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2023-2024 *FIRST*® Tech Challenge

# Forum Answered Questions Remote

## How To Use This Document

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The *FIRST* Tech Challenge Official Q&A Forum is a place where teams can ask questions and receive official answers from game expert moderators. The official *FIRST* Tech Challenge Question & Answer Forum rulings take precedence over all information in the game manuals.

Moderators will answer team questions beginning each Monday, and close on Thursday at 12:00pm eastern time. The forum answered questions are then converted to PDF (this document) to be easily read by teams and volunteers. This takes place every week for the entire season, so teams should ensure to access the new forum printout each Thursday. Any rule clarifications or changes will apply to events happening that weekend.

## For Remote Teams

Teams competing in remote gameplay must use the rules that apply when their specific event started. For example, if a team's remote event starts on Monday, 11/27/2023, the team would use rules from that date and prior. New rules or clarifications that are posted after the window opens do not apply until the next competition. Make sure to check the date of the forum post.

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## Traditional and Remote – General Robot Rules

### Q51 Train Model Button Disabled

**Q:**

I have followed all the steps in the Machine Learning Tutorial Tool Chain and whenever I generate a data set, if I try to train it the start training button does not become active. This is the same issue as described in Q17 but the response to that question does not solve the problem. I have already contacted customer support at FIRST a week ago with no resolution.

**A:**

This is a technical support question, not a game-specific rules clarification. If the issue persists, please seek help on the ftc-community (<https://ftc-community.firstinspires.org/>) forums. The FIRST Tech Challenge engineering staff is monitoring those forums, and await your questions.

(Asked by **21915** answer published at September 22nd 2023)

### Q63 How enclosed can the hexagons be in the robot?

**Q:**

How enclosed can the pixels be in the robot? Meaning, do the refs have to see the pixels at all times or can they go into the robot?

**A:**

Yes, Pixels can be in the robot. However, once inside the Robot it is to a team's advantage to keep the Pixels visible so that it is easy for the Ref to determine the quantity of Pixels that a Robot is carrying, but it is not a requirement.

(Asked by **12682** answer published at September 26th 2023)

## Q84 Which previous seasons are disallowed by <RM06> part b?

**Q:**

<RM06> b. says "The following season game and scoring elements are not allowed for Robot construction: ... Team manufactured replicas of COTS current or previous season's scoring elements." Is the intended meaning of "previous season's scoring elements" to be "scoring elements of previous season" i.e. prohibiting just POWERPLAY replicas, or (if we reposition the apostrophe) "previous seasons' scoring elements" as in "scoring elements of [ALL] previous seasons"?

**A:**

Rule RM06 should be interpreted as referring to only the previous season's game and scoring elements, which for Centerstage means any of the Power Play game and scoring elements.

(Asked by **10723** answer published at October 5th 2023)

## Q89 Grappling Hook

**Q:**

Does the interpretation of <RG06> include grappling hooks? In other words if a hook mechanism is attached to the Rigging, then released from the robot so that it is only held by aircraft cable and then that cable is winched back in order to lift the robot, is this allowed?

**A:**

A mechanism that operates as described is legal. Note that launching the hook is not legal.

(Asked by **15259** answer published at October 3rd 2023)

## Q93 Robot Weight

**Q:**

What is the max that a robot may weigh this year. I believe in the past it was 40 lbs.

**A:**

There is no weight restriction this year. See Q38 for additional details.

(Asked by **8136** answer published at October 3rd 2023)

## Q95 Grappling Hook - Clarification

**Q:**

This is an clarification on Q89. Which of the following would be considered launching the hook? a) The hook is propelled from the robot attached with fishing line. b) The hook is propelled from the robot attached with aircraft cable. c) The hook is propelled from the robot attached with #25 chain (a safety hazard, yes, but a great hypothetical as we reduce degrees of freedom) d) The hook is propelled from the robot attached to a spring-loaded linear slide.

**A:**

Placing a hook onto the Rigging by a mechanism (arm, slider, etc.) and then winching on a cable to lift the Robot is allowed. Launching the hook where it travels independent of the Robot is illegal per Rule RG06, regardless of what the connecting cable is made of, and will receive a G24 penalty (major plus yellow card). A1: illegal A2: illegal A3: illegal A4: As long as the hook remains attached to the slide until it is placed on the Rigging, then this mechanism is allowed.

(Asked by **15259** answer published at October 5th 2023)

## Q143 Energy source/storage by spring-like mechanisms or rubber bands clarification

**Q:**

When RG05 says be careful in the stored energy from spring-like or other mechanisms, Is it then a fair assumption that it is ok to deform a rubber band, spring device, or surgical tubing in a way that stores energy prior to the start of the match. Our intent would be to store energy for the purpose of launching the drone.

**A:**

Yes, rubber bands, springs, etc. are all acceptable methods for launching a Drone. The intent of RG05 is not to eliminate stored energy devices but to ensure that teams use them safely. Remember that during a match FTA's may have to access your robot and we don't want anyone hurt if the energy is accidentally released.

(Asked by **6889** answer published at October 29th 2023)

## Q145 Question About Drone Launching

**Q:**

Would it be acceptable to use a bow string (or similar) to launch the paper drones from the robot?

**A:**

There is no rule against using a bow string as a stored energy device to launch a Drone providing it is done safely. See Q143 for additional details.

(Asked by **6704** answer published at October 31st 2023)

## Q149 is pneumatics allowed?

**Q:**

One of my FTC student is interested in pursuing a pneumatics solution for the claw mechanism. I am trying to lean in and say YES to ideas right now and am exploring any legal or illegal game rules but don't see any related to

pneumatics or dc motors with pump valve attachments?

**A:**

No, Rule RG01 J expressly forbids the use of pneumatic devices.

(Asked by **23585** answer published at October 29th 2023)

## Q154 Can the team numbers be on a moving part or the robot?

**Q:**

The most visible part of our robot where we could install the team numbers is on our arm. Would we be allowed to install the team number onto the arm even though it moves? Another point of concern is that at some points in the game the team number might be upside down.

**A:**

Yes, placing numbers on a moving part of the Robot is allowed providing the numbers are always clearly visible through the range of motion of the mechanism. A Team Number that is temporarily upside down is acceptable.

(Asked by **19591** answer published at October 31st 2023)

## Q157 18inch rule in terms of flexible tubing

**Q:**

When flexible (easily bends) tubing is installed on the robot for intake, can the tubing extend slightly (1/2 inch) beyond the 18-inch boundary of the robot?

**A:**

The maximum size of the Robot for starting a Match is 18 inches (wide by 18 inches long by 18 inches high). However, per Rule RG02 b allows for flexible materials surgical tubing to extend up to 0.25 inches (0.635 cm) beyond the 18 inch size constraint. A 1/2" extension is outside of the allowable margin. Consider tucking it in at startup, once the Match starts Robots may expand beyond the starting size constraint.

(Asked by **20373** answer published at November 2nd 2023)

## Q180 Is the drone part of the robot?

**Q:**

For inspection purposes, is the drone considered part of the robot? Is it required to fit within the 18" sizing tool when preloaded? Or is the robot measured before the drone is preloaded? For example, the robot is 17.25" wide, but when the drone is preloaded and the robot is measured from the tip of the wing to the far side of the robot it is now 18.5" wide - is this legal and will it pass inspection?

**A:**

For sizing purposes, the Drone is not considered part of the Robot. Per Rule RG02a, "Preloaded game elements may extend outside the starting size constraint".

(Asked by **18094** answer published at November 10th 2023)

## Q181 Field wall keeping robot in starting configuration Rule <RG02>

**Q:**

Can a robot with easily flexible parts (such as surgical tubing or a zip tie) start a match with these parts pressed up against the field wall in such a way that they would bend? If this is allowed, then during inspection could a team bend the parts in the same way which they will be bent on the field when a match starts in order to fit within the 18 inch sizing tool since that would be the configuration in which the robot would start the match.

**A:**

No, the Robot must be within the 18" x 18" x 18" size without relying on any external forces from the sizing box or the wall.

(Asked by **16449** answer published at November 14th 2023)

## Q183 <RE01> Allowable Power Switch Label

**Q:**

Rule <RE01> specifies the requirements for the robot's main power switch label. Does the label shown in the rule have to be made from paper or can an appropriately sized and colored 3D printed replica of the label be used in place of the paper label? One example of a 3D printed power label can be found here <https://www.thingiverse.com/thing:3097705>.

**A:**

A multi-color plastic label is allowed if it is visually identical to the power button image shown in Game Manual Part 1 rule RE01.

The 3D printed power label referenced in the question is allowed because it is visually identical to the required label. The label has a white background, a red dashed line border, and the correct interior elements colored in black.

(Asked by **21490** answer published at November 16th 2023)

## Q191 Roughtop tread used in something other than drivetrain

**Q:**

<RG01> a. says "The following types of...parts are not allowed: Those used in a Robot drive system that could potentially damage the Playing Field and/or Scoring Elements such as high traction wheels and high grip tread." The legal/illegal parts document seems to flat-out ban the HiGrip Wheel and Rough top Tread. If those parts were used in a way that were unlikely to damage anything (say high grip tread as flappy intake), would they be allowed?

**A:**

High grip tread may not be used in any device that contacts the tile floor due to potential damage to the soft rubber tile. However, the tread may be used elsewhere on the Robot, provided that it does not damage Game Elements

(Asked by **10723** answer published at November 16th 2023)

## Q197 Are team logos considered fiducial markers?

**Q:**

Our team logo is a pair of eyes. Are we allowed to embed our logo into a 3D-printed team prop?

**A:**

Based on the feedback we have received from Teams and volunteers we are clarifying and relaxing the restrictions on the types of images that are allowed on the Team Prop. The intent of rule TE03b is:

1. prevent the use of any object on the field that could confuse or distract other Robots.
2. prevent the use of canned solutions to simplify the task of object identification.

Therefore, any image that resembles a QR code, AprilTag, or coded vision target is not allowed. All other images such as team logos, sponsor logos, raised areas, cut outs, etc. are allowed, providing no other rule is violated.

(Asked by **5484** answer published at November 21st 2023)

## Q202 Fiducial Legality under RM06c

**Q:**

In GM1 RM06c, fiducial images of any type are disallowed for Robot construction. In Q192 and Q197, patterns, logos, and images of any type are interpreted as fiducial and disallowed under TE03 because of this. a) Does RM06c use the same definition of "fiducial", and thus prohibit use of patterns (such as patterned pocketing) and team/sponsor logos on team robots? b) Does RM06c concern any fiducial markings on COTS parts? A specific example would be the barcodes on Andymark NeveRest Motors.

**A:**

The answers to Q192 and 197 have been updated as follows. If this does not answer your question please re-submit.

Based on the feedback we have received from Teams and volunteers we are clarifying and relaxing the restrictions on the types of images that are allowed on the Team Prop. The intent of rule TE03b is:

1. prevent the use of any object on the field that could confuse or distract other Robots.
2. prevent the use of canned solutions to simplify the task of object identification.

Therefore, any image that resembles a QR code, AprilTag, or coded vision target is not allowed. All other images such as team logos, sponsor logos, raised areas, cut outs, etc. are allowed, providing no other rule is violated.

Fiducials as part of a COTS label are allowed.

(Asked by **16461** answer published at November 30th 2023)

## Q258 Can I use LED lights for object detection

**Q:**

Can I use these lights to illuminate my TGE? [https://www.amazon.ca/DKKY-Lighting-Spotlight-Headlight-Controller/dp/B0B7MQ84L8/ref=sr\\_1\\_6?](https://www.amazon.ca/DKKY-Lighting-Spotlight-Headlight-Controller/dp/B0B7MQ84L8/ref=sr_1_6?)

crd=21S2CMLNK069S&keywords=rc%2Bled%2Blights&qid=1704045274&srefix=rc%2Bled%2Blights%2Caps%2C124&sr=8-6&th=1 These lights will go through the 5V ports on the REV control hub. Are these lights allowed under the <RE12> rules in the game manual part 1



**A:**

There is not enough information in the descriptions provided to make a yes/no determination.

It's not clear from the Amazon product description whether or not the clear domes on the LEDs are focusing lenses, which would not be compatible with RE12.a - from the description and the intent of the product (as well as the stated use in this question) it appears that the intended use is as a "flashlight" which would not be compatible with RE12.a.

It is also not clear from the description how bright the LEDs are. RE12.b may apply if the lights are bright enough to potentially interfere with other robots, teams, field personnel, etc.

(Asked by **19530** answer published at January 9th 2024)

## Q262 Robot Moves on Initialization Sticker

**Q:**

In previous years, rule RG02 required the robot to have a sticker "Robot Moves on Initialization" if it did move during that phase. This year, that requirement seems to be gone. Is that an oversight or do we not need the sticker anymore?

