

Q85 Hanging Size Restrictions

Q: Is it permissible to have your robot be outside of the vertical area of your alliance's rendezvous area during a hang? The robot would not be in contact with the ground/carpet (entirely supported by the bar or other robots on the bar) but would be outside of the vertical area of the rendezvous area.

A: There is no requirement that a ROBOT be fully contained by its RENDEZVOUS POINT in order to score HANG points.

(Asked by 4604 at Jan 8th 20)

Q86 G3. During AUTO, no defense - what about Rendezvous Point?

Q: Is it OK for a robot to pass into/thru the RENDEZVOUS POINT area during AUTO, and is it a violation if there is incidental contact with an opponent's robot?

A: There are no rules prohibiting ROBOTS from entering the RENDEZVOUS POINT during AUTO or contacting other ROBOTS within the RENDEZVOUS POINT during AUTO.

(Asked by 3229 at Jan 8th 20)

Q87 G3. During AUTO, no defense - what about the Trench Run?

Q: Provided there is no violation of G10, is it permitted for a robot to travel thru an opponent's TRENCH RUN during AUTO?

A: There are no rules prohibiting ROBOTS from entering either TRENCH RUN during AUTO. Contact with opposing ROBOTS in their TRENCH RUN is restricted by !G10 as you have noted.

(Asked by 3229 at Jan 8th 20)

Q88 G12. Leave the opponent's CONTROL PANEL alone - clarification please?

Q: Provided there is no violation of G10 or G12, can a robot interact with their opponent's CONTROL PANEL, possibly causing it to over-rotate or no longer be on the assigned color?

A: Yes, a ROBOT may interact with an opponent's CONTROL PANEL, provided that !G12 is not violated.

(Asked by 3229 at Jan 9th 20)

Q89 G18. Don't overextend yourself - are multiple extending components permitted?

Q: Can we confirm that a robot is permitted to have more than one component that extends beyond the frame perimeter, as long as neither extends more than 12 inches?

A: Yes, a ROBOT may have multiple extensions provided that each extension complies with !G18.

(Asked by 3229 at Jan 9th 20)

Q90 # of Power Cells needed to use control panel

Q: In section 4.4.2 of the manual do you need to score a total of 49 power cells to get to stage three? The wording is confusing, do the power cells add onto each other?

A: Each stage must be charged individually after the previous stage has been ACTIVATED. Per Section 4.4.2 "CAPACITY is the number of POWER CELLS, defined in Table 4-1, that must be scored to charge each stage". Per 4.4.3, "A stage may be ACTIVATED once it reaches CAPACITY, and a stage must be ACTIVATED before the next stage can begin charging." Additionally, note also in 4.4.2 that "POWER CELLS scored after a stage is at CAPACITY generate MATCH points but do not contribute to the next stage's CAPACITY."

(Asked by 3618 at Jan 9th 20)

Q91 Short Human Player

Q: As a short person myself I noticed that the top shelf at the human player station is quite high to reach the power cells. Is it okay for the human player to bring and use a step stool?

A: Per !H1, "The only equipment that may be brought to the ARENA and used by DRIVE TEAMS during a MATCH is listed below[...]" Unless required due to a disability, and thus permitted per !H1-D, a step stool would not be permitted.

(Asked by **3618** at Jan 8th 20)

Q92 When to spin the Control Panel

Q: Are you allowed to start spinning the control panel before you have all of the power cells scored?

A: There are no rules prohibiting spinning of an ALLIANCE'S CONTROL PANEL prior to "having all of the POWER CELLS scored" (i.e. CAPACITY for that Stage), however, per 4.4.3, "A stage may be ACTIVATED once it reaches CAPACITY" and thus any spinning or interaction with the CONTROL PANEL will not be contributing to accomplishing ROTATION CONTROL (or, in Stage 3, POSITION CONTROL).

(Asked by **3618** at Jan 10th 20)

Q93 roboRIO as a co-processor?

Q: Are there any restrictions on a team that would prohibit them from using a second roboRIO, strictly as a co-processor, assuming it is not running the FRC image and not controlling any actuators, and it is clear that the second roboRIO is different than the primary roboRIO (via marking or through the modification of the case)?

A: A second roboRIO may be used as a co-processor provided that the ROBOT is controlled via a single roboRIO per !R57. Rules that refer to "the roboRIO" such as !R59 would refer to this controlling roboRIO.

(Asked by **900** at Jan 8th 20)

Q94 Can you clarify the definition of the Initiation Line?

Q: The current definition of the initiation line is: "INITIATION LINE: a white tape line spanning the width of the FIELD and located 10 ft. (~305 cm) from the face of PLAYER STATION 2 to the near edge of the tape." The wording seems awkward. Does this actually mean "the near edge of the tape is located 10 ft from..."? Does the initiation line include entire width of the tape, or just the plane of the alliance station-facing tape edge?

A: Yes, your wording of "the near edge of the tape is located 10 ft from [the face of PLAYER STATION 2]" is equivalent of the manual's wording of "located 10 ft. (~305 cm) from the face of PLAYER STATION 2 to the near edge of the tape." Since INITIATION LINE is defined as the white tape line, the entire tape line would be included, not just a plane.

(Asked by **5675** at Jan 9th 20)

Q95 Momentary Encroachment for S6

Q: Knowing that momentary by definition is intentionally vague to allow for ref discretion and that field tour videos are not representative of allowed actions, can the GDC clarify the desired intent for momentary encroachment into the chute in S6? Is a human player only allowed to have fingertips break the plan of the chute opening? Could a whole hand be in the chute opening (such as 41 seconds into the loading bay filed tour video) as long as it's only briefly to release a ball?

A: Per 4.5, "The official FIRST Robotics Competition definition of momentary is fewer than three (3) seconds." In general, this means that encroachment into the chute for less than 3 seconds will not be penalized, however, please note at the top of Section 5 that "Event staff have the final decision authority for all safety-related issues within a venue." For example, if your method of entering a POWER CELL is deemed a safety risk, or the HUMAN PLAYER is breaking the plane of the chute without a POWER CELL at all, Event Staff may request the activity be discontinued.

(Asked by **5414** at Jan 9th 20)

Q96 Points during autonomous

Q: When scoring points during autonomous period, will those points count towards total score? Last year, only certain alliances received points.

A: All AUTO and TELEOP points outlined in Section 4.4.5 "Point Values" are included in the final MATCH score for an ALLIANCE. Just like the 2019 season, an ALLIANCE'S final MATCH score is the sum of the points earned throughout the MATCH. If your team has concerns about scoring at your event, please bring it to the attention of the HEAD REFEREE.

(Asked by **7911** at Jan 9th 20)

Q97 Event Rule E17 - 802.11a/b/g/n/ac Wireless Prohibitions

Q: Event Rule E17 prohibits "802.11a/b/g/n/ac" but no mention is made of the "ax" or "Wi-Fi 6" variant. Given the issues in the past regarding wireless interference, is this intentional and 802.11ax is permitted, or was this an oversight?

A: Good question! Please see [Team Update 02](https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate02.pdf). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **5881** at Jan 10th 20)

Q98 Follow Up to Q66: Items that have qty discounts

Q: The Blue Box in R13 includes "If COTS parts were sourced in bulk, the cost may be scaled proportionally to assess the Fair Market Value of one unit" Does this mean that a team must actually purchase the bulk qty or can a team that only purchases one item still use the available bulk scaled value? If an item is given to a team but it can be purchased in bulk which cost should be used? If the entity that donates the item to a team purchased it at bulk price can the team use that price as its FMV?

A: Yes, this means that the team must have sourced the item in bulk quantity to use the scaled bulk price. If the item was sourced by the team in any way other than in bulk, the team should attempt to determine the cost as sourced and only use a bulk price if that is all that is available (ex. a team receives a donation of 9 rivets that are only sold in boxes of 100, if no single unit cost can be found, the team would scale the cost of the box to assess the FMV).

(Asked by **3847** at Jan 9th 20)

Q99 Identical functional replacement, and relationship to quality

Q: R13's blue box includes "for the part or an identical functional replacement" Does this instance of "identical functional replacement" also refer to the definition provided in R11 or is this a different standard? Does the quality of a product effect it's status as an identical functional replacement? Can #25 chain that sells for \$10 / ft be cost accounted the same as #25 chain that sells for \$1 / ft since many reasonably astute observer's would be unable to differentiate them?

A: Yes, the phrase in !R13 would be defined the same as the phrase in !R11. While we cannot rule definitely on a particular component, it is likely that a chain that sells for ten times the cost has differences in "form, fit, feature set, and function" such as material strength, wear life, etc. The reasonably astute observer test in !R11 is intended to be a guideline and not a purely visual test as many parts with wildly different price and performance may be visually indistinguishable.

(Asked by **3847** at Jan 9th 20)

Q100 R13 Bulk items shipped as one part

Q: Is it acceptable to account the Fair Market Value for items that are sold in qty but shipped as a continuous item as individual parts on the BOM? A simple example would be electronic crimp connectors that are sold on a reel. Each individual item must be cut from the larger item, but vendors sell/price them per unit and ship them as one continuous item.

A: Yes, if individual items are packaged in a way that makes them appear continuous, such as a reel, but are used individually on the ROBOT, this would meet the bulk sourcing criteria outlined in the Blue Box under !R13. If an item is sold as a continuous item and some fraction of it is used on the ROBOT (such as belt, chain, rope, etc.), this would be more appropriately described by the "raw material" section of the !R13 Blue Box and should be assessed in that manner.

(Asked by **3847** at Jan 9th 20)

Q101 COTS, Major Mechanism & Interacting with partner robots.

Q: In A7 it states that COTS items could be a Major Mechanism but you are unaware of any COTS items that are Major Mechanisms. Does the intention of a COTS item to be used in combination with a different team's robot than the one that is receiving it effect the status of the item as a Major Mechanism? Can a team give another team a hook tape strap or a COTS rod to another team with the intention that the receiving team mounts it in a way that the giving team is able lift the receiving robot?

A: Please see [Team Update 02](https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate02.pdf). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **3847** at Jan 10th 20)

Q102 Motor Assembly Bolt Replacement

Q: Can the bolts used to assemble motors(not the mounting bolts) be replaced with bolts with the same thread and length but a different material and/or head/drive type?

A: No. This would be a violation of !R28.

(Asked by **3847** at Jan 9th 20)

Q103 Fans and Custom Circuits?

Q: R52 gives us the breakers that must be used for each type of Branch Circuit. Can a fan be powered off the same circuit as a custom circuit? If a COTS computing device (laptop/limeLight/etc) has a fan may I power that fan off the same circuit as that Custom Circuit? If I purchase a Raspberry Pi(generic custom circuit) and separately purchase a Raspberry Pi Case that includes a Fan(generic fan). May I power the fan and Raspberry Pi from the same 20A or less circuit breaker?

A: Per Table 9-3, "Fans...not already part of COTS computing devices" must be powered off a PDP breaker of 20A or less and "No other electrical load can be connected to the breaker supplying this circuit." A fan that is part of a COTS computing device may be powered off the same circuit as the computing device.

(Asked by **3847** at Jan 10th 20)

Q104 Autonomous and Stage One Scoring

Q: Do Power Cells scored in Autonomous mode count toward Stage One capacity? For example, If an alliance scores all Nine (9) Power Cells required for Stage One activation during Autonomous is Stage One activated as soon as Teleop begins? Also, If an alliance scores less than Nine (9) Power Cells during Autonomous, do those continue to count toward Stage One, or is the Stage One capacity count reset when Teleop Begins?

A: Yes, POWER CELLS scored during AUTO count towards Stage 1. There is no reset of progress towards Stage 1 CAPACITY at the end of AUTO.

(Asked by **7491** at Jan 9th 20)

Q105 Control Panel Position Control Color Selection

Q: Section 3.5.1 (in the bullet below Figure 3-24) states "Once either ALLIANCE reaches Stage 3 CAPACITY, FMS relays a specified color ... to all OPERATOR CONSOLES simultaneously." Our question is regarding the word "either" in that sentence. Will BOTH Alliances receive their selected color at the same time, even if BOTH Alliances have not reached Stage 3 Capacity? Also, Could an Alliance receive it's selected color before completing the Stage 2 Capacity or Rotational Control?

A: Yes, both ALLIANCES will receive a color at the same time. This does mean an ALLIANCE could receive it's selected color before completing ROTATION CONTROL.

(Asked by **7491** at Jan 9th 20)

Q106 High Intensity lights targeting near the ALLIANCE STATIONS

Q: R8.m states "High intensity light sources used on the ROBOT (e.g. super bright LED sources marketed as 'military grade' or 'self-defense') may only be illuminated for a brief time while targeting" Many common FRC devices such as a LimeLight do arguably have High Intensity LEDs, but don't meet the parenthetical marketing example. In addition the OUTER PORT is within 3 feet of eye-level for two of the opposing ALLIANCE STATIONS. Are you able to use these devices in a continuous targeting mode?

A: The parenthetical examples are just examples, and not intended to be an exhaustive list. Any high intensity light source on a ROBOT, regardless of how it is marketed, may only be illuminated for a brief time while targeting.

(Asked by **2834** at Jan 10th 20)

Q107 Contact with SHIELD GENERATOR above the HANDLE

Q: During endgame, Is it acceptable for a robot to contact a portion of the GENERATOR SWITCH above the HANDLE, so long as G26 is not violated? Consider a robot which is suspending from and grasping the RUNG, but also contacts a vertical face of the GENERATOR SWITCH above the HANDLE. Would that robot be in violation of rule G26? Would the contact above the HANDLE section prevent endgame credit for HANGING or LEVEL, even if that non-grasping contact is still in place 5 seconds after match end?

A: As long as !G26 is not violated, there are no restrictions on how ROBOTS can interact with any part of the FIELD. Unfortunately, we cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE.

(Asked by **2992** at Jan 10th 20)

Q108 Two robots starting at same location on the Initiation Line?

Q: Given that a robot must start "positioned such that its BUMPERS are intersecting the infinite vertical volume created by the corresponding ALLIANCE'S INITIATION LINE", and the INITIATION LINE is 2" wide, is it legal to line 2 robots at the same place in the line such that they are each occupying approximately half the area of that section of tape, or must a robot's bumpers completely transect the 2" line?

