fabricated by Team members. **For example, parts ordered by the Team and 3D printed by a third party would be prohibited.**

c. Teams will be required to provide this documentation to inspectors, Head Referees, or judges at any time. **Failure to provide acceptable documentation will result in the part being deemed illegal for use;** therefore, <R3>, <R26>, and / or <G1> will apply.

When no VEX-specific definition for a word is provided, the dictionary definition can usually be applied. The dictionary definition for "[documentation](#)" is "*material that provides official information or evidence or that serves as a record*".

We are not going to explicitly specify a minimum form of evidence that must be provided for point "b", as it will be at the inspector's discretion to investigate depending on the part and situation in question. In most cases, the engineering drawing specified by point "a" will be sufficient. If there is further question about the physical fabrication process, examples of possible evidence could include, but are not limited to, pictures or videos of team members fabricating the part.

Window of VEXU Student Eligibility

28-Aug-2022

VUR7

Hello,

Student - A person is considered a Student if they meet both of the following criteria:

1. Anyone who is earning or has earned credit toward a high school diploma, certificate, or other 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, 2003 (i.e., who will be 19 or younger at VEX Worlds 2023). Eligibility may also be granted based on a disability that has delayed education by at least one year.
- Middle School Student - A Student born after May 1, 2007 (i.e., who will be 15 or younger at VEX Worlds 2023). A Middle School Student may "play up" and compete as a High School Student.
 - High School Student - Any eligible Student who is not a Middle School Student.

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 who 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>

I have a quick question about when a VEXU student can graduate and still be eligible to compete. The definition of Student solves this for High School and Middle School students with the 6th month window. Does this 6 month window apply for VUR7, allowing VEXU students who graduate within 6 months of the World Championship to compete?

Thank you for your time!

Answered by committee

The definition of Student solves this for High School and Middle School students with the 6th month window. Does this 6 month window apply for VUR7, allowing VEXU students who graduate within 6 months of the World Championship to compete?

Thank you for identifying this oversight! Rule VUG7a was updated in the October 4, 2022 Game Manual update:

All VEX U Team members MUST be matriculated in a post-secondary school OR have earned a post-secondary education diploma, certificate, or other equivalent during the six (6) months preceding the VEX Robotics World Championship. The intent of this rule is to permit students graduating mid-year to still be able to finish their competition season

VUR7 Bushings and Similar Components

24-Sep-2022

VUR7

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. a. 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. For example, a pre-fabricated non-VEX wheel (which would be illegal under VUR5) would not be considered a "fastener," even though it may also technically serve the purpose of bridging the connection between tread and a shaft.

In the vast majority of applications, bushings allow components to spin freely on shafts. Since bushings are explicitly allowed, it stands to reason that 2 parts are considered "fastened" if they are constrained together along many axes, even if they are not totally locked together. For example, a bushing might be used to fasten a gear to a shaft. The gear can spin relative to the shaft about the pitch axis, but it cannot spin about the roll or yaw axes, or translate along any axis. As such, it is fastened to the shaft. Is this a correct interpretation of the rule?

If so, we have 4 follow-up questions:

- 1.) Some potential fasteners allow relative rotation about one axes, just like bushings, but are not explicitly listed in VUR7. Bearings are the most obvious example. Are COTS bearings and other similar components legal if they are used as fasteners?
- 2.) Some potential fasteners allow relative rotation about multiple axes. For example, a ball and socket hinge prevents fastened components from relative translation along x, y, and z, but it allows relative pitch, yaw, *and* roll. Are COTS ball and socket hinges and similar components legal if they are used as fasteners?
- 3.) Some potential fasteners allow relative translational rather than relative rotation. For example, a COTS linear slider might be used to fasten a claw to the robot's chassis. The slider allows relative translation along x, but it prevents relative translation along y and z, and it prevents relative pitch, yaw, and roll. Are COTS sliders and similar components legal if they are used as fasteners?
- 4.) Some potential fasteners allow relative translational and rotational movement at the same time. For example, [this linear bearing](#) could be used to fasten a claw to a linear rail. The linear bearing would allow for relative translation along the y axis *and* relative rotation about the pitch axis, but would prevent relative x and z translation, and roll and yaw rotation. Are COTS linear bearings and similar components legal if they are used as fasteners?

Thank you for your time!

Answered by committee

Thank you for your questions.

Are COTS bearings and other similar components legal if they are used as fasteners?

Are COTS ball and socket hinges and similar components legal if they are used as fasteners?

Are COTS sliders and similar components legal if they are used as fasteners?

Are COTS linear bearings and similar components legal if they are used as fasteners?

Yes. COTS bearings, ball and socket hinges, sliders, linear bearings, and similar components are all legal for use as fasteners in the **VEX U** competition.

VUR7 Belts

14-Oct-2022

VUR7

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. For example, a pre-fabricated non-VEX wheel (which would be illegal under VUR5) would not be considered a “fastener,” even though it may also technically serve the purpose of bridging the connection between tread and a shaft.

Recently, [Q&A #1208](#) broadened the definition of “fastener” to include COTS bearings, linear bearings, sliders, and ball joints. The reasoning seems to be that a “fastener” is something whose sole purpose is to constrain the motion of other parts on the robot, even if that motion is not restricted in all axes.

Therefore, the question raised is: Are COTS belts also considered fasteners? Currently, the only VEXU legal belts are VEX Pro timing belts, but there are many other COTS belts, such as [V-belts](#), [round belts](#), and [flat belts](#), along with timing belts that have different tooth profiles and dimensions than the available GT2 and HTD timing belts.

Belts act as a fastener in the sense that they link the motion of two or more pulleys together. While the pulleys themselves would not be fasteners as shown by the wheel example, the belt’s sole purpose is to constrain the motion of the pulleys, and thus could be considered a fastener under the expanded definition.

Thank you!

Answered by committee

Therefore, the question raised is: Are COTS belts also considered fasteners?

Thank you for your question. No, a belt is not a fastener, and COTS belts do not qualify as legal fasteners for the Spin Up competition.

Edit: This answer was revised on 2023-03-22. Although belts are not fasteners, they will be considered legal for future use.

Modification of Motor Cartridges

5-Jul-2022

In Change Up Q&A 612 it was ruled that VEXU teams may modify V5 smart motor gear cartridges through any legal means: <https://www.robotevents.com/VEXU/2020-2021/QA/612>

Is this still the case?

Thank you.

Answered by committee

Yes.