**A:**

The Robot Moves sticker is not required this year. However, Teams may still place this sticker on their Robot if they wish.

(Asked by **20267** answer published at January 9th 2024)

## Q264 GoBilda U-channel Sharp Edges

**Q:**

Our robot inspector has newly informed us this year that our GoBilda U-channels, which make up much of our robot, have too sharp of corners and need to be filed down. If this is true, that means that nearly all teams need to file down a lot of corners, so we want to know if the sharp edges rule applies to this scenario?

**A:**

The Inspectors have the responsibility for determining if the edges or corners have the potential of cutting a person's skin. If they perceive a hazard, then the edges must be filed.

(Asked by **18119** answer published at January 9th 2024)

## Q269 Anti-static spray onto robots

**Q:**

Rev Robotics has documented issues with the IMU in the newer Control Hubs stating ESD as a major contributor. We understand that the Event Host can decide on the use of anti-static spray on the field. We also understand that teams may spray their robots with anti-static spray as long as it is done outside the venue. Is there a time interval required between the time of spraying a robot and inspection or game play? We are presuming the spraying of the robot can not be done post inspection.

**A:**

You are correct that event organizers are encouraged by FIRST to apply staticide on their fields, but it is at their discretion.

Teams who wish to apply staticide to their robots can do so at anytime during the competition provided that the spray is fully dry before the robot is introduced to the field. Teams may also be asked by venue hosts to spray outside due to the potential fumes. Be advised that it may take upwards of 1 hour for the spray to fully dry.

(Asked by **4327** answer published at January 17th 2024)

## Q272 Are phone holders that clip on the controller allowed?

**Q:**

A driver for my team is looking to use a phone Mount clip to secure the phone to the game pad, during match driving. This would allow the driver to use his hands more freely and see the phone telemetry while he is driving. Rule DS03 allows mechanical modifications to a game pad controller, but it is unclear if that same rule extends to phones. This is really more of an enhancement, adding a clip to the game pad, but not changing it any way. Can we use the clip?

**A:**

A phone mounting clip is allowed providing the field personnel can clearly see the screen.

(Asked by **19460** answer published at January 11th 2024)

## Q274 RG01 -i clarification

**Q:**

We were going through the inspection checklist before our competition in a week. Our coach noticed that the aluminum of our intake drags of the floor. Technically grounding the chassis to the field. The rule states that "Those that are designed to electrically ground the Robot frame to the Playing Field" are illegal. Considering the fact that it was not designed for grounding, are we ok? Or should we scramble a replacement material?

**A:**

Intakes, or grabbers, that touch the floor are legal providing they do not cause damage to the Tiles during operation.

(Asked by **18045** answer published at January 18th 2024)

## Q302 Autonomous selector switch

**Q:**

We have 6 different autonomous programs currently. We need to account for Blue vs red side. We have different ones based on our alliance partners capability. Is it legal to add a selector switch, rotary or other on the robot so we can have one Autonomous program but we select which program we want to run before the match? We understand the switch must be set BEFORE match play and cannot be touched after the randomized dice are chosen. We will already know the program we want to run.

**A:**

Yes. Sensors (including switches) that are compatible with RE11 are allowed to be used on a robot. We also believe the answer to [Q278 \(/qa/278\)](#) is also related to your question from a software-centric perspective.

(Asked by **24488** answer published at February 1st 2024)

## Q312 Clarification PWM Signal wire may be relieved from Q85, RE14

**Q:**

The PWM wire (of the 3 wires) is a pulse width (of ~800-2200 microsecond) carrying wire and not current carrying. Teams can optimize and reduce the wire size to better innovate. Manufacturers utilize the same gauge for PWM as Power for convenience and not necessity, lower gauges will not create negative impact or safety concern and increase innovation. Team design and reliability is the proof. Can FIRST exempt PWM signal wires and allow =>32awg.

**A:**

The short answer is No.

For reasons of safety, all wires in the PWM wiring bundle must be no less than 22AWG as referenced in [Q85 \(/qa/85\)](#) .

A simple inversion of the connector where it plugs into the control/expansion hubs would result in the ground and signal lines being swapped and the undersized signal line now needing to carry the full current of the servo.

(Asked by **3763** answer published at February 7th 2024)

## Q318 Anti-Static Paint

**Q:**

Regarding Q269, it talks about the ability to use staticide on robots. Is it allowed to be able to use Anti-Static Paint? It is not clearly stated as to whether or not it is legal, and we want to verify. It would be on our side plates and it would be dry by comp.

**A:**

RM03 states, "Allowed materials and legal COTS parts may be modified (drilled, cut, painted, etc.), as long as no other rules are violated." FIRST Tech Challenge does not restrict the kinds of paints used, except those prohibited by RG01 (containing hazardous materials like lead, cause a mess on the field, etc...). When painting COTS parts/materials, DO NOT paint over any identifying markers (labels, serial numbers, etc) that inspectors may need to use to identify the components being painted. Teams should be aware that these paints may have different handling precautions over generic paints and that the manufacturer's recommendations and the MSD sheet should be consulted before using.

(Asked by **10355** answer published at February 8th 2024)

## Q324 Sister Team Robot at States

**Q:**

I know this violates the spirit of rule 7, but I'm looking for definitive authority to appease those who disagree. Can a team that advances to the State Championship use a Robot built by a team that did not advance? Rule 7.1 states "A FIRST Tech Challenge Robot is a remotely operated vehicle designed and built by a registered FIRST Tech

Challenge Team..." It does not specifically state that the "registered FIRST Tech Challenge Team" needs to be the same team that built the robot. Any guidance?

**A:**

This is not legal per rule C05 "One Robot Per Team", part d. - "It is against this rule to use a Robot built by another Team".

(Asked by **9986** answer published at February 8th 2024)

## Traditional and Remote – Commercial Off the Shelf Components

### Q12 Legal or illegal build kits.

**Q:**

Can you inform me if Go bilda build kits have been deemed illegal? There is no mention of them in the legal or illegal parts and I spent a lot of money upgrading this winter to try and compete.

**A:**

Teams may acquire parts and materials from any readily available source, including GoBilda, providing they do not violate any robot build rules. Pay specific attention to Rules RM01 and RM02 when purchasing parts and kits.

(Asked by **16610** answer published at September 19th 2023)

### Q25 Exceptions to rule RM02

**Q:**

Good evening. Provided no other rules are violated, which of the following kits are legal COTS items under the <RM02> exception for COTS drive chassis? Assume that a "swerve module" is a collection of parts including a wheel and mechanisms to rotate the wheel in two axis. 1) A single "swerve module." 2) A bundle of 2 or more "swerve modules." 3) A complete "swerve" drivetrain, including 2 or more "swerve modules" and a frame, necessitating no additional parts to be assembled as a drive chassis.

**A:**

Q1: A single swerve module kit does not meet the requirements in Rule RM02 and therefore is not legal.

Q2: A bundle of swerve modules violates Rule RM02 and is not legal.

Q3: A complete drivetrain made up of illegal parts is not legal.

(Asked by **16379** answer published at September 22nd 2023)

### Q40 Follow up to q25 and Exceptions to RM02

**Q:**

In q25, it was asked if a complete swerve drivetrain kit is a legal COTS drive chassis. The given answer was "A complete drivetrain made up of illegal parts is not legal." Follow up questions: 1) Which of the components in the proposed COTS kit are illegal parts? It would comprise entirely of motion components (bearings, shafts, gears)

and structural components (mounts, frame, screws). 2) Is a complete swerve drivetrain kit comprising only of parts allowed under <RM02> a legal COTS kit?

**A:**

A swerve drive module, by its very design, takes a one degree of freedom (DOF) motion and adds additional degrees of freedom to change the motion - the total DOF is dependent on the implementation, but it is always more than one. These kinds of components are not allowed by RM02's single DOF restriction for COTS parts, whether bundled in a COTS drive chassis kit or not.

(Asked by **16379** answer published at September 24th 2023)

## Q96 Gobilda linear slide legality

**Q:**

Is the GoBilda Steel Viper-Slide (<https://tinyurl.com/5bdx8rpb>) a legal COTS part under RM02?

**A:**

Per RM02, linear slides are a legal COTS. Therefore, the Gobilda Linear Slide is a legal COTS part.

(Asked by **20326** answer published at October 5th 2023)

## Q119 Definition of COTS Battery

**Q:**

Per RE12 F.ii, it states that an external COTS USB battery pack is allowed to power LEDs on the robot. What is considered an external COTS battery pack? What are the limitations on said battery packs? Additionally, are converters designed to pull 12V from the battery pack such as <https://www.amazon.com/dp/B08NRM6X2Y> allowed? It would be connected to this adapter to allow use with the REV Blinkin <https://www.amazon.com/dp/B0BHNNWJMD>.

**A:**

The COTS USB battery pack mentioned in RE12.f.ii is a simple USB charging battery intended to allow mobile recharging of USB powered devices (phones, tablets, etc). There are many examples (<https://www.anker.com/products/a1287>) available from many sources.

Thank you for asking about Battery Pack limitations. COTS USB Battery Packs are limited to a capacity of 27,000mAh or less. This is also the standard TSA limit (<https://www.faa.gov/hazmat/packsafe/lithium-batteries>) for taking Lithium-containing COTS USB Battery Packs (with 3.7V cells) onto aircraft in the USA.

COTS USB Battery Packs that adhere to the USB-PD or USB-QC specification may be used to provide a 12V source as described. Please ensure that the COTS USB External Battery is in no way connected to the robot's power system.

When using COTS USB External Battery Packs for legal LED and related uses, please observe a heightened level of vigilance in their safe use. The Robot Controller Power Distribution page ([https://ftc-docs.firstinspires.org/en/latest/control\\_hard\\_compon/rc\\_components/power\\_distr/power-distr.html](https://ftc-docs.firstinspires.org/en/latest/control_hard_compon/rc_components/power_distr/power-distr.html)) on ftc-docs has been updated with proper guidance for using COTS USB External Battery Packs ([https://ftc-docs.firstinspires.org/en/latest/control\\_hard\\_compon/rc\\_components/power\\_distr/power-distr.html#cots-usb-battery-pack](https://ftc-docs.firstinspires.org/en/latest/control_hard_compon/rc_components/power_distr/power-distr.html#cots-usb-battery-pack)). Please review this information prior to using any COTS USB External Batteries.

(Asked by **8693** answer published at October 24th 2023)

## Q179 COTS Scissor Lift

**Q:**

Are scissor lifts legal (specifically with regard to RM02)? The scissor lift will move up and down. It will be turned by a handle that rotates. This is the only axis of rotation we can identify. Do the lifts contain more than one axis of rotation or not? Link to scissor lift dimensions and information: [https://www.amazon.com/Stainless-Steel-Stand-Table-Laboratory/dp/B07KDXJGX9/ref=sr\\_1\\_3?crd=M7CME9QU2WX2&keywords=mini+scissor+lift&qid=1696890453&srefix=mini+scissor+lift%2Caps%2C99&sr=8-3](https://www.amazon.com/Stainless-Steel-Stand-Table-Laboratory/dp/B07KDXJGX9/ref=sr_1_3?crd=M7CME9QU2WX2&keywords=mini+scissor+lift&qid=1696890453&srefix=mini+scissor+lift%2Caps%2C99&sr=8-3)

Update 11/16/223 Yes, this is a legal COTS mechanism. It meets the single degree of freedom rule. One input (rotation of the leadscrew) for one output (vertical lift of the stage).

**A:**

(Asked by **18094** answer published at November 15th 2023)

## Q187 Legality of goBilda linear servo and servo-driven gear rack

**Q:**

Are the following COTS components from goBilda legal under RM02? 1. Hitec Linear Servo (<https://www.gobilda.com/hitec-linear-servo-100mm-stroke-4-1mm-sec-22-2kg-thrust/>) 2. Servo-Driven Gear Rack Kit (<https://www.gobilda.com/servo-driven-gear-rack-kit-single-gear-rack/>)

**A:**

A1: Yes, the linear servo is a legal 3 wire servo. A2: Yes, rack and pinions are legal.

(Asked by **23216** answer published at November 16th 2023)

## Q195 Carabiners Allowable?

**Q:**

Are carabiners allowable parts?

**A:**

Yes, carabiners are a legal COTS part.

(Asked by **6168** answer published at November 21st 2023)

## Q196 Clarification on Wound Springs and Degrees of Freedom

**Q:**

Regarding RM02 Would a sub assembly that contains a wound spring but produces a linear motion be allowed (as a single DOF)? Specific examples being a tape measure and a retractable badge holder. In both cases the body internally contains an inaccessible rotary mechanism, but what extends from the body (metal tape and string respectively) is linear. Would the gimble fitting on the end of the badge holder be disallowed as an added DOF? If so, could we modify the badge holder to remove?