A: As long as both ROBOTS are intersecting, this would be an acceptable position. Remember that per the blue box in !G1, "Teams are encouraged to position ROBOTS such that it is clear to REFEREES that !G1-D is not violated."

(Asked by 5675 at Jan 10th 20)

Q109 R24 Bumper Creation

Q: According to R24, the plywood used to create the bumpers must be backed by " 3/4 in. (nominal) thick (~19mm) by 5 in. ± 1/2 in. (~127 mm ± 12.7 mm) tall plywood, Oriented Strand Board (OSB) or solid wood (with the exception of balsa)." Does the plywood have to be a single 3/4" inch piece, or could it be multiple smaller pieces glued together that add up to 3/4"?

A: Per the Blue Box of !R24 the plywood must be "sold by VENDORS as that material and thickness". Laminating multiple pieces or wood, regardless of their original size, does not meet this definition of plywood.

(Asked by 5436 at Jan 10th 20)

Q110 Contact with the shield generator switch

Q: Can we hang on both sides of the shield generator switch?

A: We are having some difficulty understanding your question. Please rephrase and resubmit.

(Asked by 5440 at Jan 10th 20)

Q111 Fair Market Values and Exchange Rate

Q: If a team purchases an item in a different currency than USD at which time should the exchange rate conversion to USD be performed? When purchased? The day of the event? Some other day/time? If a functional identical replacement item is purchasable in a currency other than USD from a vendor. May a team use the value in the other currency as the FMV and at which time should they do the currency conversion?

A: As noted in the blue box of !R13, teams are only expected to make a good-faith effort at determining the item price. This includes determining the appropriate exchange rate. Teams may use any exchange rate that occurred between the time they purchase the item and the day of the event.

(Asked by 3847 at Jan 10th 20)

Q112 Q52 & Falcon replacement shafts

Q: As asked in Q52 "Would any replacement shaft for the Falcon 500, purchased from any vendor or made by the team, be legal?" Are the output shaft mounting holes of a Falcon consider it's interface and there for any shaft can be mounted on it or is the shaft itself the shaft/interface and can't be replaced but could be modified in accordance with R28?

A: Replacing the output shaft on the Falcon 500 would be considered a modification of the output shaft/interface and permitted per !R28-A (note: this does not extend to other motors which generally require modification/replacement of components beyond the output shaft in order to replace the shaft).

(Asked by 3847 at Jan 10th 20)

Q113 Followup to Q98 and Bulk Quantity Sensors (Tonight's Episode: The rich get richer.)

Q: As further clarification of Q98, would a team purchasing a bulk quantity of sensors (IE: 360 Degree Automotive Scanner Kit - ■■■M Range, Model ■■■■-■■■■), normally sold for more than \$500 USD individually but available in sufficiently large bulk quantities at less than \$500 USD, be able to use those sensors if they were purchased in bulk? If they went on to provide those sensors to other teams for free or at a reduced cost, what should other teams report on their BOM as the FMV cost?

A: if a team's bulk purchase of an item per !Q98 brings the unit cost under \$500, they may use that item. Please see !Q98 for the answer to your other question.

(Asked by 900 at Jan 10th 20)

Q114 COTS MAJOR MECHANISM vs team MAJOR MECHANISM and assembly

Q: The answer to Q14 indicates that a kit to assemble a MAJOR MECHANISM is legal if it is COTS. If Team A were to separately source and manufacture identical parts to assemble in a kit to provide to Team B, would Team B be in violation of I1, specifically the section of the blue box regarding exploiting loopholes? What if Team A purchased the COTS kit and provided it to Team B? Is the answer different if there is slight, non-functional variation on the parts provided?

A: Please see [Team Update 03](https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate03.pdf). In addition, a team that assembles and uses a non-COTS kit provided by another team as a MAJOR MECHANISM is in violation of !I1.

(Asked by 2177 at Jan 14th 20)

Q115 Parallel power to multiple low voltage sensors

Q: In the past there has been a specific rule permitting multiple low voltage sensors to be powered from a single circuit breaker on the Power Distribution Board. I do not see such a rule this year. Is this still permitted? For example, we want to run several CTR CANCoders. These require 12 volt power. Can they be wired together in parallel and connected to a single wire that is plugged into a single Wago connector on the PDB ?

A: Provided that !R49 is followed, multiple physical devices may be wired together into a single CUSTOM CIRCUIT which may be connected to the PDP as described in !R52.

(Asked by 1218 at Jan 10th 20)

Q116 Follow up to Q113

Q: If a group of teams commit together to purchase an item in bulk at a reduced cost, can each team account the reduced FMV since they all collectively purchased the item in bulk? Or can none of the teams use the bulk price even though that is the price they actually paid?

A: !R13 does not require that the team be the only party sourcing the item, so yes, a cooperative of teams sourcing an item in bulk may use the (assumed) lower unit price that results from the bulk purchase.

(Asked by 3847 at Jan 13th 20)

Q117 Clarification on when you can do the control panel

Q: the rule book states " The TRENCH light turns on once Stage 2 CAPACITY is reached (i.e. the CONTROL PANEL is ready for ROTATION CONTROL)." as this wording is a little confusing, does this mean you can't complete ROTATION CONTROL until 29 game pieces have been scored? if so would you be able to spin the control panel before the 29 game pieces then it would count after you reach state two capacity?

A: We believe !Q92 answers your question. If it does not, please rephrase your question and resubmit. Please use the Search Q&A button on the navigation bar before posing a new question.

(Asked by 5431 at Jan 10th 20)

Q118 Pay-what-you-want software

Q: What is the FMV of software which is distributed under a pay-what-you-want license and has no suggested price?

A: Software that is available freely, but asks for a donation, should have an FMV of \$0.

(Asked by 2363 at Jan 10th 20)

Q119 Fair Market Value in International Countries

Q: What if the Fair Market Value of a product varies by country. A fictional example from "Naboo": Prod X price from a US Vendor: \$400 USD Prod X price from a Naboo Vendor: \$688 NBD = \$529 USD What is the FMV for Prod X for a Naboo team? \$400 or \$529? Does it matter that some Naboo teams are able to order from the US while others are not because of their proximity to the border? If the FMV for Prod X for Naboo teams is \$529, is this product now illegal for Naboo teams due to the \$500 limit?

A: There is no requirement for teams to list the FMV of an item as the price they paid. Per the Blue Box below !R13, teams do not need to include "other costs that may vary by locality" and therefore may list a cost from a VENDOR that would not provide a part to their locality (i.e. the "generally available to all FRC teams" clause is not intended to imply that a team may not use a price from a VENDOR that will only ship to limited localities.)

(Asked by 1114 at Jan 13th 20)

Q120 Hanging Robot Contact

Q: In the event that a hanging robot is in contact with a robot on the ground, but not supported by the parked robot (definition of not supported being "were that parked robot not present, the hanging robot would meet the criteria for hanging"), will the robot hanging on the bar be considered a 25 pt Climb, or a 5 point park?

A: It would be up to the REFEREE to determine whether the PARKED ROBOT was supporting the other ROBOT. There is no *FIRST* Robotics Competition specific definition of support, so a general definition applies "bear all or part of the weight of; hold up". We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE.

(Asked by **930** at Jan 10th 20)

Q121 When can you score Positional Control Points

Q: The rules state that both alliances receive their Positional Control color once either alliance meets the Stage 3 Capacity requirement. Let's say the Red alliance completes their Stage 3 Capacity requirement, and the colors are assigned. Assuming the Blue alliance has completed the Rotational Control objective, could they complete and earn points for the Positional Control objective, even if they haven't met the Stage 3 Capacity requirement?

A: Please see [Team Update 02](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate02.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **930** at Jan 10th 20)

Q122 Is the Aurebesh (Star Wars font) allowed for numbers?

Q: Most specifically, is the Aurebesh (Star Wars font) allowed for numbers? A wide variety of fonts have been allowed before. Are the numbers in Aurebesh close enough to standard Arabic to be acceptable? <https://starwars.fandom.com/wiki/Aurebesh>

A: No. Aurebesh is not an acceptable font for the Team Numbers on the BUMPERS.

(Asked by **2577** at Jan 10th 20)

Q123 Receiving colour data through the FMS.

Q: How does the Field communicate the colour we need from the control panel to our station? I know it gets sent threw FMS I am just curious how you read it.

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. For technical assistance, please visit the [FIRST Forums](<https://forums.firstinspires.org/forum/general-discussions/first-programs/first-robotics-competition>) or (in the case of the game data as you are asking) you can consult [the WPILib docs](<http://docs.wpilib.org/en/latest/docs/software/wpilib-overview/2020-Game-Data.html>).

(Asked by **914** at Jan 10th 20)

Q124 H10 Clarification - Power cells in rack

Q: H10 - there doesn't appear to be anything in the rule that defines what constitutes separate violations of the rule. Is it only possible to violate this rule once per match regardless of severity?

A: Please see [Team Update 05](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate05.pdf>). Violations of !H10 can lead to a FOUL, a TECH FOUL, and potentially a CARD if !C1 is violated. The severity of violation matters.

(Asked by **2502** at Jan 22nd 20)

Q125 Event Rule E16: Use of Bluetooth Hotspots at Events

Q: Rule E16 states "No wireless communication. Teams may not set up their own 802.11a/b/g/n/ac/ax (2.4GHz or 5GHz) wireless communication (e.g access points or ad-hoc networks) in the venue". An example specifies "A wireless hot spot created by a cellular device, camera, smart TV, etc. is considered an access point." I have interpreted this to mean that a hot spot created by a cellular device that utilizes bluetooth connection, that operates on 802.15.1, is allowed. Is this accurate?

A: Yes, Bluetooth is permitted.

(Asked by **6996** at Jan 12th 20)

Q126 Generator Switch hanging locations

Q: Is it allowed to hang a robot from the center of the generator switch?

A: As long as !G26 is not violated, there are no restrictions on how ROBOTS interact with the FIELD. If this does not answer your question, please rephrase and ask again.

(Asked by **6608** at Jan 13th 20)

Q127 Contact with the generator switch

Q: Can we hang on both sides of the generator switch at the same time?

A: As long as !G26 is not violated, there are no restrictions on what part of the FIELD ROBOTS interact with. If you are asking if a ROBOT can contact the RUNG on both sides of the center support on the GENERATOR SWITCH at the same time, the answer is yes.

(Asked by **5440** at Jan 13th 20)

Q128 Contact with the shield generator

Q: Can we touch the other part of the generator switch bar?

A: We believe !Q127 answers your question. If it does not, please rephrase your question and resubmit.

(Asked by **5440** at Jan 13th 20)

Q129 Motors and The Quantity of them Overall

Q: As the game manual showed the regulations on which motors can be used in "The only motors and actuators permitted on 2020 ROBOTS include the following (in any quantity)." Does this mean any number of motors can be used or is there a set quantity of motors from the given permitted motors? An example would be that we have overall 10 motors but all of which are legal for the FRC.

A: There is no limit to the number of motors used on a ROBOT, as long as !R52 is not violated.

(Asked by **2151** at Jan 13th 20)

Q130 Vertical Extension Restriction

Q: Is it legal during game play, before endgame, to have the robot extend vertically beyond the 45 inch robot height restriction? The manual mentions 12 inches beyond the frame perimeter, but not specifically height extension restrictions.

A: !G17 restricts ROBOT height to 45 inches, except for the ENDGAME. !G18 restricts ROBOTS from extending outside their FRAME PERIMETER (the fixed non-articulated structural elements of the ROBOT contained within the BUMPER ZONE).

(Asked by **6321** at Jan 13th 20)

Q131 Generator Switch Safety Concern

Q: Our team noted that there is no locking mechanism mentioned in the rules or in the CAD model. We have a concern that at the end of the match, when teams remove their robots, the switch will still be able to move. We are concerned that this could cause other robots still on the switch to move and swing causing injury to anyone near them. We would recommend either a locking pin, brake, or an automotive underhoist safety stand. These could be used to prevent the generator switch from swinging.

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. Please send your suggestion to firstroboticscompetition@firstinspires.org.

(Asked by **6101** at Jan 12th 20)

Q132 Vector file for artwork on bottom of first page of game manual?

Q: Is the horizontal graphic at the bottom of the first page of the game manual available as a vector file? If so, where can we download and can we add our team logo to it for our team tshirts?

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. Please send this question to

firstroboticscompetition@firstinspires.org.

(Asked by 2605 at Jan 12th 20)

Q133 Where can I shoot from?

Q: According to rule G9 I can't shoot from my sector (Red Alliance), which is from the initiation line to the alliance station. Can I shoot from the control panel, since I'm outside my sector and can a opposing robot bump into us?

A: As long as !G9 is not violated, there are no restrictions about where ROBOTS can shoot from. Please see !G10 and !G11 for rules regarding zones where ROBOTS are safe from opponents.

(Asked by 5089 at Jan 13th 20)

Q134 Are pneumatic tanks permitted on the low-pressure side of the circuit?

Q: Are pneumatic tanks allowed to be placed downstream of the pressure regulation outside of the high-pressure pneumatic circuit, downstream of a solenoid?

A: There are no rules that would specifically prohibit pneumatic storage tanks from being used on the working pressure side of a pneumatic system.

(Asked by 435 at Jan 13th 20)

Q135 What is the maximum robot weight ?

Q: in the section 9 ROBOT CONSTRUCTION RULES, R5 - It is mentioned that the robot weight should not exceed 125 lbs while in the section 10 INSPECTION & ELIGIBILITY RULES, I3 - the maximum weight is 150 lbs. So what should be considered the maximum weight of the robot ?

A: !R5 is a ROBOT rule and gives specific inclusions and exclusions as to what makes up the 125-pound maximum. !I3 is an Inspection rule and has a different set of requirements making up the 150-pound maximum, including the ability of teams to bring multiple MECHANISMS to inspection that they may intend to use in different configurations of their ROBOT (so not necessarily simultaneously). Teams must meet both requirements.

(Asked by 8067 at Jan 13th 20)

Q136 Replacement of damaged POWER CELLS

Q: What standard will be applied by field staff when determining whether a POWER CELL should be replaced due to damage / wear? If a POWER CELL is damaged in such a way that it compresses significantly easier than a new one would, is that ball considered damaged and in need of replacement?

A: FIELD STAFF will replace POWER CELLS when they are visibly damaged (i.e. significant tears, gouges, chunks missing etc.) and no longer suitable for play. Minor surface wear or marking is expected and will not result in POWER CELLS being replaced. Changes in non-visible behavior (such as compression) are not expected to be assessed by FIELD STAFF and will not result in the POWER CELL being replaced.

(Asked by 1114 at Jan 13th 20)

Q137 Extending into bottom goal

Q: Is the robot allowed to extend into the bottom goal (within legal extension restrictions)? Basically something that would guarantee a successful dumping mechanism into the bottom goal

A: Since anything past the front-facing surface of the POWER PORT is not on the FIELD, by!S4, ROBOTS are not allowed to have greater-than-momentary incursions into the BOTTOM PORT. Note that momentary has an official definition: less than three (3) seconds.

(Asked by 852 at Jan 13th 20)

Q138 Passive Circuit Board on RoboRIO?

Q: In order to increase reliability over the PWM-style 3-pin connectors, we have designed a passive circuit board that connects RoboRIO pins to locking connectors on the topside of the circuit board. This appears to be permitted under R69 for the MXP connector, but would having this passive circuit connect relay, servo, analog and PWM connections be a violation of R68?

A: Passive PCBs that only adapt connector types are considered connectors and would not preclude compliance with !R31, !R68, or !R70. Note that there must be no other functionality (i.e. active circuitry) located on the same PCB and the team will be responsible for proving to inspectors

that the board consists only of passive connections (a sample spare board may be helpful if visibility to the roboRIO is limited when installed on the ROBOT).

(Asked by **1425** at Jan 13th 20)

Q139 FMV of incompletely kitted subsystems

Q: A VENDOR sells a subsystem kit which will only provide nonzero value to a ROBOT when it is assembled together with other COTS robot components from outside the subsystem kit. These other components the team must provide separately. Does the FMV of the VENDOR's kit include the value of those necessary separate components?

A: If we understand this question properly, we believe the Blue Box below !R12 answers it, specifically "If the modules are designed to assemble into a single configuration, and the assembly is functional in only that configuration, then the total cost of the complete assembly including all modules must fit within the price constraints defined in R12." If the kit can only assemble in a single configuration and requires specific external parts to do so (ignoring trivialities like being able to use bolts that are too long and have them stick out or need to be cut off), then the FMV of the kit would need to be assessed against !R12 with these parts included. If the kit can be assembled "in several possible configurations, then each individual module must fit within the price constraints defined in R12." If that doesn't answer the question, please rephrase and resubmit.

(Asked by **2363** at Jan 13th 20)

Q140 Identical Functional Replacement

Q: Would any 1/16 in. aluminum, 1 in. x 2 in. x 48 in. tubing be considered an identical functional replacement (IFR) for the 1/16 in. aluminum, 1 in. x 2 in. x 48 in. that came in the KOP per R11.B and the blue box? Must it include rounded corners to satisfy the "form, fit, feature set, and function" requirement? If rounded corners must be included to be an IFR, how much of a rounded corner would be acceptable? What is the tolerance to meet the requirement?

A: No, aluminum in the same profile is not necessarily an identical functional replacement. Rounded corners are not considered a critical part of the profile for an Identical Functional Replacement provided the use on the ROBOT does not depend on the alternate feature (sharp corners). The mechanical properties of the material are important, and an Identical Functional Replacement must have similar mechanical properties (in this case, the supplier indicates that 6061-T6, 6005-T5, and 6105-T5 aluminum have similar mechanical properties).

(Asked by **900** at Jan 13th 20)

Q141 G10 & G11 interactions

Q: If a team were to violate G11 then moves in to a state in which they are now violating G10 by their bumpers crossing into a TARGET or LOADING ZONE of their opponents. Are those both separate penalties? Is there any time allowance to exit a violating state between new violations being called of either rule? If a blue robot pushes a red robot in the red target zone then blue robot enters the red target zone while maintaining contact with red robot, how many tech fouls are awarded?

A: Yes. There is no time allowance between these states. We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE.

(Asked by **3847** at Jan 13th 20)

Q142 Followup to Q120: Hanging Robot

Q: Section 4.4.4/follow up to Q120: Is it possible for a robot to be supporting another robot through the switch? Or is any robot that is only contacting the switch at the end of the match always considered to be hanging regardless of whatever forces are being placed on the switch?

A: No, it is not possible for a ROBOT to be supporting another ROBOT if the only shared contact between them is the GENERATOR SWITCH.

(Asked by **2502** at Jan 13th 20)

Q143 Clarification on G18, Scoring while outside of your frame perimeter.

Q: The egregious examples of G18 violations are causing some confusion on our team. They say you cannot extend beyond your FRAME PERIMETER to score power cells or hang. Does that mean if you cannot be in the safe measured extension beyond your frame perimeter while scoring a power cell or while hanging? We plan on having an intake extended in the safe area beyond the frame perimeter while shooting and climbing, is that legal?

A: Please see [Team Update 03](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate03.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **2987** at Jan 14th 20)

Q144 Can I use a Slip Ring to power a motor?

Q: I want to know if it's legal to use a Slip Ring to power a motor (using the proper motor controller like a Spark or Talon using brushes on the outside of the Ring). The Game Manual mentions rolling and sliding contacts on R54 but I don't understand how it applies in this case.

A: Appropriately rated COTS slip rings (that do not contain mercury) are explicitly permitted to be part of a branch circuit per !R54.

(Asked by 6652 at Jan 14th 20)

Q145 Followup to Q144+Q120 hanging definition in 4.4.4

Q: Assume two robots from an alliance have met the criteria for HANGING during endgame. Their third alliance partner (without contacting the other two robots) then grasps the HANDLE and begins to climb but still has weight supported by the ground when time expires. Nothing changes after 5 seconds. Would the scoring be for two robots HANGING and one PARKED or would all three robots be considered PARKED due to applied forces on GENERATOR SWITCH?

A: We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. As described in !Q142, a ROBOT will not be considered supporting another ROBOT if the only shared contact between them is the GENERATOR SWITCH.

(Asked by 2834 at Jan 14th 20)

Q146 Chairman's definitions

Q: On the new Chairman's Documentation Form, it tells us to "Choose one of the Following" and our options are "Started, Mentored, Resources Published, Ran, or Reached." However, this does not include many of the Chairman's definitions listed on the FIRST Website such as "Assisted". Are we allowed to list a Team Number or Type of Activity & Location under the category of "Assisted"?

A: For this season, you can use the word assisted on the Chairman's Documentation Form.

(Asked by 2341 at Jan 14th 20)

Q147 Positional Control

Q: When working on matching the FMS provided color, does the color that the control panel is rotated to have to align with the Robot, or the color sensor on the Control Panel cross brace?

A: Per 3.5.1: "POSITION CONTROL: Rotate CONTROL PANEL so a specified color aligns with **the sensor** for at least five (5) seconds." (emphasis added). The sensor is in the cross brace. Additional details can be found in the [official Field Drawings] (<https://www.firstinspires.org/robotics/frc/playing-field#FIRSTDrawings>), or other tools available on the [Playing Field page] (<https://www.firstinspires.org/robotics/frc/playing-field>).

(Asked by 2073 at Jan 14th 20)

Q148 Follow Up to Q140 - What are "critical part of the profile"s

Q: How is a team or inspector supposed to know what parts of a COTS item or material are "critical" or a "critical part of the profile" when identifying Identical Functional Replacements (IFRs)? If two parts/items are similar but have some difference(s) and "provided the use on the ROBOT does not depend on the alternate feature(s)" can they still be IFRs of each other?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. We encourage teams to use parts as close as possible, within reason, and we believe the answer to !Q140 provides enough guidance to teams and inspectors to know which parts work as an Identical Functional Replacement.

(Asked by 3847 at Jan 14th 20)

Q149 R12 Price of Parts for BOM

Q: Hello, R12 says that no non-KOP part shall be above 500USD\$. Canadian teams received a notice in the Black Tote that Balluff Canada would be supplying sensors. One of the sensors that they spec'd for our team is slightly above 500USD. Is this technically a KOP part since the flyer for it was technically in our kit?

A: This flyer was not placed in the kit by *FIRST* and does not meet the definition of KOP provided in the Game Manual. Therefore sensors acquired through this process should be accounted at their FMV on the BOM per !R11 and may not exceed \$500 per !R12.

(Asked by **6513** at Jan 14th 20)

Q150 Bumper Rule Clarification

Q: Rule R24-G states the bumper "must attach to the FRAME PERIMETER of the ROBOT with a rigid fastening system to form a tight, robust connection to the main structure/frame." Rule R24-B states "hard BUMPER parts allowed per R24-A, -E, -F, and -G must not extend more than 1 in. (~25 mm) beyond the FRAME PERIMETER." Is it acceptable if the bumper attachment bracket extends above the top of the bumper if it does not extend more than 1" beyond the frame perimeter as shown in Figure 9-6?

A: The BUMPER attachment system may extend above the BUMPER, but any part of the BUMPER attachment system that is part of the BUMPER (per the Blue Box below !R23) must be located in the BUMPER ZONE per !R18 and any part that is part of the ROBOT must remain within the FRAME PERIMETER.

(Asked by **93** at Jan 14th 20)

Q151 Are 2 Different Motors on the Same Motor Controller Allowed?

Q: According to table 9-2 (in R30), One motor controller can power up to 2 Snow Blower motors, and the same is true for other motors as well (AndyMark 9015, BAG, AndyMark PG, KOP Automotive Motors, NeverRest). Does that mean that we can use any 2 motors from that list together (for example, a Snow Blower and a BAG), or is it only 2 motors of the same kind?

A: No, the 2 per controller indication in Table 9-2 in !R30 only allows for 2 of the same motor to be connected to a single controller

(Asked by **1690** at Jan 14th 20)

Q152 Limelight Camera Power Source

Q: This year we have motors connected to all of the 16 PDP WAGO load terminals (sides of the PDP) and we want to use the Limelight 2 as our vision sensor. It is hard for us to understand where to take power for the sensor from. the camera requires 12V 2A. what is the legal solution for this situation? (i.e where should we connect the Limelight to?)

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. For technical assistance, please visit the [FIRST Forums](<https://forums.firstinspires.org/forum/general-discussions/first-programs/first-robotics-competition>).

(Asked by **1690** at Jan 14th 20)

Q153 G9 Definition of "travelling"

Q: Say there are 2 ROBOTS on the blue ALLIANCE, A and B. If A picks up a POWER CELL in the blue SECTOR, and propels it into the center of the FIELD, where B proceeds to push it the rest of the way into the red SECTOR, the POWER CELL would never have stopped "traveling" per the definition of traveling in the G9 blue box. Does this mean that the blue ALLIANCE would receive a TECH FOUL for violating G9?

A: We cannot comment absolutely on hypothetical scenarios. The ultimate decision is determined by the REFEREES at your event, with the final call made by the Head REFEREE. Please see [Team Update 05] (<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate05.pdf>). If the REFEREE determines that ROBOT B has either taken CONTROL or become the cause of the POWER CELL to travel, this would not be a !G9 violation. If that doesn't answer your question, please rephrase and resubmit.

(Asked by **5113** at Jan 21st 20)

Q154 Pressure rating for COMPONENTS in the high-pressure pneumatic circuit

Q: R75 specifically states that COMPONENTS in the high-pressure pneumatic circuit upstream from the regulator must be rated for 125 psi, but the blue box for R82 "recommends" a rating of 115 psi for the COMPONENTS in the high-pressure pneumatic circuit upstream from the regulator. Which is correct?

A: Both are correct as they describe different ratings. !R75-a requires a device be rated for 125 PSI, which, as described in the Blue Box, can be met by ratings such as "maximum" pressure, which may be different than "working" pressure. A hypothetical device with a "maximum" pressure of 125 PSI and a "working" or "operating" pressure of 100 PSI would be legally permitted per !R75-a, but not recommended per the Blue Box below !R82.

(Asked by **5113** at Jan 14th 20)

Q155 HANGING while in violation of G18

Q: During Qualification MATCHES, if an ALLIANCE member utilizes a climbing MECHANISM that violates G18 they would be assessed a RED CARD per the G18 blue box. Would the ALLIANCE still receive points for that ROBOT's HANGING status?

A: Unless otherwise specified in the violation, assignment of a penalty/violation does not undo any points or scoring actions done along the way (in your example, the ROBOT could still be considered HANGING). Please carefully consider other rules though, particularly !C1, !C3 and !C4 if considering this strategy.

(Asked by 5113 at Jan 14th 20)

Q156 Periodic or static H9 FOULS

Q: Per H9, an ALLIANCE that holds more than 15 POWER CELLS in their ALLIANCE STATION would be assessed a FOUL per excess POWER CELL. Is that FOUL only assessed once per POWER CELL? (upon entry into the ALLIANCE STATION and not again until reentry)

A: Yes, if an ALLIANCE has greater than 15 POWER CELLS a single FOUL will be assessed for each POWER CELL over 15.

(Asked by 5113 at Jan 14th 20)

Q157 Periodic or static H10 FOULS

Q: How often should an ALLIANCE be assessed a FOUL for violating H10? At what point does an instance of an H10 violation end and a new one begin?

A: Please see [Team Update 05](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate05.pdf>). If you still have questions about !H10, please rephrase and resubmit.

(Asked by 5113 at Jan 23rd 20)

Q158 Intentionally holding POWER CELLS in violation of H10

Q: An ALLIANCE intentionally holds 33 POWER CELLS in their ALLIANCE STATION, 15 on the LOADING BAY racks and 18 in the CORRAL. (recognizing that they will receive 18 FOULS per H9) If none of the POWER CELLS in their ALLIANCE STATION change state during the remainder of the MATCH and no additional POWER CELLS are introduced into their ALLIANCE STATION, how many FOULS should be assessed per H10?

A: Please see [Team Update 05](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate05.pdf>), especially the change to !C1. If you have more questions about !H10, please rephrase and resubmit.