**A:**

Tape measures and similar devices, like a badge holder, are allowed. There is no need to take off the gimbaled fitting on the badge holder.

(Asked by **21606** answer published at November 21st 2023)

## Q198 Double Sided Tape

**Q:**

Can double-sided adhesive be used on our "pixel-picking up device" on our robot? We've designed a flat plate with double-sided crafting tape that is slightly sticky, leaves no residue and cannot actually reach the playing field. It can release pixels with a push rod system. More than happy to provide photos to help with description.

**A:**

No, double-sided adhesive cannot be used on a "pixel-picking up" device. Any adhesive contact with a game element, scoring element, or field element is prohibited.

(Asked by **21485** answer published at November 21st 2023)

## Q237 Is this bendable fiber glass tube FTC legal?

**Q:**

My team began using a bendable piece of fiberglass as the linear actuator that extends the pixels out. However, I was reading the game manual and saw that any part that is not readily available to any team is not FTC legal. Technically any team could get it on the company's website, but they mostly work with military customers, and you have to contact their sales department to get a hold of one. Could we use it on our robot? Link: <https://www.rolatube.com/product/system-50-single-tube-mast-mil/>

**A:**

The bendable fiberglass material is legal.

(Asked by **23574** answer published at December 19th 2023)

## Q244 One Way Bearings regarding Degrees of Freedom

**Q:**

According to RM02, COTS parts are limited to 1 degree of freedom, and mention how ratcheting wrenches are illegal. One-way bearings have a similar design, so would they break this rule of more than one degree of freedom?

**A:**

There are many types and designs of one-way bearings. Some use a system of springs and wedges to prevent backward motion. This is similar to a ratchet and is not allowed. Other types rely on the design of the internal races to prevent reverse motion. This type of bearing is allowed.

(Asked by **10355** answer published at December 19th 2023)

## Q308 Robot Inspection

**Q:**

1. In reference to the part W44609 TETRIX® MAX Gripper Arm Kit from legal and illegal parts, the robot inspectors referred to rule RM02 Commercial Off-The-Shelf Parts. Our claw uses one gear, one bracket, and the 3 arm linkages from the kit on the website <https://www.idesignsol.ca/products/claw-kit-276-2212>. However, our claw has a custom 3-d printed second gear, second bracket, one custom arm linkage, claw tips and servo mount. Our claw works through the two gears powered by one servo.....

**A:**

In general, a 100% team manufactured component/assembly is allowed, even if it is an exact copy of an illegal COTS component. If any portion of the component/assembly is part of an illegal COTS kit (i.e., not manufactured by the team), the entire component/assembly is not allowed. Of course, using general purpose fasteners (e.g., screws, nuts, bolts, etc.) from an illegal kit is allowed.

(Asked by **9990** answer published at February 8th 2024)

## Q309 Robot Inspection continued from number 1

**Q:**

2. Our claw works such that it is connected to one gear that spins another gear. As this is one input = one output. Please respond if this is legal or if you need more information regarding this or with a way we can send a photo showing how our mechanism works. Coach Ray Alford Team: Robo Vikings #9990

**A:**

We believe Q308 answers your question. If not, please re-submit with additional detail.

(Asked by **9990** answer published at February 8th 2024)

## Q317 Vision Sensors Legality

**Q:**

Q298 asked about the legality of Oak Lite 1 vision sensor. What about the other sensors listed as legal on page 11 of the legal-illegal parts list under vision sensors? The HuskyLens and PixyCam are also shown with the Oak Lite 1 as options. Additionally the HuskyLens has supported documentation in the SDK, as referenced in Game manual 1, section 7.2.1.

**A:**

You are correct, the image of the Oak-1 Lite was included as a mistake. We apologize for this error. The HuskyLens and PixyCam/Pixy2 meet all requirements for a Vision Sensor.

(Asked by **20077** answer published at February 8th 2024)

## Q349 Use fans to cool robot

**Q:**

We are trying to plan a robot base for next year and are trying to figure out if we would be able to use off-the-shelf fans for a cooling system for the motors. <RE10> Defines a servo as any motor with less than 6V, specifically



allowing any servo that is compatible with the control hub <RG01> only explicitly disallows closed gas devices, and doesn't mention fans Would an off-the-shelf fan be allowed by these rules?

**A:**

No. COTS fans are not servos, and RE10 merely states that servos will only be provided 6V or less by the Control System. A "fan" in and of itself is not illegal, but it must use a legal actuator and follow all other rules (including safety rules).

(Asked by **9853** answer published at March 12th 2024)

## Traditional and Remote – Raw and Post Processed Materials

### Q67 V-Slot aluminum legal to use?

**Q:**

Hi. Is it legal to use V-Slot Aluminum? There is a picture on page 16 of the "Legal/Illegal Parts" document that has V-Slot piece pictured however it is under the T-slot section. Thanks!

**A:**

Yes, v-slot aluminum is a legal material.

(Asked by **21630** answer published at September 26th 2023)

### Q82 Are rubber bands legal for shooting the drone?

**Q:**

Are rubber bands legal?

**A:**

Yes, rubber bands are a legal part of the Robot. They are not a legal part of the Drone, so when shooting the Drone, the rubber band must remain attached to the Robot.

(Asked by **13246** answer published at October 2nd 2023)

### Q288 Which VEX parts are legal in FTC Centerstage?

**Q:**

I've wanted to know if we can use plates, beams, gears, chains, wheels, connectors from VEX robotics kit?

**A:**

VEX structural and electrical elements are treated the same as any other COTS part (e.g. they must meet the single-degree-of-freedom threshold of RM02, allowed materials limitations of RM01, etc...). Note: with the exception of the Vex EDR 393 motor and paired Motor Controller 29, Vex electronics are not allowed.

(Asked by **24311** answer published at January 25th 2024)

# Traditional and Remote – Miscellaneous Robot Electrical Parts and Materials

## Q19 GoBilda Motor Legality

**Q:**

Section <RE09> of Game Manual Part 1 does not list any type of GoBilda motor as an allowed motor. Seeing how GoBilda advertises their motors as FTC legal, they have been widely used in previous years, and that they are a selectable option in the robot configuration, are the 5203 Series GoBilda motors FTC legal?

**A:**

goBILDA motor/gearbox combinations utilizing the Modern Robotics/MATRIX 12V DC Motors, along with their attached single degree-of-freedom gearboxes, are legal per rule RE10c. This currently includes motor/gearbox combinations in the goBILDA Yellow Jacket 5201, 5202, 5203, and 5204 series.

(Asked by **5237** answer published at September 22nd 2023)

## Q27 Adafruit NeoDriver LED controller legality

**Q:**

Is the Adafruit NeoDriver, I2C to NeoPixel Driver Board, <https://www.adafruit.com/product/5766> legal to use for controlling addressable LED lights of the WS2812 variety (NeoPixels) The module would be plugged into and powered by the Control Hub's 5V auxiliary ports. Using a JST SH (Stemma QT) to PH cable, the NeoDriver would be connected to an I2C port on the Control Hub. The NeoPixel wires would be connected to the remaining 3 terminals, 5Vo, GND, and NEO (data).

**A:**

Yes, per RE12.e

(Asked by **16464** answer published at September 22nd 2023)

## Q28 Gobilda linear servos

**Q:**

Are Gobilda linear servos legal?

**A:**

As long as a servo meets the constraints listed in RE10 it is allowed.

(Asked by **8899** answer published at September 22nd 2023)

## Q29 GoBilda Odometry Pods

**Q:**

In past years, we have seen odometry kits banned. Are GoBilda's new odometry pods legal, or do we need to continue to build our own? <https://www.gobilda.com/odometry-pod-43mm-width-48mm-wheel-2048-ppr-encoder/>

**A:**

Each new season brings a new set of Game Manuals and rules, it's never advised to make assumptions based on prior seasons.

Rule RM02 this season includes a trio of exceptions, one of them allowing odometry kits.

(Asked by **14840** answer published at September 22nd 2023)

## Q62 Are solenoid actuators allowed if used as a servo?

**Q:**

Our team is considering using a solenoid (6v) in lieu of a servo. Does this run afoul of regulations?

**A:**

Solenoids are not allowed per RE16.

(Asked by **14903** answer published at September 25th 2023)

## Q68 Is it legal to remove a Motor Mount to use on a robot?

**Q:**

Is it legal to remove a motor mount from a Modern Robotics/MATRIX 12VDC Motor with 8mm REX™ Pinion Shaft (5000-0002-4008) to use on the robot?

**A:**

Yes, it is legal to use a motor in which the motor mount/pinion shaft has been removed.

(Asked by **21630** answer published at September 27th 2023)

## Q69 Can we power sensors connected to the analog, digital, and i2c port from 5v aux port?

**Q:**

Past interpretation of the prior version of RE11.a allowed for many 5v in, 3.3v out sensors to be connected to the aux 5v port. The new RE11.a seems to clarify where sensors can be connected, but was it intentional to outlaw use of the 5v aux port to power them even though they are otherwise connected to the analog, digital, and i2c ports for all but power? The aux port is used to power other sensor port devices, like I2C lights (see Q27)

**A:**

No. Sensors may only be powered via the ports listed in RE11.a. If your sensor needs 5v, you will need to utilize the REV Logic Level Converter as described in RE11.b

(Asked by **14423** answer published at September 28th 2023)

## Q71 REV grounding strap wiring constraints?

**Q:**

Reading RE14.k, it seems that the only legal connection points for a REV Grounding Strap are the female XT30 ports of a Control Hub, Expansion Hub, XT30 Power Distribution Block, or the female XT30 on a REV PowerPole to XT30 adapter. Q1: Is this an accurate conclusion? Q2: Does the "No other...adapters are permitted" portion of RE14.k also apply to electrical connections "upstream" (towards the Main Power Switch) of the CH/EH/PDB/PP component the grounding strap is connected to?

**A:**

Answer 1: RE14k requires that the REV Grounding Strap be directly connected to a fully-COTS component with XT30 connectors (includes the REV provided XT30/Powerpole adapter). It may not be connected to team manufactured wiring.

Answer 2: No. Teams are allowed to wire their robot as needed as long as the wiring does not violate any of the provisions of RE14.

(Asked by **7172** answer published at September 28th 2023)

## Q75 Servo legality

**Q:**

Is this servo legal, <https://a.co/d/cFk2HOy>? If not, are there any legal servos that have 50-70 kg per centimeter with 270 degree rotation?

**A:**

In general, it is not possible for us to rule on the legality of every possible servo. As long as the servo meets the criteria in RE10 it is legal.

We thought it important to add a few cautions for teams exploring large servos:

- watch your total power budget. the main robot battery is fused at 20A
- the servo power module is over-current limited at 15A
- pay attention to the stall current. the above servo has a 8.5A stall current - a significant percentage of total robot power and of servo power module capacity
- plan for variances in the stated stall currents for servos - a plus/minus 10% variance is likely
- sustained high-current draw can cause the battery to "brown out", with the voltage dropping. large drops can cause loss of connectivity and reboots of control/expansion hubs

(Asked by **21630** answer published at October 2nd 2023)

## Q85 Are ethernet cables allowed for cable management?

**Q:**

We have some questions about using an (coiled) CAT 6 ethernet cable to power multiple servos, so we don't need cable extensions, since it is within spec of CAT 6. Could you please clarify if this is allowed, and if so, under what circumstances: a) Is it allowed to cut the ethernet cable and solder servo mounts to it? b) Can we use a keystone, so you don't need to cut the cable? c) Create a custom PCB connecting an RJ45 connector to multiple servo connectors? (With appropriate insulation)

**A:**

In general, bundled cables could be legal, as long as the individual wires within the bundle meet the requirements of RE14.i as applied to the specific connection being extended.

Be aware that typical CAT6 cables use 23 AWG, thinner than the minimum required for servo interconnections (22 AWG).

If you do end up utilizing bundled cables, be prepared to show documentation for the specifications of bundle and the specific circuits/interconnections made through the bundle.

For your other questions:

- a) attaching connectors to allowed wiring is permitted per RE14.e
- b) keystone connectors fall under RE14.e as well
- c) no. a PCB would be an example of a custom circuit and disallowed per RE16

(Asked by **19444** answer published at October 4th 2023)

## Q102 Legality of modifying COTS Circuits

**Q:**

As per Game Manual Part I, "Commercial Off the Shelf (COTS) interface modules designed to solely control light sources are allowed between the light sources and the components listed in <RE12>d" Our team wishes to modify a REV Digital LED Indicator to change the color of the LED diodes as to avoid creating a "custom circuit" (RE16). As this is not listed as either an allowed or disallowed modification in RE15, are we allowed to do this, if the replacement diode is of a similar spec?