(Asked by 5113 at Jan 23rd 20)

Q159 Quantity of HUMAN PLAYERS affecting H9 and H10 calls

Q: Is the number of HUMAN PLAYERS on an ALLIANCE taken into account when assessing H9 and H10 FOULS? Would an ALLIANCE with 3 HUMAN PLAYERS be expected to come back into compliance with H9 and H10 faster than an opposing ALLIANCE with only 1 HUMAN PLAYER? Is an ALLIANCE with 0 HUMAN PLAYERS required to comply with H9 and H10?

A: No, no, yes. There's no exemption in !H9 or !H10 that would allow for them to be disregarded if an ALLIANCE elects not to employ any HUMAN PLAYERS.

(Asked by 5113 at Jan 14th 20)

Q160 G12 violation during playoffs

Q: G12 states that you can't mess with your opponent's control panel if an opponent robot is in contact with it and they have reached capacity. Violation: Opponents are awarded one (1) SHIELD GENERATOR ENERGIZED Ranking Point if not completed at the conclusion of the MATCH. Does this mean that during playoffs there is no penalty?

A: Please see [Team Update 04](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate04.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by 6867 at Jan 17th 20)

Q161 Bumper Gap Rule Clarification

Q: In Section 9.5 (Bumper Rules), R26 states "any gap between the backing material and the frame: A. must not be great than 1/4 in. deep, or B. not more than 8 in. wide." Does this mean that a robot must comply with both A and B to pass the safety inspection, or that it must only comply with one of these two stipulations to pass the safety inspection? For example, if a robot had such a gap that was 3 in. deep but only 6 in. wide (in compliance with B. but not A.), would it still pass inspection?

A: Any gap must only meet one of the two requirements in order for the BUMPER to still be considered "supported". See the center gap near the top-center of Figure 9-8 (under !R26) for an example gap similar to the one described.

(Asked by **3243** at Jan 15th 20)

Q162 Robot Vertical Height

Q: Can the robot extend beyond the 45' vertical limit during match play (Specifically when placing power cells into the Outer Power Port)? Or must the 'bot be know higher than 45" and power cells have to be shot into the Outer Power Port?

A: Per !G17, a ROBOT may only exceed 45 inches while "... intersecting their ALLIANCE'S RENDEZVOUS POINT during the ENDGAME."

(Asked by **5500** at Jan 15th 20)

Q163 Rule R30 Clarification

Q: When TWO AndyMark PGs, KOP Automotive Motors, NeverRests, or Snow Blower Motors are run off of a SINGLE Motor Controller (per R30), can ONE of said motors be inhibited by an approved relay module to make it so that only ONE of the motors runs by itself? We would like to hook up two of the approved motors to a speed controller, and switch which of them is running, instead always having to run BOTH at the same time.

A: No, relays are not a device listed as a permitted electrical load for a Motor Controller per Table 9-2 in !R30.

(Asked by **910** at Jan 15th 20)

Q164 Q159 Clarification - Teams with 1 HP vs Teams with 2 or 3 HP and rule H9 violations.

Q: H9 states an alliance must clear excess power cells as "quickly as possible". A team with 3 human players is quicker than a team with 1 human player in resolving H9 power cell excesses. So, "as quickly as possible" implies teams should have 3 HP avoid H9 without question. So, is "quickly as possible" based on the number of HP an alliance ELECTS to play or on the number they COULD HAVE chosen to play? In other words is a 1 HP alliance expected to clear excess PC as fast as a team with 2 or 3 HP?

A: !H9 has no direct reference or reliance on the number of HUMAN PLAYERS on an ALLIANCE. Its blue box encourages a good will effort by the HUMAN PLAYER(S) to avoid this circumstance, and discourages any attempt at slowing the process or "lagging" if not due to safety concerns.

(Asked by **3572** at Jan 15th 20)

Q165 Follow up to Q159

Q: Are all configurations of HUMAN PLAYER (henceforth HP) quantity required to conform to the same general expected speed when returning to H9/H10 compliance? ie: Would an ALLIANCE with 1 HP be expected to come back into compliance with H9/H10 at relatively the same speed as an opposing ALLIANCE with 3 HPs? Also, would an ALLIANCE that elects to use a small number of HPs be seen as willingly taking on more risk of violating H9/H10 compared to an ALLIANCE that elects to use a larger number of HPs?

A: We believe the answer to !Q164 addresses your question. If it does not, please rephrase your question and resubmit. Please use the Search Q&A button on the navigation bar and "follow" questions similar to yours to help us avoid redundant content.

(Asked by **5113** at Jan 15th 20)

Q166 Clarification of R86

Q: R86 states that any pressure vent plug must relieve all stored pressure when manually operated. If a ROBOT has two (2) pressure vent plugs located such that one is connected to the high-pressure circuit and one is connected to the low-pressure circuit, both of which must be manually operated in order to relieve all stored pressure, would this violate R86?

A: Yes, this violates !R86. !R86 requires that any pressure vent plug must be capable of venting to atmosphere to relieve all stored pressure. If manually operating an individual vent plug does not relieve all stored pressure, it does not meet the requirements of !R86.

(Asked by **435** at Jan 15th 20)

Q167 Are 2 1/4 in. to 2 3/4 in. diameter pool noodles allowed?

Q: It appears R24.A. allows bumper backing to range from 4 1/2 in. to 5 1/2 in. in height. R24.C. specifies that pool noodles be "approximately 2 1/2 in. round" with no tolerance given. Are pool noodles allowed that range from 2 1/4 in. to 2 3/4 in. in diameter so they match the 4 1/2 in. to 5 1/2 in. tolerance of the bumper backing?

A: Per !R24-C all pool noodles must be approximately 2 1/2" nominal. No specific tolerance is provided for actual pool noodle measurement.

(Asked by 1477 at Jan 15th 20)

Q168 Q164 Clarification - Mistakenly used "team" and "Alliance" interchangeably - corrected.

Q: H9 states an alliance must clear excess power cells as "quickly as possible". An alliance with 3 HP is quicker than an alliance with 1 HP in resolving H9 power cell excesses. So, "as quickly as possible" implies alliances should have 3 HP avoid H9 without question. So, is "quickly as possible" based on the number of HP an alliance ELECTS to play or on the number they COULD HAVE chosen to play? In other words is a 1 HP alliance expected to clear excess PC as fast as an alliance with 2 or 3 HP?

A: We believe !Q159 and !Q164 answer your question. If these answers do not, please rephrase your question and resubmit.

(Asked by 3572 at Jan 23rd 20)

Q169 Compliance with H9

Q: H9 reads "If the POWER CELL count exceeds fifteen (15), excess POWER CELLS must be introduced into the FIELD immediately." When the count exceeds 15 does this require power cells be taken from the rack and reintroduced to the field as this would be the most immediate and safest way to come into compliance with H9?

A: There are no rules that regulate which POWER CELLS have to be introduced first.

(Asked by 63 at Jan 15th 20)

Q170 Clarify G22: Coordinated defense

Q: G22: Does this rule preclude multiple robots from playing coordinated defense against one opposing robot in an effort to isolate just that robot while leaving full field access to the rest of the opposing alliance robots?

A: No, a ROBOT is not a major component of MATCH play; isolating a single ROBOT in a particular area does not violate !G22.

(Asked by 2502 at Jan 16th 20)

Q171 CUSTOM CIRCUIT Powered Off Of VRM

Q: R52 states that CUSTOM CIRCUITS must be protected by an "up to 40A" breaker. Are CUSTOM CIRCUITS allowed to be plugged into a VRM, or is that not allowed because the VRM is protected by a 20A fuse and not a breaker?

A: CUSTOM CIRCUITS may be attached to the 12V 500mA terminals, or any 5V terminals, on the VRM providing power to the Wireless Bridge (protected by a fuse as you have described, per !R48). Any additional VRM modules must be protected by a 20A breaker (up to 3 modules per breaker) per !R52 and CUSTOM CIRCUITS may attach to any terminals on these modules.

(Asked by 4911 at Jan 20th 20)

Q172 Alliances being allowed time to ascertain an excess of PC before putting PC into the field

Q: An alliance has a full rack, empty corral, only 1 HP and he has 1 PC in hand. PC are now scored by 1 robot. The alliance is now in violation of H9 by at least 1 PC so HP dumps the 1 in hand into the field to avoid foul. In order to "assure the ref" of no H9 violation must the HP now dump the worst case violation of 4 PC immediately? Or, can they, as quick as possible, go to the corral, assess the true excess, gather the PC and return to the rack to deposit the true excess without violating H9?

A: We cannot comment absolutely on hypothetical scenarios. How ALLIANCE'S assess the number of POWER CELLS in the ALLIANCE STATION and the number of HUMAN PLAYERS utilized in order to remain compliant with both !H9 and !H10 are up to the ALLIANCE, and none of these strategies will exempt an ALLIANCE from violations of these rules.

(Asked by **3572** at Jan 23rd 20)

Q173 NeveRest Motor

Q: There's a list of that which motors can we use and there's NeveRest am-3104 in list but we have NeveRest am-2964. Previously, it was out from the old kickoff package. Can we use it?

A: Yes. The am-2964 is an assembly that integrates an am-3104 motor with a gearbox and encoder; the am-3104 motor is listed in Table 9-1.

(Asked by **7086** at Jan 16th 20)

Q174 Follow up to Q93: Can a programmable logic controller (PLC) be used as a co-processor?

Q: In the answer to Q93 a 2nd roboRIO is acceptable as a co-processor, but can a PLC running ladder logic function act as a co-processor to monitor sensor input and control pneumatics providing the PLC is receiving start/stop input from a roboRIO output? Does the PLC need to be connected to the roboRIO CAN bus?

A: There are no rules explicitly prohibiting using a PLC as a co-processor on the ROBOT, however it may not directly control actuators (including pneumatic solenoids) or their power regulating devices. See !R29, !R30, !R68, !R69, !R70, !R71, !R73-b. There are no rules requiring a co-processor to receive any signals from the roboRIO, or to be attached to the CAN bus.

(Asked by **6686** at Jan 16th 20)

Q175 Direction of rotation of Control Panel

Q: We understand that to achieve ROTATION CONTROL, the CONTROL PANEL must be spun three times in the same direction. The example in Figure 3-24 strongly implies a clockwise rotation, when viewed from above. Is this the only allowable direction of rotation, or may a robot turn the CONTROL PANEL counterclockwise for ROTATION CONTROL?

A: Direction doesn't matter, as long as it is the same direction for the required number of rotations.

(Asked by **3487** at Jan 16th 20)

Q176 H9 or H10 Precedence

Q: The red ALLIANCE has 10 POWER CELLS on their LOADING BAY racks. The blue ALLIANCE scores 10 POWER CELLS in an arbitrarily short period of time. The red ALLIANCE is now supposedly violating both H9 and H10. Obviously it would be advantageous for the red ALLIANCE to comply with H10 first, delaying introducing POWER CELLS to the FIELD. The blue ALLIANCE would benefit more from the red ALLIANCE complying with H9 first. Should the red ALLIANCE come into compliance with H9 or H10 first?

A: The purpose of the Q&A is not to provide strategic advice. If an ALLIANCE simultaneously violates !H9 and !H10 and can't remedy them in parallel, then (according to !H9 and !H10 and their respective Blue Boxes), a remedy of !H9 first promptly followed by a remedy to !H10 is unlikely to result in any violations. If the ALLIANCE opts to remedy !H10 first and then !H9, they're at risk of receiving !H9 penalties.

(Asked by **5113** at Jan 21st 20)

Q177 Clarification of G26

Q: In regards to the answer to Q107, (As long as G26 is not violated, there are no restrictions on how ROBOTS can interact with any part of the FIELD.) And per G26 ROBOTS are prohibited from grabbing, grasping, attaching, etc ARENA elements with the exceptions of the POWER CELL, HANDLE, and ALLIANCE'S Control Panel. Would a force applied to the underside of a field element on a single face be considered grabbing, grasping, or attaching?

A: We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. Ultimately, !G26 protects both the ROBOTS and the playing FIELD. We encourage teams to make it clear that any interaction will not result in FIELD or ROBOT damage in order to avoid a !G26 violation.

(Asked by **461** at Jan 17th 20)

Q178 Can a human player be considered personally "storing" a power cell in relation to H10?

Q: An alliance has less than 14 power cells on their rack. A human player is holding onto a power cell in anticipation of a robot arriving at their loading bay to receive power cells. They are in no way moving the PC at all either toward the rack or toward the bay for placement onto the field. Is the HP considered to be "storing" the PC and is in violation of H10?

A: We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. However, it's likely if there's no "concerted, good-will effort" to transport the POWER CELL to a chute or the rack then !H10 has been violated.

(Asked by **3572** at Jan 17th 20)

Q179 BOUNDARIES height above carpet

Q: Section 3.3.3 shows the BOUNDARIES height as 1 1/16" ("BOUNDARIES are secured to the carpet using hook fastener which increases the height to approximately 1 1/16 in. (~3 cm)"). However in Figure 3.1.1 the height is shown as 1 1/8". I know the difference is slight, but which one is correct?

A: Good catch! Please see [Team Update 05](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate05.pdf>).

(Asked by **2028** at Jan 21st 20)

Q180 Can a robot receive assistance during AUTO to leave the initiation line?

Q: Can a robot assist another robot on their alliance to exit the Initiation line area at the end of AUTO? or must each robot do so under their own power to receive 5 points?

A: Yes, a ROBOT can assist another ROBOT to complete this task.

(Asked by **3229** at Jan 18th 20)

Q181 Process for enforcing H9 and H10 consistently

Q: H9 and H10 seem like two of the hardest rules in recent memory for referees to enforce consistently when there are high scoring robots on the field. Will there be any directive from HQ for a "division of labor" for the referees (such as in one of the Head Referee Digests)? Similar to how after week 1 events in 2014, referees were instructed to divide into two groups: primarily entering penalties, and primarily scoring assists.

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. If you have a question about the rules, please resubmit.

(Asked by **1923** at Jan 21st 20)

Q182 CARD Violation Clarification

Q: S3, C8, and G21 all had CARD violations removed from last year to this year. S3 and G21 have the previous violations explicitly listed in the blue box for C1. Given the explicit mentions were both RED CARDS in previous years and C1 has the option for nothing, YELLOW, or RED CARDS from the head referee, should we view these as the same penalty as before (red cards) or can any of the penalties apply? Is C8 no longer expected to draw a YELLOW for egregious behavior as the mention isn't explicit?

A: !C1 allows Head REFEREES to assign YELLOW or RED cards to any egregious behavior at an Event. It is important to note that the list in the blue box if !C1 is not exhaustive, but it does provide our community with insight about explicit actions that will result in cards. !C8 could still result in a YELLOW or RED CARD, if the Head REFEREES deems the behavior is egregious.

(Asked by **5052** at Jan 18th 20)

Q183 Where is tethering permitted per G2?

Q: G2 states "nor will teams be permitted to tether to the ROBOT except in special circumstances." There are two ways to read this. That can mean at any time. It also can mean it only applies after the match given the context of the rule and the associated blue box. If the latter is true, extending that logic means we cannot tether in the pits or queuing area. Can we clarify if a rule discussing what must happen when removing the robot from the field also applies when bringing a robot to the field?

A: Please see [Team Update 05](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate05.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **5052** at Jan 21st 20)

Q184 Game piece construction

Q: Are there any videos on the construction of the game pieces for teams to follow or is there only the paper instructions in regards to the control panel

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. For other assistance, please visit the [FIRST Forums](<https://forums.firstinspires.org/forum/general-discussions/first-programs/first-robotics-competition>).

(Asked by **5900** at Jan 20th 20)

Q185 What is the meaning of "ENDGAME points" in the "Awarded for" column of Table 4-2?

Q: According to Table 4-2, an ENDGAME Points Award is awarded for accomplishing HANG, PARK or LEVEL. In the same table, a SHIELD GENERATOR OPERATIONAL Award is awarded for "earning at least sixty-five (65) ENDGAME points." The word "points" is not capitalized and appears to be a common noun. Does the phrase "ENDGAME points" refer to any kind of points earned during the ENDGAME or only for points associated with an ENDGAME Points Award?

A: "ENDGAME Points" are those MATCH points listed in Table 4-2 in the "ENDGAME Points" row (i.e. HANG, PARK, and LEVEL).

(Asked by **6343** at Jan 20th 20)

Q186 Vex 393 servo motor

Q: is the Vex 393 servo motor legal to use?

A: We cannot comment on specific part/design legality. Please consult [Section 1.8] (<https://firstfrc.blob.core.windows.net/frc2020/Manual/HTML/2020FRCGameSeasonManual.htm>) and Table 9-1. If you don't find the information needed to assess if a part is legal, please rephrase your question in a way that will help clarify the rule itself and resubmit.

(Asked by **7188** at Jan 20th 20)

Q187 Field orientation

Q: What will the field orientation be for the 2020 season? In all the previous years the red driver station has been on the left relative to the spectator viewing (opposite the scoring table) but there are a number of diagrams in the manual that show the blue on the left. We would like clarification for our scouting software.

A: The location of the scoring table and audience is not part of the ARENA specification. Generally, the Red ALLIANCE STATION is on the right if standing at the scoring table and looking at the FIELD, however this is not a requirement or formal spec. The location of the audience varies from venue to venue.

(Asked by **3138** at Jan 21st 20)

Q188 PDV BOM claims spread across multiple orders.

Q: A team orders \$750 of parts using a \$450 PDV. \$200 of these parts end up on their robot. These \$200 worth of parts are accounted for at \$0 on the BOM. Later in the season, the team orders another \$250 of parts from this same vendor, and use them on the robot. Can they account for these as \$0 for BOM purposes, because they haven't claimed the remainder of their \$450 PDV for BOM purposes, or do all parts that a team wants to claim as \$0 have to be on the same invoice/order as the PDV?

A: In order for an item to be considered part of the Kit of Parts, it must meet the Kickoff Kit or *FIRST* Choice criteria or "paid for completely (except shipping) with a Product Donation Voucher (PDV) from the current season." If a team paid for an item with their own funds, it does not meet that criteria and is not part of the Kit of Parts (i.e. there is not a \$450-worth-of-parts-purchased-from-AndyMark allocation for teams that opted out of the drive base kit).

(Asked by **1114** at Jan 20th 20)

Q189 G9 clarification

Q: If a robot shoots a power cell just past their alliance sector, does this violate G9 (no full court shots)? [Ex. shooting just past of opponent initiation line]

A: We cannot comment absolutely on hypothetical scenarios. It is unclear from the question where the proposed ROBOT is located and where the POWER CELL is traveling to. Please review Figure 7-1 in the Blue Box of !G9 and submit a re-phrased question if you are still unclear.

(Asked by 368 at Jan 20th 20)

Q190 During autonomous: where is the robot allowed?

Q: Infinite Recharge: During autonomous mode, is the robot allowed in the middle section of the field, or just between the initiation line it starts on and the opponent's alliance station?

A: We believe !Q86, !Q87, and rule !G3 answer your question. If they do not, please rephrase your question and resubmit. Please use the Search Q&A button on the navigation bar before posing a new question.

(Asked by 6351 at Jan 20th 20)

Q191 Do bumpers need to be terminated vertically?

Q: R24 states that bumpers must be constructed with 5-inch tall plywood, 2x2.5-inch pool noodles, etc. which implies that the bumper must be 5 inches tall. Can bumper height be decreased after the minimum length requirement of 6 inches on each corner is met? E.g. the bumper remains full height for the first 6 inches from the corner of the frame, but is terminated using a diagonal cut such that the top of the bumper stops at 6 inches but the bottom stops at 7 inches?

A: No, this would not comply with !R24-A.

(Asked by 484 at Jan 20th 20)

Q192 Please verify the height of the Rung from the floor on the Generator switch

Q: Please verify the height of the Generator Switch Rung to the floor given the game manual shows distance is 63 inches from main game field carpet to the top of the pipe, GE 20000 page 4 shows the distance is 62.13 inches to the bottom of the pipe, and the CAD model shows 62.5 inches from the floor to the Center line of the pipe. The pipe 1.66 inches in diameter. None of the dimensions agree. Which one is correct?

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. Any measurements or materials information can be derived from the [official Field Drawings](<https://www.firstinspires.org/robotics/frc/playing-field#FIRSTDrawings>), or other tools available on the [Playing Field page](<https://www.firstinspires.org/robotics/frc/playing-field>). Please note that the dimensions you noted from the *Game & Season Manual* and the Official Field Drawings are pulled from the SHIELD GENERATOR Floor Protection and not from FIELD Carpet.

(Asked by 4256 at Jan 23rd 20)

Q193 Loading bay vinyl coating transparent

Q: Drawing GE -20220 and the game manual show that the top of the loading bay has a vinyl coating that is not clear, however this coating did not appear present on the reveal game field videos which showed a clear (or only some coverage) of the polycarbonate on the top of the loading bay. Can you confirm that any vinyl coating will be very transparent?

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. Any measurements or materials information can be derived from the [official Field Drawings](<https://www.firstinspires.org/robotics/frc/playing-field#FIRSTDrawings>), or other tools available on the [Playing Field page](<https://www.firstinspires.org/robotics/frc/playing-field>). If you have questions about interpreting the information presented, please post them on the [FIRST Forum](<https://forums.firstinspires.org/forum/general-discussions/first-programs/first-robotics-competition>).

(Asked by 4256 at Jan 23rd 20)

Q194 Can a robot that never is outside its frame perimeter violate G25?

Q: G25 has two clauses that are confusing. Clause 2 says "...ROBOTS that remain completely inside their own FRAME PERIMETER, ... are not in violation of this rule". I assume this is specifically in reference to such a robot contacting and damaging the exposed frame of robot with bumper gaps? And that a robot, completely inside its frame perimeter, can still violate G25 by contacting an opposing robot inside its frame perimeter and damaging or functionally impairing it?

A: The phrase you've quoted regarding ROBOTS that remain completely inside their FRAME PERIMETER is referring specifically to contact with with another ROBOT'S BUMPER GAPS. A ROBOT that stays completely inside their FRAME PERIMETER is still capable of violating !G25.

(Asked by 3572 at Jan 22nd 20)

Q196 G9 clarification

Q: If a robot scores into either the inner port or outer port of the power port from just past their opponent's initiation line / just outside of their sector, does this violate G9?

A: If a ROBOT'S "BUMPERS are fully contained by their SECTOR" then they "may not cause POWER CELLS to travel into or through their opponent's SECTOR." If the BUMPERS are not fully contained by their SECTOR then they would not be able to violate !G9.

(Asked by **368** at Jan 21st 20)

Q197 R16 - "working" on robot vs. driving/practicing

Q: R16 says "During an event a team is attending (***) , the team may not work on their ROBOT or ROBOT elements outside of the hours that pits are open". May a team drive their robot on a practice field, at a location other than the venue, after load-in has begun but before the pits are open (provided no work is done on the robot other than changing batteries)?

A: Please see [Team Update 06](https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate06.pdf). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **2465** at Jan 24th 20)

Q198 G8 and G15 Clarification

Q: G8's blue box lists shooting power cells at hanging robots as an example violation. G15 also states a transitive contact through a power cell as a violation. Assuming a power cell is launched into a hanging robot, should we interpret this to result in two tech fouls plus the contacted robot being awarded a climb, the combined penalties for G8 and G15?

A: Transitive contact requires simultaneous contact between the relevant elements (e.g. neither ROBOT is directly contacting each other, but both ROBOTS are contacting the same POWER CELL at the same time). If the ROBOT that shoots the POWER CELL is no longer in contact with it when it hits the opponent ROBOT, this is a !G8 violation and not a !G15 violation.

(Asked by **5052** at Jan 22nd 20)

Q199 Timeframe for Documentation Requirement to Support Chairman's Award

Q: New for 2020, the Chairman's Award Definitions document states that teams must provide documentation supporting the various claims made. Is this supporting documentation required for all claims (e.g., starting a team, running a competition) in the past five years, or just for those claims in the 2019-2020 school year? Thanks!

A: Teams should use this form to document all activities.

(Asked by **3061** at Jan 21st 20)

Q200 Definition of "Reached" in the Chairman's Award Definitions

Q: New for 2020, the Chairman's Award Definitions document provides several examples for the definition of "Reached". One is "700 people follow a team on Instagram. This team Reached people 700 people." If a social media tweet is retweeted by a much larger organization (e.g., FIRST, local news organization), how should we determine the number of people "reached"? Is it still just the number of followers that our team has? Do we include the number of followers of these other organizations? Thanks!

A: Teams should consult the analytics provided by those Social Media organizations. You may count your own followers as reached (even if they didn't see every post), but it is unlikely that every follower of a retweeting organization sees all your posts.

(Asked by **3061** at Jan 22nd 20)

Q201 Color Control Panel

Q: When an alliance hits stage three, they will release a color to set the wheel too. What if the wheel is already on the color that is released? Do we need to spin the wheel?

A: If you are the first alliance to reach Stage 3, the color will automatically be generated to a different color than is currently sensed. If you are the second alliance to reach Stage 3, the color would have been sent to your Driver's Station prior to reaching Stage 3, so if the Control Panel were already on that color, it would not have to move.

(Asked by **1994** at Jan 22nd 20)

Q202 Are there any rules regarding indication lighting sourced from the robot?

Q: Addressable LED controls have been added for 2020 in the WPI lib code, which is pretty awesome! However, I don't see any documentation in the manual regarding rules and regulations on how it can be used, but in years past signal lighting from human players was not allowed. Are there any official rules on how these addressable LEDs can be utilized on the robot? We plan to use them to provide indication to the driver of specific conditions with color and intensity.

A: There are no rules specifically limiting onboard LEDs provided all ROBOT rules are followed.

(Asked by **3277** at Jan 23rd 20)

Q203 4.4.4 GENERATOR SWITCH Scoring

Q: The Generator Switch untouched by any robots is still in level position at the End Game Period. Does the situation be regarded as "LEVEL" and be scored still?

A: Please see Table 4-2: Point Values. Points are only awarded for the LEVEL condition if 1-3 ROBOTS on that ALLIANCE are also HANGING.

(Asked by **5849** at Jan 22nd 20)

Q204 Chairman's documentation - definition of "Team"?

Q: On the new Chairman's documentation, what is the definition of "Team"? If we are to document for 5 years, do we include activities that active mentors/coaches are involved in, do we include alumni who remain active with the team, do we include students who did things in the summer and are joining the team?

A: The word "team" is not explicitly defined for many reasons. Teams should decide for themselves what they would like to include in the documentation form to best help clarify their efforts for the Judges. Teams should capture their documentation to the best of their ability.

(Asked by **3459** at Jan 23rd 20)

Q205 Chairman's documentation - clarification of qualifying documentation

Q: Clarifying documentation for the definitions of reach: In the future, documentation will be easier but for past documentation, do photos count? If we can show team members at events or volunteering, would that work? Or maybe working drafts of agendas/programs? Or our team calendar (not a great option as things can be altered easily but we have events listed for the past few years there).

A: As long as teams are making a good faith effort, all of these examples would be great ways to confirm "reach" at a past event.

(Asked by **3459** at Jan 23rd 20)

Q206 About Gearbox

Q: Can we use worm gearbox with ratio of 70: 1

A: As long as no other rules are violated (!R12, !R14, !R27, !I1, etc), there are no restrictions on the gearboxes that can be used.

(Asked by **7086** at Jan 23rd 20)

Q207 6854 is considering a spring loaded scissor lift to reach the bar.

Q: Are springs permitted to provide tension in a scissor lift/grab mechanism. That is, when in the rest position, the springs will be full compressed (loaded) but in a locked state.

A: As long as !R39 and !I7 are not violated, springs are permitted.

(Asked by **6854** at Jan 23rd 20)

Q208 H10 Blue box grammar

Q: In rule H10, the blue box includes the following: "H10 means that POWER CELLS may neither be stored in the CORRAL during the MATCH nor required to contact the LOADING BAY rack before entering the FIELD." English this is not. Perhaps you meant "H10 means that POWER CELLS are not allowed to be stored in the CORRAL during the MATCH. There is no requirement for POWER CELLS to contact the LOADING BAY rack before entering the FIELD." ?

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. If you have a question about a rule, please rephrase and resubmit.

(Asked by **2834** at Jan 23rd 20)

Q209 4.4.4 GENERATOR SWITCH Scoring

Q: In the answer to Question 203. If a robot was touched by opponent robot by the end of game, and regarded as "HANGING", and it touched the Generator Switch as well, but actually NOT hanging physically (i.e. the robot sit on the ground and an arm touch the switch lever). The Generator Switch is physically in level position. Does the LEVEL points available or not?