**A:**

This type of modification is not allowed. This would constitute an internal modification of the circuits in the LED indicator and is not allowed per RE15

(Asked by **542** answer published at October 10th 2023)

## Q141 [GND, 3.3V] Buses

**Q:**

The [GND, 3.3V] pins on the REV Hubs appear to be on the same internal [GND, 3.3V] buses. Is it permissible to connect the [GND, 3.3V] pins to external [GND, 3.3V] buses? External Bus could be two wires of appropriate gauge on a slip ring or coiled wire. We feel this would simplify wiring for many applications.

**A:**

No sharing of GND or 3.3v wiring. For two predominant reasons;

- keep the inspection process simple and easy to understand
- not all 3.3v ports are internally connected to the same protections circuit.

(Asked by **9999** answer published at October 31st 2023)

## Q146 REV Blinkin firmware update and/or

# customization

**Q:**

REV has instructions for updating the firmware in the Blinkin LED Driver, including how to modify the firmware to create custom light patterns. <https://github.com/REVrobotics/Blinkin-Firmware> Q1: Could custom firmware following the "Creating a custom function" instructions solely for producing custom light patterns to indicate the color of pixels held in the robot be legal? Q2: If no, would it still be legal to follow REV's instructions to update the OEM firmware without modification?

**A:**

The answer to both questions is no.

Updating the REV Blinkin firmware in the described manner would violate RE15 - for allowed modifications as well as RE16 as the system would now effectively be equivalent to a generic programmable device (i.e. arduino, raspberry pi, etc.)

(Asked by **21430** answer published at November 2nd 2023)

## Q172 Clarification on powering USB hub for Control Hub (RE13/RE14)

**Q:**

RE13.b.ii specifies that Vision Cameras can connect to REV Control Hub (Robot Controller) using a "powered USB hub", but doesn't mention allowed power sources for the USB hub. RE14.c.ii mentions energy sources for a powered USB hub, but RE14 also says "smartphone" robot controller device and RE14.c.ii refers only to connecting the hub to an Expansion Hub USB. Thus RE14 perhaps excludes the Control Hub USB. Q: Can a USB hub connected to a Control Hub be powered by sources listed in RE14.c.ii?

**A:**

Yes, powered USB Hubs may only draw energy from the sources listed in RE14.c.ii.

(Asked by **7172** answer published at November 8th 2023)

## Q184 Is modifying the case of a webcam legal?

**Q:**

Is modifying the housing of the vision sensor circuit/PCB legal? To be clear, we are not modifying the circuit, only the case of the webcam. The 3D printed housing wouldn't affect the safety. <RE15> says "Approved electrical and electronic devices may be modified to make them more usable; they may not be modified internally or in any way that affects their safety." The modification would comply with <RE13 B> and <RE11>. Documentation of the modification could be presented at inspection.

**A:**

Modifications to the housing of a vision sensor are acceptable as long as the modifications don't obscure the identification of the vision sensor for robot inspectors

(Asked by **11206** answer published at November 21st 2023)

## Q193 GoBilda Servo Voltage range acceptable for rule RE10?

**Q:**

Our team is new and wanted to confirm whether this servo was acceptable for use. RE10 states that servos that are compatible with the REV control hub are acceptable to use (three-wire servo connector, etc). There's also a separate requirement for it to not exceed 6V. The GoBilda servo 2000 Series Dual Servo Dual Mode (SKU: 2000-0025-0002) has a voltage range of 4.8V-7.4V (pulse amplitude of 3-5V). Thank you.

**A:**

We believe the wording of the existing servo rules may be a bit misleading in their intent with respect to operating voltages.

Servos that are compatible with a 5-6v range are allowed. The REV Expansion and Control Hubs produce 5v servo outputs. The REV Servo Power Module produces 6v.

(Asked by **23676** answer published at November 21st 2023)

## Q223 Can a LED screen, which displays real-time video from Logitech C920, be mounted to robot?

**Q:**

Can an LED screen, which displays real-time video from Logitech C920 vision camera, can be mounted to robot (we would like to use the display like a rear-view camera during tele-op gameplay)?

**A:**

No. An LED video display screen (or any other video display screen) would fall under RE16 - Additional Electronics and is not allowed.

(Asked by **48** answer published at December 7th 2023)

## Q229 Servo current limit on REV control hub

**Q:**

The inspection checklist states that servos must not exceed the manufacturer specs for the controller <RE11>. The REV control hub has a 2 amp limit per servo port pair (<https://docs.revrobotics.com/duo-control/control-system-overview/control-hub-basics>). Commonly used GoBilda servos have a stall current of 2 amps at 4.8V and 2.5 amps at 6V. So the GoBilda servo could use slightly more than 2 amps at 5V (REV hub output). Does that mean a GoBilda servo cannot be directly connected to the REV hub?

**A:**

Servos are allowed to be directly connected to the REV Hubs (Control and Expansion) as long as the Voltage range of the servo is compatible with the hub (see RE10). Current draw is not a factor for compatibility, only for performance. For a much more in-depth answer, please visit this FTC-Community forum post (<https://ftc-community.firstinspires.org/t/rev-control-hub-servo-port-compatibility/858>).

(Asked by **14343** answer published at December 11th 2023)

## Q249 Legality of GoBilda Servo Extension

**Q:**

Is the GoBilda Servo extension (sku 3802-2745-4527) legal? <https://shorturl.at/krGN0> It is not on the legal or illegal list It seems to be a wire extension as it only passes through the signals. One potential conflict is- Game rule RE14.i.iii states PWM signals must be 22AWG or gauge specified by the manufacturer. Cat6 cable is specified by GoBilda for the extension but Cat6 is normally 23AWG. Summary- Can we use the extension and use it with a CAT6 cable legally?

**A:**

No. The goBILDA 4 Channel Servo Extension via CAT6 (<https://www.gobilda.com/4-channel-servo-extension-via-cat6/>) product is not a legal servo power injector as per RE10.

Please note that some servo products, like the goBILDA Servo Extension and goBILDA Servo PDB, are not designed for nor intended to be used with the REV Control Hub or FIRST Tech Challenge Competition electronics. Be sure to consult Game Manual 1 and carefully read all product documentation when evaluating product legality in FIRST Tech Challenge.

(Asked by **8479** answer published at December 19th 2023)

## Q251 Flashing LED Legality

**Q:**

<RE12> states that signalling LED should flash at a rate no faster than 1 hertz. Q1: Is a single or small set (2-3) of flashes where each flash is less than 1 second long disallowed by this? Q2: Is strip of LEDs that has a fast moving pattern, but each LED in the patter, flashes a a rate less than 1 hertz disallowed by this?

**A:**

The Orange Box at the bottom of RE12 is a set of recommendations and guidelines. Teams who employ LEDs with quick (>1Hz) flashing or motion patterns must be aware that they may be requested to change or disable their flashing or motion patterns at the discretion of the Head Referee regardless of frequency or duration of the flashing.

(Asked by **18127** answer published at December 19th 2023)

## Q252 Suction, motor, fan, air for CenterStage Intake

**Q:**

Rethinking intake for CenterStage. One student's idea is to use SUCTION CUPS for pickup and a motor blowing air through tube(s) to suction cups to release the pixel. The motor would connect to a custom-made fan-like device and tubing. Is this FTC legal?

**A:**

No, suction devices are illegal. Rule RG01.j specifically prohibits vacuum based mechanisms.

(Asked by **21377** answer published at December 19th 2023)

## Q268 LED Battery

**Q:**



Can I use a second REV battery connected to the Blinkin LED Driver to power the LEDs?

**A:**

No.

Powering light sources from a 2nd main battery would violate at least two rules: RE03 (only 1 main battery pack per robot) and RE12.f (allowed light source power sources).

While a USB battery pack is allowed, it is not equivalent to a 2nd main robot battery. The USB battery pack includes safety features not found with the main robot battery.

(Asked by **17257** answer published at January 10th 2024)

## Q330 Legal Grounding Straps

**Q:**

Is the AndyMark Resistive Grounding Strap (am-4648, <https://www.andymark.com/products/resistive-grounding-strap>) a legal grounding strap for use on the robot as per RE14k? It has identical connectors on both ends, the same resistor rating, length, and wire gauge.

**A:**

No, the AndyMark Resistive Grounding Strap (am-4648) (<https://www.andymark.com/products/resistive-grounding-strap>) is not a legal grounding strap for the 2023-2024 CENTERSTAGE presented by RTX season. Only the REV Resistive Grounding Strap (REV-31-1269) (<https://www.revrobotics.com/rev-31-1269/>) is legal this season.

(Asked by **3507** answer published at February 13th 2024)

## Q336 Acceptable Wire Gauge for Custom Servo Cables

**Q:**

We are looking to create a custom servo extension cable for our slide. Following rule 14.i.iii, would we be allowed to use a 3-wire 18 AWG multi-conductor coiled cable to create a custom servo extension? Is it acceptable to solder on 22AWG servo extension cables to the bare ends with heat shrink and strain relief to create the cable? The wire would have 22AWG -> 18AWG -> 22 AWG. Additionally, could we use a 4-wire multi conductor and have two servos share the +5V and GND wires?

**A:**

The use of 18AWG wire to make servo extensions fits within the guidance for servo wire sizes and connections (i.e. 22AWG or larger, remember that smaller numbers equate to larger wire diameters).

While it's legal to allow multiple servos to share servo power from the same servo port (e.g. using a servo "Y" cable or equivalent) it is not allowed to combine power across multiple servo ports - that could create potential overcurrent conditions and safety issues. If you do use a "Y" cable (or equivalent), be careful not to exceed the current rating of 22AWG wire; each servo will still attempt to pull its maximum rated current at stall, regardless of the size wire being used, and that current stacks for both servos.

(Asked by **20681** answer published at February 29th 2024)

## Q350 Cable Management for Viper Slider

**Q:**

We are using a viper slider. We are wondering if the following cable would be legal to use for our servos that are part of the sliding system? <https://www.coilcablespecialist.com/22-awg-6-conductors-electronic-shielded-coil-cable-2206em0s.html>

**A:**

In general it's not possible for us to blanket rule on the legality of a generic cable (with no connectors) because it's impossible for us to predict how you'll eventually be using that cable. This is especially true for multi-conductor cable bundles where there are even more considerations to make.

When considering the legality of a multi-conductor cable used for powering/controlling servos, keep in mind these considerations:

- If each conductor of the 22AWG cable bundle is 1:1 replacing a single conductor in an existing 22AWG servo cable bundle (6 conductors = 2 servo 3-wire bundles) then you will likely not run afoul of current carrying limits; be careful to read the cable specs to ensure the cable can handle the current load (2+ Amps for most servos).
- RE14.f and RE14.i will need to be carefully considered, especially if you'll be crimping new 3-pin 0.1" servo connectors to the multi-conductor bundle (colored heat shrink (<https://a.co/d/iYS8y4b>) does wonders).
- Be sure to have documentation about the wire bundle conductors at inspection as highlighted by the orange box in RE14.i.iv.

(Asked by **23554** answer published at March 12th 2024)

## Traditional and Remote – Sensors and Control System

### Q36 T265 camera legal this year?

**Q:**

Will the Intel T265 Tracking Camera be legal this season 2023-2024? This camera model was legal in the past. A lot of teams purchased and spent a lot of time on them already.

**A:**

No, the Intel T265 is not legal for use. The Intel T265 is a stereoscopic (having more than one image sensor) camera which would violate rule RE13.b.iii in Game Manual 1.

(Asked by **15167** answer published at September 23rd 2023)

### Q56 Are optic flow sensors considered image sensors?

**Q:**

Would a optic flow sensor considered as an image sensor as in the definition of the Vision Camera and Vision Sensor?

**A:**

An optic flow sensor usually combines a camera, distance sensor (sonar or lidar are most common), and sometimes an IMU. This type of device uses these component sensors to make decisions and provides outputs that can be read/used by a control system - this is the very definition of a Vision Sensor as defined by Game Manual 1. Just be sure the device does not violate any Vision Sensor rules in RE13.b, and also ensure that none of the component sensors violate any rules such as RE12.c in the case of optic flow sensors containing lasers (such as lidar sensors).

(Asked by **19071** answer published at September 24th 2023)

## Q59 Vision Camera Questions

**Q:**

We are a rookie team so we want to know how many vision cameras are allowed to use this year (one other team told us that only one vision camera can be used). Also are Pixy or Pixy2 Cam allowed?