A: The GENERATOR SWITCH may be scored as LEVEL if all ROBOTS contacting the GENERATOR SWITCH are considered HANGING, whether physically or as a result of an opponent's !G15 violation.

(Asked by **5849** at Jan 23rd 20)

Q210 Can we use multiple spike relays down stream from a Talon motor controller?

Q: Rule R30 explicitly allows two Bag motors to be controlled by a single Talon motor controller on a single circuit breaker on the PDP. We want to be able to direct the output of the motor controller to only one or the other of the Bag motors, not both at the same time. Can we insert two spike relays between the Talon and Bag motors such that we can use the Spike relays to direct the current to one or the other Bag. Our intent is to REDUCE the load on the Talon by turning one of the Bags off.

A: We believe !Q163 answers your question. If it does not, please rephrase your question and resubmit. Please use the Search Q&A button on the navigation bar before posing a new question.

(Asked by **1218** at Jan 23rd 20)

Q211 Gas Charged Lift Arm

Q: We are looking into using a gas charged lift support arm, they are meant to be used to lift car hoods and hatches for mini vans. These are not controlled by pneumatics, are these legal to use? I can not see where it says it is or isn't.

A: Yes, closed loop COTS pneumatic (gas) shocks are legal, as long as all other rules are satisfied (see final Blue Box of !R77).

(Asked by **6732** at Jan 23rd 20)

Q212 Regarding R1,R2 - Minor Protrusions

Q: Does a polycarbonate plate of 1.5 mm (~0.6 in.) that goes 1.5mm beyond our FRAME PERIMETER fall within the classification of Minor protrusions? Does this comply with R1? and R2?

A: No, this would not be considered a minor protrusion per !R1or!R2.

(Asked by **3158** at Jan 24th 20)

Q213 Enabling and Tethering, follow up to Q183

Q: As a follow up to Q183, with TU5, the statemen "Teams may not tether to the ROBOT while on the FIELD ... nor will teams be permitted to tether to the ROBOT except in special circumstances (e.g. during TIMEOUTS, after Opening Ceremonies, before an immediate MATCH replay, etc.) and with the express permission from the FTA or a REFEREE." Would the on field calibration period be one of the special circumstances approved by the FTA, etc?

A: Yes, tethering to the ROBOT during the on-field calibration period can be approved by the FTA.

(Asked by **2073** at Jan 24th 20)

Q214 Does R28 prohibit attaching other components to a motor housing using tape, glue, etc

Q: Do the rules allow another component to be attached to a motor housing with tape, glue, zip-ties, or other means that allow the motor to be returned to its earlier state by removal of the component and attachment method? It's not clear whether R28 prohibits such attachment. One could argue that the motor itself is not being modified at all, but such an interpretation would make the R28-G "minimal labeling" exception unnecessary.

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. Please also refer to [Team Update 07]

(<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate07.pdf>). Generally, use of cable ties or other hardware to mount a motor or secure another ROBOT part (e.g. wire) to the motor does not modify the motor. Use of adhesive on the motor is a modification to the

motor housing, and if not an exception listed in !R28, is not permitted.

(Asked by **199** at Jan 28th 20)

Q215 R28 - Difficulty removing Neo Motor cover to press on pinion

Q: In an attempt to remove the motor cover from neo motors, per manufacturer specifications. The screws heads are stripping very easily, we are doing this in order to press on pinions. The only way we have found to remove the screw is to Dremel a slot in the screw head. We have not found a way to remove the cover without damaging the cover. Would it be a violation to mill a hole in the cover of the motor to safely press pinions onto the motors?

A: Yes, this violates !R28.

(Asked by **1723** at Jan 27th 20)

Q216 pwm output

Q: Can we connect 1 pwm output to 2 motor drivers in Roborio

A: Yes, the use of a "Y" cable to connect a single roboRIO PWM output to multiple PWM motor controllers is still considered a "direct connection" and complies with !R68.

(Asked by **7086** at Jan 27th 20)

Q217 Traction Devices that could damage the Arena

Q: Rule R6 indicates that part of the traction system must not have metal. We are developing a drivetrain that uses belts which have riveted chains adapted. these will work like the treads of a tank. The chains do not touch anything in the game arena and the rivets are covered with urethane to avoid contact with the ground. But this traction device would not damage the FIELD carpet, however it would have copper coated with urethane. Would this still violate the rule R6?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. Generally, !R6 prohibits traction devices which "could damage the ARENA" and provides "metal" as one possible example. A device which has all metal surfaces that may interact with the FIELD carpet covered with urethane likely does not violate !R6.

(Asked by **6694** at Jan 27th 20)

Q218 Can two opposing robots both get a G11 simultaneously?

Q: Consider a RED ROBOT in front of RED PLAYER STATION 2 whose bumpers are just intersecting their protected LOADING ZONE. Also consider a BLUE ROBOT also in front of RED PLAYER STATION 2 whose bumpers are just intersecting their protected TARGET ZONE. Given that the PLAYER STATION is 6 feet wide, these two robots can contact each other. Would both alliances be penalized with a G11 tech foul?

A: We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. More generally, it's possible for both ALLIANCES to simultaneously violate !G11 if both ALLIANCES meet the criteria defined.

(Asked by **2834** at Jan 27th 20)

Q219 Legality of PLG motor available in FIRST Choice

Q: Is the PLG motor available in FIRST Choice allowed for use in the 2020 robot? It is not listed in rule R27.

A: The Johnson Electric JE-PLG-149 motor is listed in Table 9-1 in !R27 and therefore permitted.

(Asked by **100** at Jan 27th 20)

Q220 Follow-Up to Q192: Verify the height of the Rung (and other generator switch components)

Q: In the answer to question 192, you said any measurements can be derived from the official field drawings, or other tools on the playing field page. After downloading multiple files from that page, we still find contradicting information. The field drawings show a height of 111.8 in for the generator switch pivot above the floor protection. The Solidworks field CAD shows 111.4 in, the Inventor and Fusion models both show 112.66 in, and the game manual shows 111.375 in. Which of these is correct?

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. Any measurements or materials information can be derived from the [official Field Drawings](<https://www.firstinspires.org/robotics/frc/playing-field#FIRSTDrawings>), or other tools available on the [Playing Field page](<https://www.firstinspires.org/robotics/frc/playing-field>). Please note that the dimension you noted from the Game & Season Manual is pulled from the top of the SHIELD GENERATOR Floor Protection, while the dimension in the Official Field Drawings are pulled from the bottom of the SHIELD GENERATOR Floor Protection. Also note that the SOLIDWORKS CAD package is the only official CAD release from FIRST. Other CAD packages are derived from the official CAD models. In the case of any discrepancies, please refer to the SOLIDWORKS CAD release.

(Asked by 27 at Jan 27th 20)

Q221 Control Panel spin

Q: Will the control panel spin freely? Or will there be resistance/friction?

A: The CONTROL PANEL system does have resistance, however neither a coefficient of friction for the system nor friction force required to move the CONTROL PANEL are specified. A sense for the force required to move the CONTROL PANEL can be inferred from the materials information provided in the [official Field Drawings](<https://www.firstinspires.org/robotics/frc/playing-field#FIRSTDrawings>), tools available on the [Playing Field page](<https://www.firstinspires.org/robotics/frc/playing-field>), experimenting with the [lazy susan bearing](<https://www.triangleoshkosh.com/lazy-susan-turntable-bearing-12d10346>) provided in the [Kickoff Kit's Black Tote](<https://firstfrc.blob.core.windows.net/frc2020/KitofParts/2020KitofPartsChecklist-BlackTote.pdf>), and the [Field Tour Videos](<https://www.youtube.com/watch?v=4dAqyPWYtmw>) on Youtube.

(Asked by 4533 at Jan 27th 20)

Q222 R6 and Plaction Tread wheels

Q: Follow up to Q217: do traction wheels with a tread joined by alligator clips (e.g. Andymark plaction with nitrile treads) have the potential to violate R6 as a portion of the wheel is metal that comes into contact with the field surface?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event.

(Asked by 3229 at Jan 30th 20)

Q223 Can a FRAME CORNER be less than 6in and still covered by a bumper?

Q: Per !R17, bumpers must be placed on at least 6in of each side of the outside corner. Per figure 9-2, it appears that a less than six inch bumper cannot protect a greater than 6 inch side. However, the manual is not clear if a side can be less than six inches. Does this rule and diagram allow for a FRAME CORNER / side of the FRAME to be less than 6in, and if so: does it need to be covered by a bumper that is six inches, or just the length of side? (Picture an open chassis with 4in on each side)

A: Per !R17, "if a FRAME PERIMETER side is shorter than 12 in. (~31 cm), that entire side must be protected by BUMPER (see Figure 9-3)". Note that this applies to sides of the FRAME PERIMETER as defined in !R1 and the accompanying Blue Box, an open chassis with a 4" frame side does not have a 4" FRAME PERIMETER side and is not permitted (see the bottom right corner of the top image in Figure 9-2).

(Asked by 5243 at Jan 30th 20)

Q224 Two motors, Two motor controllers, One PDP slot

Q: In regards to Q163 and R30, would it be permissible to use two speed controllers or relay modules that are spliced together following specifications in R49 to control two snowblower motors?

A: No, this violates !R52.

(Asked by 379 at Jan 30th 20)

Q225 Hoist allowed?

Q: Our team is looking at the Ironton Electric Cable Hoist (220lb single line, 440lb double line) to purchase for the robot. Is this type of item allowed and are there any special details the team needs to watch for installation?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. If you have a specific question about a rule, please rephrase and resubmit.

(Asked by 7313 at Jan 30th 20)

Q226 Dry Film Lubricant Applied to Bumper Fabric

Q: We are considering using a spray-on dry film lubricant on our bumper fabric to help reduce the friction with the Power Cells to reduce the probability that the PCs would get rolled under the robots and damaged. The dry film lubricant that we are considering is designed to be used on cloth and will not transfer to other materials that come in contact with the bumper, so we believe R10 is not violated. We also believe that this does not violate the bumper construction rules. Would this be legal?

A: Using dry-film lubricant on an external surface of the ROBOT, such as on a BUMPER, would violate the R10 requirement that lubricants only be used to reduce friction within the ROBOT.

(Asked by 1533 at Jan 30th 20)

Q227 R26 - structure/frame material moves from robot to bumper after inspection

Q: Can a structure/frame member be attached to the robot in an easily removable way (ie having a T-handle pin connecting it to another piece) during inspection, and then be attached to the bumpers in a more rigid fashion (ie with screws/bolts)? This would allow the frame member (with the bumper attached) to be easily removed for maintenance while ensuring the bumper is fully supported per R26.

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. The ROBOT presented at Inspection may not be different from the ROBOT the team fields for Qualification or Playoff MATCHES per !I3 (with exceptions listed in !I4). If you have a question about the meaning of a specific rule, please rephrase and resubmit.

(Asked by 2177 at Jan 30th 20)

Q228 Follow-up to Q226

Q: As a follow-up to Q226 on the use of dry film lubricants on bumper fabric, we accept that even though these materials would not contaminate the field, they are considered lubricants and can only be used inside the robot. Another material we are considering evaluating is a PTFE (teflon) based spray-on water repellent fabric treatment. Does R10 prohibit the use of this material on the bumpers?

A: PTFE spray or other cloth treatments are not items listed in !R24 and are therefore not permitted in the construction of BUMPERS.

(Asked by 1533 at Feb 3rd 20)

Q229 Follow Up to Q226 #2

Q: Are cleaning agents considered lubricants in R10? Does R10 prohibit the use of cleaning agents on bumper fabric such as "pledge enhancing polish" to help remove dirt from the bumpers and keep the bumpers appearance nice through out the event?

A: Cleaning agents (or any treatments) that leave a residue are not a permitted item listed in !R24 and are therefore not permitted in the construction of BUMPERS.

(Asked by 3847 at Feb 3rd 20)

Q230 R33 - Powering Raspberry Pi from COTS power pack

Q: Does R33 make it permissible to power co-processors (like vision-processing Raspberry Pi's and Arduino's) and camera devices with "COTS USB battery packs"? And are those packs similar to those traditionally used to charge mobile phones and devices?

A: Yes and yes.

(Asked by 3176 at Jan 31st 20)

Q231 Servo Power Module as Part of a Custom Circuit

Q: In Q115, it was answered that "Provided that R49 is followed, multiple physical devices may be wired together into a single CUSTOM CIRCUIT which may be connected to the PDP as described in R52." Does this ruling include the Rev Servo Power Module as one of the multiple physical devices? In other words, can a Rev Servo Power Module which is powering a servo share one PDP slot with a different electronic device such as a Limelight camera, provided that the provisions of R52 and R49 are met?

A: Yes, the REV Servo Power Module may be wired as described in !Q115.

(Asked by 696 at Feb 3rd 20)

Q232 Pressure relief valves

Q: Can I use QEU14-S from automationdirect as replacement of pressure relief valves Norgren 16-004-011 that we got in the KOP
https://www.automationdirect.com/ad/shopping/catalog/pneumatic_components/special_purpose_pneumatic_fittings/quick_exhaust_valves/qeu14-s

A: We cannot comment on part/design legality, previous calls of Head REFEREES or LRIs, or questions that are overly broad, vague, and/or include no rule references. Please consult [Section 1.8]
<https://firstfrc.blob.core.windows.net/frc2020/Manual/HTML/2020FRCGameSeasonManual.htm>) and, if needed, resubmit a different question. See the Blue Box below !R77-B for relief valve requirements.

(Asked by **2231** at Jan 31st 20)

Q233 About part of robot outside of robot perimeter during inactive time

Q: We Team 3037 are building a robot, maybe part of the robot will be outside of robot perimeter even during inactive period. Inactive means during idle time or when robot is not performing any activity. But even its extension won't exceed more than 12 inches beyond perimeter even in inactive or idle period. Is it okay? Or part of Robot can only go beyond perimeter but still less than 12 inches only in active period I mean when performing some sort of activity. Need some clarification.

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision will be made the Lead ROBOT Inspector (LRI) at each event. Per !R2 and !G1 a ROBOT must be fully contained within its FRAME PERIMETER at the start of the MATCH. !R4 and !G18 do not restrict when, during a MATCH, a ROBOT may or may not extend beyond the FRAME PERIMETER and do not require your ROBOT take any particular form during "inactive" times.

(Asked by **3037** at Feb 3rd 20)

Q234 Bumper Height

Q: R24 allows for BUMPERS with wood between 4.5" and 5.5" tall, and R18 says that " BUMPERS do not have to be parallel to the floor". Does the combination of these rules allow for a single side of a BUMPER to have multiple heights within the 4.5"-5.5" range, provided that at any given point, the cross section is between 4.5" and 5.5", complies with the cross section figure 9-6, and is entirely within the BUMPER ZONE as defined by R18?

A: Yes, this is permitted.

(Asked by **3419** at Feb 3rd 20)

Q235 Follow Up to Q91: Short Driver/Operator/Coach

Q: We have a follow up question to Q91: We have a student who is 4'9" (due to genetics, not a disability). If she were a Driver/Operator/Coach, she would have difficulty seeing over the ALLIANCE STATION Shelf and/or OPERATOR CONSOLE(S). In this case, since it is a direct limitation of how the FIELD is constructed, we respectfully ask that she be permitted to bring a step stool, since otherwise she'd be precluded from being a member of the drive team.

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. However, teams will not be granted an exception to the requirements in !H1 for having short drivers if their height is not related to a disability.

(Asked by **8032** at Feb 3rd 20)

Q236 BoM Cost Accounting

Q: If a team purchases an item from vendor A but can obtain an identical functional replacement from vendor B, must the price of the item from vendor A be recorded on the Bill of Materials or can the price vendor B sells the item for be used?

A: Per the Blue Box below !R13, the Fair Market Value of a part is the price defined by a VENDOR for a part or an identical functional replacement. This means that a team can identify a price from any VENDOR the part is available from as the Fair Market Value and use that on their BOM.

(Asked by **8262** at Feb 3rd 20)

Q237 Use of Zebra Motionworks at events

Q: Zebra Technologies offers event A the opportunity to provide teams with the option of placing a Zebra MotionWorks tracker on their robots to provide information about robot positioning to the public. Is event A permitted to employ these technologies and if so, do any additional restrictions

apply to teams using these tags?

A: Please see [Team Update 10](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate10.pdf>).

(Asked by **4513** at Feb 7th 20)

Q238 Materials allowed for structural components

Q: Do structural components on the robot have to be made from aluminum, or is mild steel allowed, I recently got access to an old bed frame, which I believe work very well to support upper structures of our robot.

A: There are no rules specifically governing the materials that ROBOT parts may be constructed from (other than those specifically prohibited for safety per !R8). We cannot comment on part/design legality, previous calls of Head REFEREES or LRIs, or questions that are overly broad, vague, and/or include no rule references. Please consult [Section 1.8] (<https://firstfrc.blob.core.windows.net/frc2020/Manual/HTML/2020FRCGameSeasonManual.htm>) and, if needed, resubmit a different question.

(Asked by **5457** at Feb 3rd 20)

Q239 Modification of Sensor leads on Neo and Neo 550 Motors.

Q: R28-B allows the modification of Motor input leads to FRC legal motors. Are the sensor leads on the Neo and Neo 550 allowed to be trimmed and connectors and splices added in the same way, or is this a rule violation since some of those wires are sensor outputs from the motor and not inputs.

A: Good question! Please see [Team Update 09](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate09.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **4272** at Feb 4th 20)

Q240 Cost of Fabricated Items

Q: Does R11 exempt FABRICATED parts that are manufactured using less than \$5 of raw materials (as defined in R13) from being counted towards the \$5000 robot cost limit?

A: If the raw material used to make the part is "purchasable from a VENDOR" for less than \$5 the part is exempt from the BOM per !R11-A.

(Asked by **8262** at Feb 3rd 20)

Q241 Technician

Q: Is the TECHNICIAN allowed to communicate the robots' mechanical status to the pit crew after a match via wireless communication, based solely on its perception and without having previously communicated with the DRIVE TEAM?

A: There are no rules specifically governing DRIVE TEAM or TECHNICIAN communication outside of a MATCH. Note that the wireless communication must comply with all Event Rules (e.g. !E9-F and !E16).

(Asked by **3158** at Feb 3rd 20)

Q242 What counts as 'on the robot'?

Q: Rule R11 says "the total cost of all items on the ROBOT, including software, shall not exceed \$5000 USD." What, specifically, does "on the ROBOT" refer to? If a team has two alternate mechanisms (two configurations) does the \$5000 have to include the cost of both mechanisms simultaneously, or does each configuration need to be below \$5000 total?

A: Good question. Please see [Team Update 10](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate10.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **4907** at Feb 7th 20)

Q243 Hoists, Yes or No?

Q: Are hoists accepted materials for robots or do we have to manufacture one ourselves?

A: We cannot comment on part/design legality, previous calls of Head REFEREES or LRIs, or questions that are overly broad, vague, and/or include no rule references. Please consult [Section 1.8]

(<https://firstfrc.blob.core.windows.net/frc2020/Manual/HTML/2020FRCGameSeasonManual.htm>) and, if needed, resubmit a different question.

(Asked by **7313** at Feb 4th 20)

Q244 Control Panel Status Light behavior for Rotation Task

Q: The Success case in Figure 3-24, Table 3-4, and the 2020 Field Tour Video: Trench Run and Control Panel at <https://www.youtube.com/watch?v=4dAqyPWYtmw> (at about the 50s point) provide contradictory information about the behavior of the Control Panel Status Light for the Rotation Task. Fig. 3-24 shows the light continuing to blink past the point where the control panel has stopped for 2 seconds. It also shows that the light will be ON after the control panel has been stopped for 2 seconds.

A: Good catch; thank you! Please see [Team Update 10](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate10.pdf>).

(Asked by **4061** at Feb 7th 20)

Q245 Clarification of Chairman's definition "started"

Q: The definition of "started" includes the statement: "A Team has Started a team if they...funded or sourced funding (i.e. grants or sponsorship) of at least 50% of the team registration fee." If an FRC team fully funds the registration fee for a pre-existing FTC, FLL, or FLL Jr. team (e.g., one originating 1+ years ago) this year, is that considered to be "starting" that team this year? If no, what if the team receiving funding consists of entirely new members but the team has an "old" number?

A: The purpose of the word "started" is to understand the impact that *FIRST* Robotics Competition teams have on their community (locally or globally). In other words, it would be inappropriate to "start" a *FIRST* LEGO League team in one season and then "start" the same team (regardless of the actual makeup of the team) the next season and count that as two teams "started".

(Asked by **2723** at Feb 5th 20)

Q247 Frame Perimeter Protrusion

Q: Our robot has two 1/8 inch thick gusset plates bolted outside the frame perimeter of our robot (one on each end). We are wondering if this complies with R1: "Minor protrusions no greater than 1/4 in. (~6 mm) such as bolt heads, fastener ends, weld beads, and rivets are not considered part of the FRAME PERIMETER." Thank you!

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. Gusset plates or other COMPONENTS attached to the ROBOT that are not part of the family of protrusions listed in !R1 are considered part of the FRAME PERIMETER.

(Asked by **5016** at Feb 6th 20)

Q248 PWM COTS Servo part

Q: Is the Actuonix L16-R Miniature Linear Servos a legal PWM COTS servo since it is less than \$75?

A: We cannot comment on part/design legality. Please consult [Section 1.8]

(<https://firstfrc.blob.core.windows.net/frc2020/Manual/HTML/2020FRCGameSeasonManual.htm>) and, if needed, resubmit a question.

(Asked by **1065** at Feb 6th 20)

Q249 Minimum Age Requirement on Drive Team

Q: Pg 129 of this years manual defines a Human Player as "a pre-college student DRIVE TEAM member who acts as a POWER CELL manager." Are there any specific minimum age requirements for a member of the drive team? If so, where would the documentation for minimum age requirements be found?

A: There are no minimum age requirements to be a member of a DRIVE TEAM.

(Asked by **6933** at Feb 6th 20)

Q250 Just want to verify at start no part of the robot can exceed the perimeter at all.

Q: We are working on our robot and a part of the ball catcher which is elevated a good 12 inches above the perimeter (chassis base) extends past the perimeter about 3 inches currently. Would this be considered unacceptable? I have team members who are viewing this as acceptable and some who view it unacceptable

A: We believe that the combination of !G1-C and !R2 answers your question. If not, please rephrase and resubmit.

(Asked by **5215** at Feb 6th 20)

Q251 Does R73 allow attaching sensors to the CAN bus via a topology other than daisy chain?

Q: According to R73, "additional switches, sensor modules, custom circuits, third-party modules, etc." can be added to the CAN bus, but it does not specify how. Does this mean that they may be attached via star/multi-drop instead of daisy chain?

A: There are no rules that require a specific CAN topology.

(Asked by **199** at Feb 6th 20)

Q252 High Intensity Light Sources and Targeting - Followup to Q106

Q: As a followup to the answer provided for Q106, please clarify: Can a robot have a high intensity light source illuminated whenever it is using said light source to actively target a goal?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. Illumination of high intensity lights permitted per !R8-m is specified as "brief".

(Asked by **900** at Feb 6th 20)

Q253 intentional ejection of power cells Rule G7.

Q: What is considered intentional ejection of power cells out of the field? If you are shooting toward the power port and miss over the top, is that a foul?

A: Whether an action is intentional or not would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. Generally, launching a single POWER CELL towards the POWER PORT and missing such that the POWER CELL exits the FIELD is unlikely to be deemed intentional ejection.

(Asked by **7121** at Feb 6th 20)

Q254 Vacuum Device Interaction with FIELD

Q: Are vacuum devices permitted to interact with the ARENA, FIELD carpet, POWER CELLS, and other game elements provided that they do not cause any damage?

A: !G26 prohibits various interaction with ARENA elements, regardless of whether or not such interaction (e.g. attaching) is via vacuum.

(Asked by **95** at Feb 6th 20)

Q255 Followup to Q252 - High Intensity Discussions with LRIs

Q: As "brief" remains undefined and we are not in possession of an LRI to determine if our light source is high intensity, can you please provide a partial list of characteristics that may be used by an LRI to determine if a light source is high intensity or lit "briefly"? Approx. how far away will an LRI be when this determination is made? Is there a candlepower, lumen, or watt measurement to use? Does wavelength impact this? Would a military grade IR light source be considered high intensity?

A: Correct, the manual does not define "brief," level of permitted intensity, or wavelengths permitted. !R8 requires that teams assess ROBOT parts (and/or their use) for safety hazards, and if a reasonably astute observer would agree that a part (and/or its use) is likely to cause an unsafe condition for event participants or interfere with the operation of other ROBOTS, it's likely a violation of !R8. The Lead ROBOT Inspector (LRI) has the ultimate authority at an event.

(Asked by **900** at Feb 7th 20)

Q256 Pneumatics: Is an off-board compressor legal?

Q: In previous years, the use of an off-board compressor has been explicitly allowed in the rules. That portion has been removed this year. It is our first year using pneumatics and we don't want to have issues at our first event with having to add the compressor on and being overweight.

A: Correct, the manual does not allow for off-board compressors.

(Asked by 5257 at Feb 6th 20)

Q257 R11 - Accounting for bumper sets

Q: R11 states "The total cost of all items on the ROBOT". ROBOT is defined to include BUMPERS. Should we account for the cost of every configuration of BUMPERS that we present at inspection (e.g. a Red set and a Blue set) or just for one exemplary set of bumpers?

A: We believe the edit to !R11 in [Team Update 10](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate10.pdf>) answers your question. If not, please rephrase and resubmit.

(Asked by 3847 at Feb 10th 20)

Q258 R11 - Cost Account for batteries and assemblies

Q: R11 states "The total cost of all items on the ROBOT". ROBOT is defined to include the power system. Should teams account for each battery assembly, "ROBOT battery and its associated half of the Anderson cable quick connect/disconnect pair (including no more than 12 in. (~30 cm) of cable per leg, the associated cable lugs, connecting bolts, and insulation)" or just one exemplary battery assembly? If only one should they account for the highest cost battery assembly.

A: A team should account for a single battery assembly on the BOM. If battery assemblies vary in price, the cost of the most expensive one should be assessed. Other battery assemblies may then be used on the ROBOT in MATCHES per !I4-E.

(Asked by 3847 at Feb 7th 20)

Q259 Legality of Multiple Circuits on a PDP Breaker

Q: R52 describes the legal quantity of circuits per PDP breaker. Is it permissible to power both a CUSTOM CIRCUIT and an additional PCM/VRM via one (1) 20A PDP breaker? Is it permissible to power one (1) additional PCM (which is connected to a pneumatics solenoid) and one additional VRM (which powers a CUSTOM CIRCUIT) via one (1) 20A PDP breaker?

A: No, a CUSTOM CIRCUIT and additional PCM/VRM may not be powered off the same breaker as they are separate lines in the Table 9-3 and per !R52 "No other electrical load can be connected to the breaker supplying this circuit." Yes, up to 3 total PCMs or VRMs in any combination may be connected to a 20A PDP breaker per Table 9-3.

(Asked by 1114 at Feb 11th 20)

Q260 Cost accounting for tape - Follow up to Q100

Q: Should tape be accounted for like a raw material in the same way that belt, chain, rope, etc. are accounted for? Would different colors of otherwise identical tape be Functionally Identical Replacements or would teams need to account for each color?

A: It's appropriate to treat common tapes (e.g. electrical, gaffers, duct, etc.) as raw material for the purposes of cost accounting (we can't be absolute about all tape as there may be types of tape where it's not appropriate). We cannot rule on if a different color tape is a functional equivalent - if the tape's color matters (for sensing, aesthetics, marking, etc.), then a different color is not a functional equivalent.

(Asked by 3847 at Feb 7th 20)

Q261 Multiple layers of bumper cloth clarification

Q: R24-D states, in part, "...multiple layers of cloth ... are permitted if needed to accommodate R21..." which reads in part, "Each ROBOT must be able to display Red or Blue BUMPERS to MATCH their ALLIANCE color..." In order to improve the durability of our bumper cover material, and maintain the color requirement, is the use of multiple layers of the same color cloth, (eg the 200D slick bumper material from a VENDOR-not-to-be-named here) legal?