**A:**

1. Welcome to *FIRST* Tech Challenge!
2. There are no rules that specify a maximum quantity on sensors, Vision Cameras, or Vision Sensors.
3. The Pixy and Pixy2 are Vision Sensors, the Pixy2 is specifically called out as a common Vision Sensor in the definition of a Vision Sensor. Note that the Pixy and Pixy2 do not have native software support in SDK 9.0, so teams will need to develop their own software drivers to use them.

(Asked by **23280** answer published at September 24th 2023)

## Q83 Will the OpenMV Cam RT1062 be allowed?

**Q:**

We were wondering if the OpenMV Cam RT1062 qualifies as a Vision Sensor since you can upload your own code to it, but it doesn't stream images to the control hub if you use it with I2C, however, if you connect it with USB it can. (Section 7.2.1 Game Manual 1) So is it allowed to be used?

**A:**

No. This is a user programmable microcontroller board and as such falls into the category of "Additional Electronics disallowed by RE16.

(Asked by **19444** answer published at October 2nd 2023)

## Q98 Using Motorola phone as a camera sensor with a Control Hub

**Q:**

Are we allowed to use a Motorola phone as a camera sensor connected to a Rev Robotics Control Hub in order to have a video processing stream as opposed to a frame by frame processing stream. We do not want to use the FTC app on the phone as a secondary control hub.

**A:**

The short answer is no.

This type of phone usage would need to fit into either a Vision Sensor model or a Vision Camera model.

RE11.a requires that sensors (including vision sensors) be connected only to I2C, digital I/O, encoder, or analog ports of the REV control or expansion hubs. A USB port is not a valid connection for a sensor. The usage is therefore not a Vision Sensor usage

RE16 disallows additional electronics. Using a phone in the above described fashion is creating a user-programmable device and falls under the guidance of RE16. Vision Cameras cannot be user-programmable devices.

(Asked by **24346** answer published at October 10th 2023)

## Q105 Intel T265 request

**Q:**

My team and many others have spent a lot of effort creating software based on Intel T265, not to mention the cost of acquiring it. Please note that although T265 is stereoscopic, it is not used for vision at all. Teams use the estimated position it provides that is calculated by its internal algorithms that combine its camera views and its IMU. In our view it is essentially an alternate for dead wheel odometry. We graciously request it be allowed as in previous years.

**A:**

Game Manual Part 1 is the definitive answer as to the allowed use of cameras, either as Vision Cameras or as Vision Sensors. Both usages are limited to a single image sensor. Vision Cameras are additionally limited to provide image/video streams only

As such, the Intel T265 camera is not legal for use as it fails the image sensor limitation and provides other than just image/video stream data.

(Asked by **4327** answer published at October 18th 2023)

## Q123 I2C to SPI protocol converter legality

**Q:**

Is this COTS I2C to SPI converter legal as per RE11.f? <https://www.mikroe.com/i2c-to-spi-click> A legal sensor with an SPI interface would be connected to the converter and the converter would be connected only to the I2C port of a Control or Expansion Hub.

**A:**

Yes, this I2C to SPI converter is an example of the types of protocol converters allowed by RE11.f

(Asked by **21028** answer published at October 18th 2023)

## Q132 How to set camera exposure

**Q:**

How do you use the ExposureControl classes with the Camera now that Vuforia has been removed from the Library?

**A:**

This is not a rule clarification question, but a technical support question. As such, this question should be asked on the FTC-Community forums (<https://ftc-community.firstinspires.org>) where the FIRST Tech Challenge engineering staff and community members are ready to take your questions.

(Asked by **16760** answer published at November 2nd 2023)

## Q136 Voltage Sensor

**Q:**

Are digital voltmeters allowed? (This is the one we have been using:  
[https://www.amazon.com/gp/product/B086RHJ95R/ref=ppx\\_yo\\_dt\\_b\\_asin\\_title\\_o00\\_s00?ie=UTF8&th=1](https://www.amazon.com/gp/product/B086RHJ95R/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&th=1)).

**A:**

The referenced voltage sensor is not allowed because it is not powered by a REV Expansion Hub or REV Control Hub via analog, digital, encoder, or I2C ports as required by rule RE05.c in Game Manual Part 2.

(Asked by **14840** answer published at October 26th 2023)

## Q148 Container for driver control system

**Q:**

Last year at the district championship, a referee warned our team that our driver control box limited the screen view for referees. We would appreciate a clarification on how much should be visible to the referee. Our container is a "treasure box" which is part of our team's pirate costume theme. Currently, the treasure box surrounds the driver station on 4 sides plus the bottom, with walls extending to about midway up the REV driver station. Photo link: <https://drive.google.com/file/d/1Ro1>

**A:**

The driver control box as it is currently configured is not legal. The current design blocks the view of the field and when opened has a possibility of extending into the field. The box can be made acceptable if the lid were removed completely rather than hinged.

(Asked by **4924** answer published at November 9th 2023)

## Q153 Is using a laser mouse sensor for odometry legal?

**Q:**

Our team is wondering if it's legal to use a laser mouse sensor with SPI protocol (like PMW3389 from <https://www.tindie.com/products/citizenjoe/pmw3389-motion-sensor/>) using a laser, allowed by RE12c and connected to an I2C port on the REV control hub via I2C to SPI bridge (like <https://www.mikroe.com/i2c-to-spi-click>), because we can't connect the sensor to the hub via USB as it seems it's restricted by RE11a.

**A:**

Yes, as long as the laser module complies with all applicable rules (i.e. RE12.c) and all protocol converters comply with sensor rules (i.e. RE11.f)

(Asked by **22042** answer published at October 31st 2023)

## Q159 Question on Digital Break Beam Input Sensors

**Q:**

Can you confirm that the following sensor would be legal. <https://www.adafruit.com/product/2168> Its an optical break beam sensor we would like to connect to a digital input on the control hub, can function on either 3.3V or 5V (We understand that for 5V you need Logic Level Converter)

**A:**

In general, it is not possible for us to rule on the legality of all potential sensors. When determining the legality of a particular sensor, apply the constraints imposed by RE11 as a guide to legality.

In this particular case, the "sensor" you are asking about is in two distinct parts; an IR LED emitter and a IR detector.

As long as the IR emitter is connected and powered in accordance with RE12 and the IR detector meets the constraints of RE11, the combination would be allowed

(Asked by **9225** answer published at November 8th 2023)

## Q162 Alternate level shifter

**Q:**

The Rev level shifters were made for motor encoders and are not connectorized in a way that's easy for other uses. Since use of the 5V Aux port is dis-allowed for sensors, would this equivalent level shifter be considered legal? <https://www.adafruit.com/product/5649>

**A:**

Yes. This is an example of the types of level-shifters allowed by RE14.j

(Asked by **6055** answer published at November 15th 2023)

## Q169 Clarification of answer to Q141 - sharing of GND and 3.3v wires.

**Q:**

Q141 says "No sharing of GND or 3.3v wiring." (full stop), which inspectors or officials could read more broadly than we think is intended. We seek to clarify Q141's answer. The analog/digital ports are designed to support two sensor inputs per physical port, e.g. using a REV-31-1386 sensor splitter cable. Q1: Can two or more sensors connected to a common digital/analog physical port share its GND/3.3v wires? Q2: Can multiple I2C devices sharing a common I2C port (bus) share its GND/3.3v wires?

**A:**

**Q141 (/qa/141)** was meant to clarify that the power/ground bus used by sensors/pathways to provide signals should be scoped to the ports/connectors that provided it. For example, Digital Connector 0/1 on the Control Hub provides a power/ground plane intended to be used to power sensors/pathways to provide a signal for Digital Channel 0 and/or Digital Channel 1 - not for a device/pathway providing signal to Digital Channel 2 nor for Analog Channel 0, and certainly not for powering an I2C device chain.

(Asked by **7172** answer published at November 8th 2023)

## Q199 Is it legal to use an inline USB isolator to prevent ESD problems with the Logitech C270

**Q:**

We continue to have control hub crashing issues due to ESD when the Logitech camera is plugged into any of the usb ports. we've identified that it only crashes when the robot makes metal connection with the field elements, and only when the usb camera is connected. Is it legal to use an inline USB isolator such as an ADUM3160?

**A:**

Yes. This is an example of the types of USB surge protectors allowed by RE14.a.

(Asked by **14670** answer published at November 28th 2023)

## Q215 Are we allowed to use Logitech 920 camera with the mount that comes attached to it?

**Q:**

Are we allowed to use the Logitech 920 Camera, with the mount that comes attached to it out-of-the-box, as an FTC-legal vision camera or do we need to somehow remove the included camera mount?

**A:**

The camera may be used with the attached mount. Teams are not required to remove it.

(Asked by **48** answer published at December 4th 2023)

## Q234 Driver station android device

**Q:**

Android devices/phones listed in the legal parts list are pretty old Motorola models. Are we allowed to use a newer Motorola G model as our driver station Android device?

**A:**

The only legal Android devices/phones are enumerated in RE07, as long as they meet the requirements of RS03. No other Android devices/phones are allowed.

There are a lot of challenges with trying to support general Android smartphones, especially since Android isn't a standard across the industry and instead each manufacturer forks and manages their own "flavor" of each version of Android. These different "flavors" of Android can have different behaviors regarding Wi-Fi management, permissions management, lifetime and update schedules, and other things that cause great hardships in terms of application and device support especially for remotely controlling robots. The REV Driver Hub is intended to be our long-term Android support device and is the direct replacement for COTS Android smartphones.

(Asked by **23216** answer published at December 14th 2023)

## Q257 Legality of navX2 MXP and navX2-Micro Navigation Sensors

**Q:**

Are either the navX2-Micro Navigation Sensor (<https://www.andymark.com/products/navx2-micro-navigation-sensor>) or the navX2 MXP Navigation Sensor (<https://www.andymark.com/products/navx2-mxp-robotics-navigation-sensor>) legal?

**A:**

Compatible external I2C IMU sensors such as the navX2-micro are legal per RE11.a. Be aware that the navX2 MXP is designed specifically to be used as an I/O expansion port for the FIRST Robotics Competition roboRIO controller incorporating a navX2 IMU; the navX2 MXP may not be directly compatible with the REV Control Hub or REV Expansion Hub.

(Asked by **11329** answer published at January 9th 2024)

## Q260 Is the TFmini Plus laser sensor from Benewake legal?

**Q:**

The TFmini Plus laser sensor from Benewake, marked with 'Exempt' optical characteristics, which are stricter and safer than Class I standards, is also compliant with RE11. Is it legal in this season? the produce url: <https://en.benewake.com/DataDownload/index.aspx?pid=20&lcid=23>

**A:**

Yes. IEC/EN 62471 "Exempt" and IEC/EN 60825-1 "Class 1" are both acceptable and equivalent standards for RE11.

(Asked by **19961** answer published at January 9th 2024)

## Q275 REV Through Bore Encoder Repair

**Q:**

Can the broken casing of my REV Through Bore Encoder be repaired using 3D printing? Is it feasible to use the original manufacturer's CAD to print or design a new casing? I will design a new casing for it but will not modify the internal circuitry. This is an encoder with expensive shipping costs, so we want to repair it.

**A:**

Repairing the casing (including using 3D printing) is allowed. Care should be taken not to modify any of the internal circuitry and the repairs should not obscure/hide what the sensor is so that inspectors can easily identify that it is a sensor/encoder.

You should also be prepared to explain the process you went through to the robot inspectors at your events.

(Asked by **17257** answer published at January 16th 2024)

## Q282 Can I use control system signals to control a Blinkin LED Driver that is powered by a USB

**Q:**

Can I use control system signals to control a Blinkin LED Driver that is powered by a USB battery pack?

**A:**



Yes. In general most COTS LED controlling interface modules, like the REV Blinkin LED Driver, internally isolate the power and the control signals so that they can safely be powered and controlled by different sources. When choosing how to power your LED sources (per RE12.f) and optionally control them (per RE12.d and RE12.e), keep in mind that if using external power sources those external power sources must stay isolated from internal robot power sources. If you're ever unsure, either ask (<https://ftc-community.firstinspires.org/>) or find another way.

(Asked by **17257** answer published at January 18th 2024)

## Q292 Limelight Smart Camera FTC legal?

**Q:**

Is the Limelight camera FTC legal? We purchased a Limelight for our FRC bot, but then we got to wondering if... We checked the Legal and Illegal parts list and found no answer. We checked Chief Delphi and there are many different and conflicting answers. So FIRST, what's the official answer? Thank you, ROBOhana #16764

**A:**

No, the LimeLight Vision Camera is not legal for use in 2023-2024 competition season. User-Programmable devices, including Vision Cameras and Vision Sensors, are not allowed.

(Asked by **16764** answer published at February 1st 2024)

## Q298 Oak-1 Lite USB C connection

**Q:**

The Legal and Illegal Parts list shows the Oak-1 Lite in the Vision Sensor category. I want to confirm that using the Oak-1 Lite along with a Vision Camera such as the Logitech C270 is allowed. Out of the box the Oak-1 Lite connects using a USB C connection. Therefore, during inspection it would appear as if there are two 'usb cameras' plugged in. If the Oak USB C connection is allowed, I hope this question sets precedent for inspectors to know that not all vision sensors connect via I2C.

**A:**

No, the Oak-1 Lite Camera is not legal for use in 2023-2024 competition season. User-Programmable devices, including Vision Cameras and Vision Sensors, are not allowed.

(Asked by **19367** answer published at February 1st 2024)

## Q314 Simple LED lights

**Q:**

Confirming that simple straw-hat LEDs are again acceptable for use this year (they were last year) when used with a passive current limiting resistor as recommended by the supplier. The LED's use would follow <RE12>.

**A:**

Under current rules, this combination of a resistor with an LED would be considered as a custom circuit and not allowed per RE16

(Asked by **10138** answer published at February 8th 2024)

## Q325 Using Motor Port to Power Control/Expansion Hub

**Q:**

The male XT30 connector on my Control Hub is not making a reliable connection any more. I read on an online forum a recommendation to instead use an empty motor port - instead of plugging into the XT30 to power my Control Hub, I could cut/splice a power and motor cable together to instead provide power directly into a motor port to power my Hub. Is this safe/legal?

**A:**

Absolutely not. Doing so can irreversibly damage your Control Hub and can provide an overall unsafe 12V power system on the robot. The only safe and legal way to power the Control Hub or Expansion Hub is through the XT30 ports on the hubs. For recommendations and a more thorough explanation, see this ftc-community forum post (<https://ftc-community.firstinspires.org/t/using-motor-port-to-power-control-expansion-hub/1026>).

(Asked by **12789** answer published at February 8th 2024)

## Q327 Follow up to Q314 - Permissibility of passive components

**Q:**

Following up to Q314: 1. Can the use of an LED be considered a sensor since the use of added passives is permitted by RE11.c (and some sensors can explicitly be used as light sources)? 2. Can direct wired LEDs with integrated resistors be used (these seem limited to 12V selection)? This puts us into a bind requiring adding Spark-mini's for something that was permitted last year under similar game manual wording. Hoping the intent is clear (simple indicators). Happy to discuss in forum too.

**A:**

A1) No. Sensors can have integrated LEDs (e.g. beam-break sensors discussed in [Q159 \(/qa/159\)](#) ), but LEDs cannot alone be considered sensors.

A2) Yes, such products (<https://www.revrobotics.com/rev-31-2010/>) are commonly used (<https://www.adafruit.com/product/1757>).

(Asked by **10138** answer published at February 14th 2024)

## Q329 Xbox Elite Series 2

**Q:**

Can you clarify if the Xbox Elite Series 2 controller is legal? It's not specifically listed in the legal parts list, but could fall under the XBox 360 listed. This one is bluetooth capable, but we would use it via a wire instead of bluetooth.

**A:**

No, the Xbox 360 Wired Controller is the only Xbox branded controller currently supported.

(Asked by **21485** answer published at February 14th 2024)

## Q345 Is the camouflage green PS4 controller allowed?

**Q:**

On GM1-DS03 it says Sony DualShock 4 Wireless Controller for PS4 (ASIN # B01LWVX2RG) is legal. This ASIN refer to the jet black color. However, we have a Green Camouflage color with a different ASIN number (ASIN # B01MTKXP31). Is it legal for using it for competition?

<https://drive.google.com/drive/mobile/folders/1Z5pcrXVh2vci3vFKjhvJsF0q3CRVpCBg>

**A:**

Yes. The Amazon Standard Identification Number (ASIN) provided is merely a helpful breadcrumb to help you source a legal gamepad, and is not specifically a required identifier. The last line of DS03 provides the definitive answer to your question, "Different color gamepads are allowed provided they are the same model as the allowed gamepad."

(Asked by **6436** answer published at March 7th 2024)

## Traditional and Remote – Robot Software Rules

### Q335 OpMode Annotation Requirement?

**Q:**

We program in Blocks, and having a SINGLE OpMode program that provides Autonomous and Driver Control "behaviors" is more beneficial than multiple different OpModes (gamepad is used to select behavior during INIT). If our OpMode is annotated as a Teleop OpMode, we can still enable the 30-second autonomous timer using the timer selector switch, but the timer is not enabled by default. At our tournament, it was questioned if this is okay. Is an OpMode used in Auto required to be annotated as such?

**A:**

There is no requirement that an autonomous opmode be annotated in the code as autonomous.

There is a requirement that the 30-second timer be enabled for robots that are going to run an autonomous opmode during the autonomous period.

Teams that do not annotate their autonomous opmodes should make sure to enable the 30-second timer for each match they participate in.

(Asked by **12789** answer published at February 29th 2024)

### Q344 Can an OpMode save things in a static context during pre-match?

**Q:**

Can the drive team, before bringing the robot into the playing field, run a teleop OpMode that saves some configuration-info into a static context (f.e. boolean for red/blue alliance), and then bringing the robot into the field (without switching it off) and continuing the regular steps - choosing the required autonomous Opmode and

running the init and so on...? (The intention for this is to create some setup parameters that the autonomous opmode will use)

**A:**

Teams should not be transporting a powered robot. It's not directly declared as illegal to do so, but it is a safety risk and thus the safety rules demand the robot to be off.

If teams want to store setup parameters, they should consider writing/reading files on the Control Hub filesystem. There's even an example program that uses custom myBlocks written in Java that makes reading and writing the filesystem accessible to blocks users here:

[https://ftc-docs.firstinspires.org/en/latest/programming\\_resources/shared/myblocks/rw\\_example/rw-example.html](https://ftc-docs.firstinspires.org/en/latest/programming_resources/shared/myblocks/rw_example/rw-example.html)  
([https://ftc-docs.firstinspires.org/en/latest/programming\\_resources/shared/myblocks/rw\\_example/rw-example.html](https://ftc-docs.firstinspires.org/en/latest/programming_resources/shared/myblocks/rw_example/rw-example.html))

(Asked by **23422** answer published at March 7th 2024)

## Traditional and Remote – The Judging Process

### Q266 Custom Control Award Form; follow-up to Q232.

**Q:**

Does Q232 imply that the control award may take any graphical form or are teams required to adhere to the form published on firstinspires.org? In previous years our team was told we were required to use the template form on firstinspires.org. Q1: Can teams answer the questions listed in the official template using a custom page instead of the one on firstinspires.org? Q2: If teams are allowed to use a custom page, can they deviate from the questions on the official template?

**A:**

Teams are permitted to create their own form, but must at a minimum answer the questions on the official template. Font size must be at least 10pts, and the submission may not exceed 2 8.5x11 pages.

(Asked by **8693** answer published at January 18th 2024)

### Q299 Mentor definition for Connect Award

**Q:**

Q1: What interactions qualify someone as a mentor for the Connect Award? Q2: More specifically, must interactions with professional mentors follow the same standards of repeated communication as team to team mentorship (GM1 appendix F)?

**A:**

For the Connect Award, a mentor may be someone who assists a team with their robot function and/or design (software, programming, machining parts, etc.), they may assist with project management to help the team with organizational skills. These are just a few quick examples. The specific requirement is that the adult coach or mentor has provided guidance and support to a team over the course of a season, and demonstrates to the team gracious professionalism in their demeanor and behavior. There are no additional guidelines for this award.

(Asked by **12087** answer published at February 15th 2024)

## Q307 Bringing additional mechanisms or parts of robots for judging

**Q:**

Game manual 1 <C05> states that "Each registered Team may enter only one Robot". Is it legal for teams to bring additional parts, mechanisms, or robots to show judges their iteration process, so long as they only enter one robot in the competition?

**A:**

If the team would like to show unique parts or mechanisms of the robot, and those mechanisms are not being used at the current competition, those may be brought to be used as a visual aide. Otherwise, teams can use pictures, video, or animations to show past iterations of their robot without needing to bring a secondary robot.

(Asked by **21336** answer published at February 20th 2024)

## Traditional and Remote– Engineering Portfolio

### Q232 Custom Control Award submission

**Q:**

Are Custom control award submissions created on programs such as Canva, Adobe Illustrator or other graphic design programs allowed or must control award submissions be submitted on the form published on firstinspires.org?

**A:**

The use of programs such as Canva and Adobe Illustrator are allowed.

(Asked by **20403** answer published at December 21st 2023)

## Traditional and Remote – Judges Interview

### Q310 Bringing an additional robot to competition solely for judging demonstration purposes

**Q:**

According to <C05>, each registered team is only allowed to bring one robot to a competition. However, our team would like to bring an additional (completely different) robot solely for the purpose of demonstrating during judging with zero intention of competing with it. Q1: Are we allowed to do this? Under what conditions of the robot would we be able to do this? Q2: If the answer to Q1 is no, is there any way we'd still be able to bring parts of our robot to the competition?

**A:**

A team cannot bring an entire second robot to a competition. If the team would like to show unique parts or mechanisms of the robot, and those mechanisms are not being used at the current competition, those may be brought to be used as a visual aide. Otherwise, teams can use pictures, video, or animations to show past iterations of their robot without needing to bringing a secondary robot.

(Asked by **11138** answer published at February 8th 2024)

## Remote – All Match Period Gameplay

### Q64 GS12 - Human player inadvertently and temporarily straying into wing/field

**Q:**

Scenario: There is no robot in the wing. During the gameplay, the human player inadvertently leans her head over the vertical plane of the field perimeter, into the wing/field area, perhaps to enjoy the gameplay. Q1: Does the team incur an immediate penalty in this scenario? Q2: Human player realizes her action and backs her head out of the wing/field within X seconds. Does the team still incur a penalty in this scenario? Q3: If the answer to Q2 is no, what is the value of X?

**A:**

A1: The *Human Player* should receive a *Warning* the first time they extend into the *Playing Field Perimeter* without demonstrating a clear intent to place a *Scoring Element* into the *Wing*. Subsequent extensions into the *Playing Field Perimeter* without the intent of placing *Scoring Elements* into the *Wing* should receive a *Minor Penalty* for each occurrence per rule GS12.

A2: Same answer as A1.

A3: Not applicable.

(Asked by **23312** answer published at September 26th 2023)

## Remote – End Game Gameplay

### Q271 Can the yellow bar be used to stabilize the robot during suspending?

**Q:**

Q1: Can the robot use the yellow bar to suspend as long as the primary source of support is the truss. Q2: Can we clamp on to the yellow bar for that extra stabilization support? We have a robot with a long arm that rotates to grab onto the bar. the only issue is that there is a lot of force trying to force the robot back down to the bottom. Q3: Can we add clamps that will grab onto the yellow bar to prevent the robot from rotating after it has suspended?

**A:**

A1: Yes, provided that the contact with the yellow bar only provides stabilization per rule GS06.a

A2: No, per rule GS06.b.

A3: No, per rule GS06.b.

(Asked by **19591** answer published at January 9th 2024)

## Traditional and Remote – Team Prop Construction Rules

### Q15 Are light blue and pink legal Prop colors?

**Q:**

TE02 says that the TGE (Prop) may include multiple shades of the assigned color, but can the Prop be made entirely of a shade of the assigned color? So, could a Prop be light blue or pink since those are shades of blue and red?

**A:**

Yes, light blue and pink are acceptable colors providing it is obvious to the field personnel which alliance the Team Prop belongs to.

(Asked by **16626** answer published at September 20th 2023)

### Q73 RM06 and the Prop

**Q:**

Is it correct to conclude that RM06 does not constrain (the design or construction of) the prop?

**A:**

Yes, Rule RM06 applies to the Team Prop. Note that RM06 should be interpreted as pertaining only to the previous season's game elements (Power Play), not every game element from every FTC game.

(Asked by **18996** answer published at October 3rd 2023)

### Q77 Can a Team Prop have retroreflective tape as part of its construction?

**Q:**

TE02 specifies the Team Prop must be Red or Blue. TE03 disallows fiducial markers. Can a Team Prop incorporate red- or blue-colored retroreflective tape in its construction, or does that count as a fiducial marker?

**A:**

Per Rule TE03, a Team Prop may not have any retroreflective materials.

(Asked by **10723** answer published at October 5th 2023)

### Q79 Solo cups as Team Prop

**Q:**

Are Solo, or other disposable cups allowed to be used as team props this year. In Game Manual 1, Section 7.4. there is no mention of not using Solo or other cups. I recall last year they were not allowed due to many teams

using them in Freight Frenzy. Additionally, <RM06> Current Season Game and Scoring Elements does not disallow them either

**A:**

Drinking cups in general are allowed providing they meet all the other Team Prop requirements, specifically size and uniform color. Many cups have a solid exterior color but are white inside. To be used in a Match, the cup would have to be oriented such that no white is visible, i.e. open side down. The cup would have to be inspected in the same orientation it will be used on the field.

(Asked by **20077** answer published at October 5th 2023)

## Q110 Can Team number on Team Prop be printed on white background?

**Q:**

Game Manual 1 says Team Prop has to be of solid color of red or blue, except for Team number. So is it ok we print team number on a piece of white paper then stick it onto the team prop?

**A:**

No, the only non-alliance color on the Team Prop can be the numbers themselves.

(Asked by **23226** answer published at October 12th 2023)

## Q118 Team Prop size

**Q:**

Can the Team Prop be cone or cylinder or water cup of base radius and its height more than 3" but less than 4"?

**A:**

Yes, a cone shaped Game Element with a base between 3" and 4" in diameter and between 3" and 4" tall meets TE04.

(Asked by **23305** answer published at October 17th 2023)

## Q120 Glitter PETG for team prop?

**Q:**

The team prop can not be retroreflective. We 3D print a prop using PETG red transparent with glitter. It does not return a light beam back to it's source. Is this acceptable to use? The glitter in the filament is reflective but it is not retroreflective per the definition of "Retroreflection occurs when a surface returns a large portion of directed light beam back to its source. Retroreflective materials appear brightest to observers nearest the light source"

**A:**

No, this is not a legal material. Red transparent PETG with metal flake does not satisfy rule TE02 for being a uniform color.

(Asked by **20349** answer published at October 17th 2023)



## Q140 Team Numbers on Team Prop

**Q:**

I see that in <TE05> b &c, team numbers must be no more than 0.5 inch in height. and may only appear on the team prop one time. It looks like this rule may apply to team numbers that are on the team prop in a color other than red or blue. If the team has designed & 3D printed a team prop that includes their team number as a part of the 3D print (i.e. completely red or blue 3D printed material), and the team number is larger than 0.5 and/or appears more than one time, would that be acceptable?

**A:**

3D printed numbers must follow the same rules as any other method. Therefore, a Team Prop that includes their team number as part of the 3D print and is larger than .5 inch or appears more than once is not allowed.

(Asked by **9848** answer published at October 26th 2023)

## Q160 Can we use previous years game elements

**Q:**

Team props are required to match the team alliance (red or blue). Could we use a game element from a previous year that is already colored red and blue as our team prop provided that it fits within the 4x4x4 sizing range for team props?

**A:**

We believe Q73 answers your question. If it does not, please rephrase your question and resubmit.

(Asked by **19591** answer published at November 7th 2023)

## Q176 Can the team prop have holes in it?

**Q:**

If the team prop is 3D printed and all one solid color (red or blue) can the prop have holes in it? For instance a 4x4 inch cube with the team numbers cut out all the way through the cube?

**A:**

Yes, A Team Prop may have holes in it. Remember, the Team Number must abide by Rule TE05.

(Asked by **22523** answer published at November 9th 2023)

## Q182 Can team props be different based on the alliance colors?

**Q:**

Our team wants to use a different team prop based on whether we are on the red or blue alliance for each match. Assuming the team props meet all of the other requirements and both are inspected, is it legal to use two different shaped team props based on the alliance color?

**A:**

There is no rule requiring that the red and blue Team Props be the same design. All Team Props must pass Inspection prior to use in a match.

(Asked by **18119** answer published at November 14th 2023)

## Q192 Team prop patterns

**Q:**

What patterns are allowed on the team prop? I know we can't have qr codes and ARUCO codes. But are patterns of lines or circles allowed? As long as they are a shade of red or blue of course

**A:**

Based on the feedback we have received from Teams and volunteers we are clarifying and relaxing the restrictions on the types of images that are allowed on the Team Prop. The intent of rule TE03b is:

1. prevent the use of any object on the field that could confuse or distract other Robots.
2. prevent the use of canned solutions to simplify the task of object identification.

Therefore, any image that resembles a QR code, AprilTag, or coded vision target is not allowed. All other images such as team logos, sponsor logos, raised areas, cut outs, etc. are allowed, providing no other rule is violated.

(Asked by **18035** answer published at November 16th 2023)

## Q194 Team prop for blue side can be purple?

**Q:**

Can our team prop for the blue side be a shade of purple? How about if our Team prop for the red side is pink?

**A:**

Purple is not an acceptable color for the blue side Team Prop.

(Asked by **20077** answer published at November 16th 2023)

## Q204 Team Prop Design

**Q:**

As an extension to some Team Prop Questions. Q1:If a 3d printed team prop is designed to look like a cute cartoon robot, may it have eyes engraved/extruded in it since Q176 allows for holes in team props, or would those be considered fiduciary markers as per Q197? Q2:Are decorative designs engraved/extruded into a prop allowed if not used for vision control?

**A:**

The answers to Q192 and 197 have been updated as follows.

Based on the feedback we have received from Teams and volunteers we are clarifying and relaxing the restrictions on the types of images that are allowed on the Team Prop. The intent of rule TE03b is:

1. prevent the use of any object on the field that could confuse or distract other Robots.
2. prevent the use of canned solutions to simplify the task of object identification.

Therefore, any image that resembles a QR code, AprilTag, or coded vision target is not allowed. All other images such as team logos, sponsor logos, raised areas, cut outs, etc. are allowed, providing no other rule is violated.

A1: Yes this would be legal.

A2: Yes, engraved/extruded designs are allowed provided they do not violate the requirements outlined above.

(Asked by **15259** answer published at November 30th 2023)

## Q212 Team Numbers and definition of height

**Q:**

<TE05> b) The Team number may be no more than 0.5 inches (1.27 cm) in height. The formal definition of height is: the distance from the bottom to the top of something, the distance upward from a given level to a fixed point, or something measured vertically. Is a 3D-printed cylinder with numbers raised by ~0.25" on the top face be considered legal height for TE05 subrule (b) where a box of dims ~0.75" x ~2.0" would enclose the numbers as viewed from above?

**A:**

Rule TE05 b refers to the height of the text from the bottom edge of the number to the top edge of the number as viewed perpendicular to the text. The rule does not restrict the distance that a number is extruded from a surface. When viewed from above, the numbers must fit into a box no larger than .5" height. The length of the box is dependent on the number of digits in your team number and is not restricted.

(Asked by **519** answer published at November 29th 2023)

## Q213 Regarding Team Prop patterns

**Q:**

In Q192 and Q197, it was noted that patterns, logos, or images are prohibited as fiducial markers under TE03. We are wondering specifically if this will affect our team props depending on the interpretation of "pattern". We want to ask if this ruling will apply to the circular indentations on our props, which are cubes that have indentations placed on each side to make them look like 6-sided dice (DICE is our team name).

**A:**

The answers to Q192 and Q197 have been updated as follows: Based on the feedback we have received from Teams and volunteers we are clarifying and relaxing the restrictions on the types of images that are allowed on the Team Prop. The intent of rule TE03b is:

1. prevent the use of any object on the field that could confuse or distract other Robots.
2. prevent the use of canned solutions to simplify the task of object identification.

Therefore, any image that resembles a QR code, AprilTag, or coded vision target is not allowed. All other images such as team logos, sponsor logos, raised areas, cut outs, etc. are allowed, providing no other rule is violated.

A Team Prop made as you described is legal providing all other rules are met.

(Asked by **5126** answer published at November 30th 2023)

## Q235 Prop color shade vs. tint

**Q:**

Game Rule TE02 - ...Team Game Element may include multiple shades of the assigned color. A shade of a color is a primary hue color with black added (color will be darker than the original). A tint of a color is a primary color with white added (color will be lighter than the original). Since Q15 answer was yes that light colors (light blue and pink) are allowed, does the rule mean tint (lighter colors) or shade (darker colors) of red or blue?

**A:**

Both lighter shades and darker shades of red or blue are allowed for the Team Prop as long as the colors can be clearly distinguished by field personnel as being red or blue.

(Asked by **20079** answer published at December 14th 2023)

## Q263 Team Game Element Number Location

**Q:**

Our team game element is a mug, and has the team number inside the mug. It meets the 1/2 inch height requirement, and is visible from 12 inches away. Our robot inspector was not sure if it was legal, due to it only being visible when looking down into the mug. We figured it was fine since it is for non-gameplay identification purposes only. Do we need to move our team number?

**A:**

You are correct that the Team Number is only required for non-gameplay purposes. Having the team number inside the mug or even on the bottom is acceptable.

(Asked by **18119** answer published at January 9th 2024)

## Q280 Team prop size and orientation

**Q:**

If a 4 inch cube is bisected along the plane passing through opposite edges, and we take a resulting half of the cube (so that two opposing faces are right triangles with adjacent edges of length 4, two faces are 4 inch squares, and the 5th face is a  $4 * \sqrt{2}$  by 4 rectangle, is this a legal team prop shape if (A) if the prop is placed with the 4 inch square down, or (B) the prop is placed with the rectangle with length  $4 * \sqrt{2}$  down?

**A:**

A1: Yes, in this orientation the Team Prop is legal. A2: No, in this orientation the Team Prop is illegal.

(Asked by **14343** answer published at January 18th 2024)

## Q283 Team Prop - Team Number

**Q:**

Our team props are solid red and blue 3D printed objects with the team number depressed in the object at .5 inches. Can we color in our team number with a with black sharpie or could we color in the team number with a different shade of red or blue on the respective red and blue objects?

**A:**

Yes, the numbers may be colored in with a Sharpie. Black or any other color is acceptable.

(Asked by **11848** answer published at January 18th 2024)

## Q301 Is it allowed to have two different sets of team props?

**Q:**

Our team found that our object detection code works differently under different lighting conditions. One set of props work better for certain lighting conditions and another set of props work better for another lighting conditions. Since we don't know what lighting conditions it will be at the comp, can we bring two sets of props for inspection?

**A:**

Yes, Teams may bring multiple Props or Drones to an Event for inspection.

(Asked by **23226** answer published at February 1st 2024)

## Q304 Team Prop Paper Cylinder

**Q:**

Can a team prop be a red or blue paper cylinder? Specifically, the top and bottom of the cylinder are open, and not solid (can see through from one side out the other).

**A:**

Yes, providing it meets the other parameters such as color, size, and Team number. Be aware that a paper cylinder is very fragile and it may get damaged during normal gameplay if a Robot runs into it. Plan to bring plenty of spare to an event.

(Asked by **12126** answer published at February 1st 2024)

## Q320 Team Prop with multiple shades

**Q:**

According to <TE02>, a team prop can include multiple shades of the same color. So, to clarify, does this mean that a red alliance prop can be pink with red dots on them, and it would be legal, or would it need to be entirely one shade?

**A:**

Multiple shades are allowed but if the dots are intended to be used as fiducial marks they would be illegal per rule TE03.

(Asked by **19411** answer published at February 8th 2024)

## Q328 Q320 followup - fiducial markers on team prop

**Q:**

In your response, you mentioned how <TE03> banned fiducial markers. My question is how you would define fiducial markers? We detect the dots on our team prop by using Hough circle transforms, and they don't look like any of the examples of fiducial markers given (April Tags, QR codes, etc). Since it is just a line of 3 dots, would detecting those as our prop be legal?

**A:**

Fiducial Markers are objects or patterns intentionally placed in a scene to establish the identity of the scene or objects within the scene. It you want to detect features of the Team Prop, that is fine but if you want to detect something you put on a Team Prop because you can't detect the Team Prop without it, then that's a fiducial. As such, your dots are perfect examples of fiducials.

(Asked by **19411** answer published at February 18th 2024)

## Q343 Is there a weight specification for the team prop?

**Q:**

Our team was doing a practice match with another team and there was a team prop that weighed 25 pounds, and we are wondering if this is allowed?

**A:**

No, there is no weight requirement for the Team Prop. However, there is an expectation that Field Personnel can easily and safely move Team Props during Randomization. If the weight of the Prop causes an issue with the field reseters, the Team may not be eligible for the Auto bonus. Also, if the Prop causes an imprint in the Tile that Robots have to drive over, it will be considered field damage. A Team Prop this heavy would also constitute an immovable object on the field that will obstruct Robot travel and would be penalized per rule G29.

(Asked by **10544** answer published at March 7th 2024)

## Traditional and Remote – Drone Construction Rules

### Q22 Drone construction by cutting up paper sheet into smaller parts.

**Q:**

Rule <DR05> Construction Material Constraints: states - "... The Drone must be made of a single, continuous sheet of paper no larger than a single sheet of 8 ½ x 11 or A4 size uncoated printer paper. ..." Q1: Can the paper size be smaller than the standard Letter/A4 size paper? Q2: Can the paper be cut up to make individual drone parts that are later attached together? Team members thought of an origami airplane that requires multiple separate parts that need to be joined together.

**A:**

Q1: Yes, a Drone may be made from a single sheet of paper smaller than a standard letter/A4 sheet. Q2: No, multiple pieces of paper, even if in aggregate they are less than a standard letter/A4 sheet, are not allowed.

(Asked by **23312** answer published at September 21st 2023)

### Q33 Notch in drone

**Q:**

Are we allowed to cut a notch in the drone in order to attach a rubber band, spring or similar device?

**A:**

There is no rule against cutting a notch in the Drone.

(Asked by **14840** answer published at September 21st 2023)

## Q34 Drone Folding Lines

**Q:**

<DR05> states that we may use a color printer to achieve the required red and blue colors. In the description, it also says "images." Are we also allowed to print folding lines to assist with the construction?

**A:**

Yes, that is a legal image.

(Asked by **14840** answer published at September 21st 2023)

## Q39 do we have to make a paper airplane?

**Q:**

A drone is defined as a "paper airplane" but it then says that it can be made out of any acceptable building material. Q1) do we have to make it out of paper? Q2) does it have to be in the shape of an airplane?

**A:**

The rules for Drone construction are spelled out in Game Manual 1 Section 7.5 Q1: See Rule DR05 Q2: See Rule DR02

(Asked by **19591** answer published at September 23rd 2023)

## Q74 DR05 Continuous piece

**Q:**

Would a single, continuous A4 piece of paper, that has a 1" long cut in the center of the paper, such that the paper maintains the same surface area, and remains one piece with continuous edges, meet the requirements of <DR05> ?

**A:**

Yes, that satisfies the single sheet requirement.

(Asked by **18996** answer published at October 3rd 2023)

## Q80 DR05a - are specialty papers allowed as long as they are sold as printer paper?

**Q:**

Are specialty papers like those made with Tyvek allowed for drone construction as long as they are 20lb weight or lower and not "coated"? (Example: <https://www.jampaper.com/white-14lb-tyvek-8-1-2x11-paper-item-2179214491>).

**A:**

No, specialty papers such as Tyvek are not allowed.

(Asked by **16461** answer published at October 3rd 2023)

## Q100 Is this a legal drone?

**Q:**

Is this a legal drone design (assuming it was the correct team color had a team number on it)? It follows a non-ballistic trajectory and has a fuselage and 4 wings (<DR02>). Pictures:

<https://docs.google.com/document/d/1vxjkC7jRas4xYdUXCO9SUta7wY9F9WxlcpdZV3v545g/edit?usp=sharing>

**A:**

No, this is not legal for several reasons. It does not look like a "paper airplane", it does not follow a glide path, and it has 4 fins not wings.

(Asked by **6955** answer published at October 11th 2023)

## Q115 Can the Drone have print on it?

**Q:**

Are you able to have printing on the drone? If it is unseen?

**A:**

Yes, printing is allowed provided rule DR05 b is satisfied, no other rules are violated and the printing is not offensive. Note that the rules for the Team Scoring Element (Drone) are different than the rules for the Team Game Element (Team Prop). The Drone only needs to be predominantly red or blue and may have images, symbols, lettering, on it. The reason for the rule requiring predominantly red or blue is so that Field Personnel can easily determine which alliance earns points.

(Asked by **20022** answer published at October 17th 2023)

## Q117 How about making drones like these planes?

**Q:**

Trying to make paper drones like these planes... <https://thetravelbible.com/wp-content/uploads/2023/08/tim-samedov-10-1600x900.jpg> <https://i.stack.imgur.com/orPsV.jpg> <https://external-content.duckduckgo.com/iu/?u=https%3A%2F%2Ftse1.mm.bing.net%2Fth%3Fid%3DOIP.IA1GE6CtrJyVQyR3W7bc3AAAAA%26pid%3DApi&f=1&ipt=3f426fc713fe25df6dfcd0c4d8b67173bd61612d8953f3bd91dd980372c07826&ipto=images> OK or not?

**A:**

We cannot make a decision on hypothetical Drones. When you have a Drone built from allowable materials please submit the photo and we will rule on the legality of the design.

(Asked by **21852** answer published at October 17th 2023)

## Q121 May a team cut a notch in their Drone?

**Q:**

Is it allowed to cut (or tear) a notch in the drone to aid in launching?

**A:**

Yes, Teams may make cuts in their Drones provided no other rules are violated.

(Asked by **21533** answer published at October 17th 2023)



## Q122 Does the drone have to be red or blue?

**Q:**

<DR05> states that we may use a color printer to achieve the required red and blue colors. I know the drone has to have the team number to be easily identifiable, but does it have to be colored to match our alliance color?

**A:**

Rule DR03 states that "The predominant color of a Drone must match the Team's assigned Alliance color for the Match (red or blue)".

(Asked by **19591** answer published at October 17th 2023)

## Q126 Drone Construction

**Q:**

(a) Can we use glue or tape on the drone? (b) Can we apply water to the paper during construction to help folds in the paper become sturdy / stiff?

**A:**

A) No, rule DR05d state that no other materials are allowed. This includes tape, glue, paperclips, etc. B) Providing the water has evaporated and it leaves no residue, it is permissible to wet the paper during construction.

(Asked by **21457** answer published at October 19th 2023)

## Q127 Continue on Q117, how do I submit pictures, a pdf file?

**Q:**

Continue on Q117, how do I submit pictures, a pdf file?

**A:**

There is a new resource "Is your Drone Legal" that contains instructions on how to submit Drone photos. You can find the document at <https://www.firstinspires.org/resource-library/ftc/game-and-season-info>  
(<https://www.firstinspires.org/resource-library/ftc/game-and-season-info>)

(Asked by **21852** answer published at October 19th 2023)

## Q128 Glide Path and Drone Legality

**Q:**

Q1: In Q100 you cite a "glide path". Is this replacing the "non-ballistic trajectory" Q2: In the new "Is Your Drone Legal?" document, L2 clearly has wings, IL2 clearly has no wings, what is the place where there is "enough wing" between those two designs?

**A:**

A1: Glide path and non-ballistic trajectory are interchangeable terms.

A2: FIRST strives to compose robot construction rules that can be applied objectively and consistently across all FIRST Tech Challenge competitions. Despite our best efforts to try and write a subjective rule, the application of is subjective. The Inspectors will be looking for Drone characteristics that have the general configuration of an airplane with a defined fuselage and wings that have a reasonable potential for providing meaningful aerodynamic lift. The "Is Your Drone Legal" guide and the Robot Inspector's guide are two resources we made available to teams and inspectors to help you in building legal drones.

(Asked by **15259** answer published at October 19th 2023)

## Q135 Legal or not drone not answered yet

**Q:**

I have submitted the pdf file for a design through the special link to upload file, no answer yet, or I am not looking at the right place? Q117, Q127

**A:**

The review process is now operational. Please remember that all submissions must be of a final, match ready Drone. That means the color must be correct, it must have a Team Number, be made from the allowed materials, and be the correct size and shape. A Drone violating any of the DR rules will be deemed illegal.

(Asked by **21852** answer published at November 15th 2023)

## Q142 Drone Bond Paper

**Q:**

This paper appears to be legal, 8.5 x 11, 20 LBS, non-coated, Red and Blue, but it says Bond on the label, <https://a.co/d/2cAYTTL>. Bond Paper, [https://en.wikipedia.org/wiki/Bond\\_paper](https://en.wikipedia.org/wiki/Bond_paper), is basically made from high-quality durable fiber pulp.

**A:**

Yes, Bond paper is a common printer paper and is an acceptable material for building Drones

(Asked by **18474** answer published at October 26th 2023)

## Q164 Drone paper modifications

**Q:**

Requesting a clarification on what modifications to the drone paper are allowed. Notches are allowed and paper smaller than 8.5x11 is allowed. Q1: Can the starting sheet of paper be an irregular shape as long as it is smaller than 8.5x11 and a single piece? Q2: During construction, can pieces of the paper be trimmed with scissors and discarded - final drone is still single sheet. Q3: Can the drone have holes cut or punched in the paper assuming the cut-outs are discarded.

**A:**

A1: Yes, the starting size of the paper can be any shape as long as it is equal to or smaller than 8 1/2 x 11 or A4. A2: Yes, the paper can be trimmed as long as the cut off parts are discarded. A3: Yes, holes may be cut out of the paper.

(Asked by **19746** answer published at November 7th 2023)

## Q171 Can a Silver Sharpie be used to add the team number to the drone?

**Q:**

Sharpie offers 2 types of silver pens (1) Sharpie Oil-based Paint Marker and (2) Sharpie Permanent Marker. I believe that the paint marker is not allowed and that the permanent marker is allowed. Can you state if either are legal per <DR05>?

**A:**

A1: Per Rule DR05b, the oil-based paint version of the Sharpie is not allowed.

A2: The standard Sharpie Permanent Marker is legal.

Remember, the reason for requiring a Team Number is so that Drones can be returned to the Teams post Match. Any attempt to "game the rules" by adding weight by the use of excess ink or other marking materials will result in the Drone being disallowed.

(Asked by **21457** answer published at November 7th 2023)

## Q177 We made a very small drone

**Q:**

Our team has found an optimal drone design for our launch system, but its design is strange and we would like to confirm that it is allowed. It has a clearly defined wings and fuselage, and is 1.5 inches long 2 inches wide (including wingspan) and 1 1/4 inches tall. Is this an acceptable drone design?

**A:**

We believe [Q178 \(/qa/178\)](#) answers your question about size. If it does not, please rephrase your question and resubmit. As for the shape, please refer to the document "Is your Drone Legal" located at [https://www.firstinspires.org/sites/default/files/uploads/resource\\_library/ftc/is-your-drone-legal.pdf](https://www.firstinspires.org/sites/default/files/uploads/resource_library/ftc/is-your-drone-legal.pdf) ([https://www.firstinspires.org/sites/default/files/uploads/resource\\_library/ftc/is-your-drone-legal.pdf](https://www.firstinspires.org/sites/default/files/uploads/resource_library/ftc/is-your-drone-legal.pdf))

(Asked by **23738** answer published at November 9th 2023)

## Q178 Is there a minimum size requirement for the paper drone?

**Q:**

Can we have a drone that only uses half or even smaller portion of the standard 8.5x11 paper?

**A:**

There is no restriction on the minimum size of a Drone, Teams may use as much or as little of the allowed paper as they wish. However, it is to a Team's benefit to be large enough for the Scoring Referee to see it from 12 - 18 feet away. And the Team Numbers must be legible.

(Asked by **23226** answer published at November 9th 2023)

## Q259 Drone Color

**Q:**

Can we use a felt tip pen to color the drone or does it have to be printed from an inkjet or store bought with the pink, red, or blue color?

**A:**

Yes, you may use a felt tip marker to color the Drone.

(Asked by **17346** answer published at January 2nd 2024)

## Q284 How will robot inspectors determine that the weight of paper for a drone is legal?

**Q:**

<DR05>.a requires the paper weight to be no more than 20lb (75 g/m<sup>2</sup>). Given the subtle differences between 20lb (5grams, 0.09mm thickness) and 24lb paper (6grams, 0.12mm thickness) what would a team need to prove that their drone paper is legal?

**A:**

If there is concern that the paper exceeds the 20 lb. weight specification requirement, the inspector will ask the team if they have the packaging or a photo of the packaging. Without team provided documentation, inspectors will use their judgment with a team-friendly approach to evaluate the Drone's paper weight specification.

(Asked by **2901** answer published at January 21st 2024)

## Q297 Wing angle of drone configuration

**Q:**

What angle do the wings have to be from the fuselage of a drone to be eligible? Here's a link to some examples of different angles. [https://drive.google.com/drive/folders/1-K\\_rHxm0dtCXJkdZDs6DopqzeChEMGrn](https://drive.google.com/drive/folders/1-K_rHxm0dtCXJkdZDs6DopqzeChEMGrn)

**A:**

There is no specific wing angle that a Drone must meet to be legal. The intent is that the wing has an aerodynamic influence on the flight path of the Drone and that it is visibly a "paper airplane". Wings that are tight against the fuselage turn the Drone into a dart, which is not allowed. If there is a question at Inspection, the Inspector may ask the team to demonstrate the Drone in flight.

(Asked by **5199** answer published at February 8th 2024)