A: Use of more than a layer of BUMPER cloth for reasons other than to display Red or Blue (i.e. satisfy !R21) or to display Team Numbers (i.e. satisfy !R22) is not permitted per !R24-D.

(Asked by 5881 at Feb 7th 20)

Q262 R1 / R2 - Minor Protrusions

Q: Our team has a question about what else falls under the "etc." in R2. Would a small (less than 1/2 inch) shaft that sticks through our Frame Perimeter by a very small amount (~.100 inches) with a snap ring be considered covered by the minor protrusions allowance? We have bolt heads that are of similar size that we see as covered, but are questioning the legality of a shaft that serves a similar purpose. Also, would a 1.125" bearing

flange be too large in cross section area to qualify?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. In general, shafts of a small diameter and the flanges of most bearings are considered minor protrusions per R1 and R2.

(Asked by 2471 at Feb 10th 20)

Q263 Q260 - Color IFR - Follow Up

Q: Given - "We cannot rule on if a different color tape is a functional equivalent - if the tape's color matters (for sensing, aesthetics, marking, etc.), then a different color is not a functional equivalent." Does using multiple colors of otherwise identical wire to meet R55, mean that the wires are no longer functional equivalent and should be accounted for separately? Does the color of an item to meet a rule mean that it's not functionally equivalent to a different color of the same item?

A: A wire color that's identical except for color may or may not be a functional equivalent. For example, a blue wire of the same gauge, etc. may be considered functionally equivalent to the original black wire even though it's a different color - it has the same functional purpose electrically and they both communicate negative leads. If the color change communicates something different (e.g. a red wire being swapped in for a black wire), it's not functionally identical.

(Asked by 3847 at Feb 10th 20)

Q264 Q261 follow up: Use of fabric for numbers legality

Q: With Q261's answer, we are confused on the legality of using any fabric for showing bumper numbers via embroidery, gluing, etc. as they are not meant for showing RED or BLUE, but are used to satisfy R21. Is this method of showing bumper numbers now considered illegal? Does the ruling change if embroidery on a piece of alliance color fabric sewn onto the main bumper set (ie multiple layers of the same cloth used to show numbers to satisfy R21-A)?

A: Good catch, thank you. Please see [Team Update 11](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate11.pdf>) and the edited answer to !Q261. If that doesn't answer your question, please rephrase and resubmit.

(Asked by 4513 at Feb 11th 20)

Q265 "Layers" as relating to bumper cloth

Q: We looked closely at our smooth, rugged bumper fabric and found that it is constructed of multiple warp threads in the X direction, multiple weft threads in the Y direction, and multiple stitch threads in the Z direction. How shall we determine how many "layers" has this fabric?

A: A cloth is often constructed from multiple layers of fiber, this is not multiple layers of cloth.

(Asked by 2363 at Feb 10th 20)

Q266 Is the Operator Console to be cost accounted?

Q: Is the OPERATOR CONSOLE considered part of the ROBOT for the purposes of R11 and other cost accounting rules? Invited re-submission of Q73.

A: No, the definition of OPERATOR CONSOLE states it relays commands to the ROBOT and is therefore never considered part of the ROBOT.

(Asked by 2363 at Feb 10th 20)

Q267 Q261 Follow Up - Bumper Fabric Layers

Q: If a team has removable red and blue covers for their bumpers to meet R21, are they allowed to have a different color (non-Red/Blue) fabric layer under the cover during each match?

A: No, that would be considered having layers of fabric.

(Asked by 3847 at Feb 10th 20)

Q268 Model Numbers for Field Light Sources

Q: The 2020 game manual states that the lights surrounding the outer port are a Phillips Color Kinetics LED Light String, but it does not specify a part number. The colored light bars on the shield generator are also not elaborated on as to specifications or a part number. What are the part

numbers or model names for these two light sources?

A: Part numbers and assembly details for lighting features are not part of the field specifications and therefore not provided. Information about lighting is provided via [the Playing Field page](https://www.firstinspires.org/robotics/frc/playing-field), specifically in photo albums and Field Tour videos.

(Asked by **900** at Feb 13th 20)

Q269 Use of a tool to carry power cells

Q: Can a tool be used to carry power cells by a HP to loading or storage?

A: No, this would be a violation of H1.

(Asked by **6087** at Feb 10th 20)

Q270 Are custom closed cell EVA half round foam roller legal?

Q: Our bumpers are custom made, they are 1 piece but they look like a capital B. They are two half round pieces of foam rollers we had customized to be 1 piece with the back flat, making a "B" shape when viewed from the side. Every team is going to somehow secure 2 pieces of "pool noodle" together anyways, is this legal? They function as pool noodles, we are not too concerned about the material but that they are one piece instead of two. Search "closed cell half round foam roll" for image of half.

A: BUMPERS must be constructed using stacked pairs of pool noodles of the shape and size indicated in R24-C.

(Asked by **5727** at Feb 10th 20)

Q271 R24-G - Fastening System

Q: R24-G states that the bumper "must attach to the FRAME PERIMETER of the ROBOT with a rigid fastening system to form a tight, robust connection" and "The attachment system must be designed to withstand vigorous game play." Is an attachment system that allows a portion of the bumper to move slightly ($\leq 1/4$ ") vertically legal assuming the bumper never leaves the bumper zone? There is no horizontal movement. Basically, the question is a clarification of the words "tight" and "rigid."

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. In general, BUMPERS are expected to be rigid in all directions.

(Asked by **6843** at Feb 13th 20)

Q272 Can bumper covers be made of two different fabrics?

Q: Can bumpers be made of two different rugged fabrics if they are sewn together, not overlapping, to cover a single bumper? If yes would it still be ok if there is a slight variance to the colors between fabrics, while still staying within rule R21?

A: There are no rules against using multiple pieces of fabric sewn together to create BUMPERS, as long as the result is in compliance with all other BUMPER rules.

(Asked by **340** at Feb 10th 20)

Q273 Non-Flexible Robot Elements

Q: The sidebar of rule R26 states "flexible ROBOT elements, such as thin plastic, ... are not considered 'structure/frame' of the ROBOT." In this context, what is the criteria used to determine if a part is non-flexible? Deflection angle when pressed, material and thickness, overhang length of unsupported material, or some other criteria?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. The blue box of R26 states that "the intent of this rule is to make sure the BUMPER wood is properly supported to minimize the likelihood of breakage on impact." The inspector and LRI will evaluate the flexibility of the structure/frame based on this. Additionally, consider R1 when evaluating flexible elements that may be part of the FRAME PERIMETER.

(Asked by **3574** at Feb 10th 20)

Q274 Discontinued COTS Items

Q: If a COTS item used on the robot is purchased by a team and later is discontinued by its manufacturer due to the release of a newer version, how is the fair market value of such item determined?

A: For products which are no longer commercially available, teams should make their best effort to locate pricing information. If it cannot be located, a best estimate should be made based on similar products.

(Asked by **8262** at Feb 10th 20)

Q275 Reversing Control Panel Rotation

Q: The definition of ROTATION CONTROL says the robot must "rotate [the] CONTROL PANEL at least three...complete revolutions in the same direction." It does not specify what happens if the direction of rotation changes. For example if the robot rotates the CONTROL PANEL four turns clockwise then one turn counter-clockwise, does this count as the CONTROL PANEL having been turned one time, three times, or something else?

A: Revolutions in the opposite direction don't subtract. The stack light will flash once the required number of rotations has been counted in a direction.

(Asked by **5987** at Feb 10th 20)

Q276 Multiple solenoid valves

Q: Could you please clarify the intent of R87? I would like to use two SVs to control a cylinder so that I can start it and stop it at any position. This can be accomplished by using check valves in opposing directions on the output of two SVs so that one can only supply pressure and the other can only vent and route these to a common port on a cylinder. I would just reverse one of the SVs and use the input to vent, but they require a pilot pressure higher than our desired operating pressure.

A: Connecting the output of two solenoid valves together with check valves in place such that the outputs are never additive does not violate !R87. Make sure the resultant configuration complies with !R86-A and be prepared to explain/demonstrate how the output of the solenoid valves are not additive.

(Asked by **1421** at Feb 11th 20)

Q277 Vacuum Under Robot

Q: Is producing a sub-atmospheric pressure volume under a robot considered 'grappling' or 'grasping' the field carpet and thus a violation of G26?

A: This is considered "attaching" to the FIELD and is in violation of !G26-C. We have added clarification in !G26-Cin [Team Update 11] (<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate11.pdf>).

(Asked by **95** at Feb 11th 20)

Q278 Q275 Clarification

Q: A follow-up to the answer of Q275. If "revolutions in the opposite direction don't subtract", does that mean that they reset? If I spin the CONTROL PANEL 3 rotations CW, 0.5 rotations CCW, then 1 rotation CW, how many revolutions would the CONTROL PANEL have counted?

A: The CONTROL PANEL only resets when more than 5 complete rotations are detected in any direction. Rotations in either direction of less than 5 complete rotations do not affect the rotation count in the other direction.

(Asked by **5987** at Feb 10th 20)

Q279 Is a robot guarding POWER CELLS in their LOADING ZONE a violation of either G6-C or G8?

Q: Consider that enough POWER CELLS have been scored that H9 requires an alliance to recycle them into the field. In addition, an alliance robot is intersecting their LOADING ZONE but not making an active attempt to pick up the new POWER CELLS (ex. already possess 5 CELLS). The entering POWER CELLS will settle between it in and the WALL close to its LOADING ZONE. An opposing alliance would not obtain these without risking a G11. Is this legal, controlling (G6-C) or amplifying the challenge (G8)?

A: We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. Generally speaking, !G8 only applies when a ROBOT takes an action, such as the examples given in the blue box. However, the same is not true for !G6, and a !G6-C violation is possible in a situation such as the one provided. Generally, a ROBOT cannot be in CONTROL of a POWER CELL without contacting it, either directly or transitively through another object.

(Asked by **2834** at Feb 17th 20)

Q280 Hard Line Pneumatic Tubing?

Q: R77-D permits teams to use additional pneumatic tubing of their choice and does not specify or limit the materials that this tubing may be made of. Does this mean that hard line (typically copper or stainless steel) pneumatic tubing is legal provided that it meets the other criteria (namely pressure rating and outside diameter)? If this is the case, bending or deforming tubing (of any material, even polyurethane) is not listed in R76, does that mean it is not legal to bend pneumatic tubing?

A: Pneumatic tubing made of other materials may be legal, provided it meets the requirements of !R75 and !R77-D. Bending of pneumatic tubing that only causes elastic deformation is not considered altering the condition of the tubing. Bending or deforming of tubing that results in a permanent change in its shape (plastic deformation) is a change in the condition of the tubing, and not permitted per !R76.

(Asked by **5413** at Feb 11th 20)

Q281 Pool Noodle Jointing

Q: R-24C states, " All pool noodles used in a BUMPER set (e.g. Red set of BUMPERS) may not be modified (with the exception of cutting to length or beveling ends) or deformed and must be the same diameter, cross-section, and density (e.g. all round hollow or all hex solid)." R-25 gives examples of pool noodles covering corners. Can we joint our corner pool noodles together, so one noodle intersects the perpendicular noodle, via cutting the noodles, so they joint together? Or is this "modifying?"

A: Please see [Team Update 12](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate12.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **4580** at Feb 14th 20)

Q282 Contacting vertical surface generator switch above the handle

Q: If our robot is pushing against the vertical surface of the horizontal beam 1ft above the rung (beam not deemed as part of the handle) at the end of the game to enable our climb, would that be deemed to be violating (G26)? Specifically, suspending. We realise that this question is closely related to Q107, but would appreciate confirmation on this one, as this is how our robot intends to operate. We don't want to get to competition and find out that our climb is illegal. Thanks,

A: We cannot comment absolutely on hypothetical scenarios. Generally, if interaction is solely contact with or pushing against a FIELD element, it's unlikely that the ROBOT is being suspended from that element. However there may be circumstances in which a ROBOT is contacting/pushing against and being suspended from that FIELD element (that's not the HANDLE); that assessment will be made by the Head REFEREE at the event.

(Asked by **5584** at Feb 12th 20)

Q283 Offboard Compressors and R79

Q: We are looking for clarification to R79. Are we allowed to use an off-board compressor and tank system to cool motors? We would only plug the tubes from our off-board system into the ports on our Falcon 500s and release the air to cool them between matches

A: Provided that one or more set screw plugs are removed from the Falcon 500, the device is not considered a pneumatic device as it is not a sealed system capable of maintaining pressure. !R79 and other pneumatic rules do not apply in this case (though other safety and event rules may apply).

(Asked by **3175** at Feb 11th 20)

Q284 Direct Replacement of Robot Assembly

Q: In I4, it states: E. replacement of a MECHANISM with an identical MECHANISM (size, weight, material) Based off of I4. I do not have to reweigh when adding the mechanism. With that being said, If I was to bring in a fully assembled drive train rail that can be easily swapped, but is a DIRECT REPLACEMENT, material, weight, motors, and all, does this "drive rail" count towards my 150lbs weight that I must be inspected with, or due to the fact that it is a DIRECT REPLACEMENT, it does not count?

A: Identical spares intended for use per !I4-D and !I4-E do not need to be presented for Inspection and therefore do not count towards the 150lb. weight limit specified in !I3.

(Asked by **4130** at Feb 12th 20)

Q285 Changing the color under the CONTROL PANEL color sensor

Q: Does changing the color physically present under the CONTROL PANEL color sensor break H8: Teams may not interfere with any automated scoring hardware

A: Yes. Changing the color present under the CONTROL PANEL color sensor by any means other than rotating the CONTROL PANEL would be a violation of H8.

(Asked by **2168** at Feb 12th 20)

Q286 Can the robot's pneumatic system be connected to a device incapable of holding pressure?

Q: For a more specific case than the title question, can the Falcon 500, with one or more set screws removed, be connected to the robot's pneumatic system through the "cooling port" on the Falcon? Can this be done both directly (using a solenoid to release stored pressure) and indirectly (using the exhaust from a solenoid that's used to control a pneumatic device)?

A: Items open to atmosphere (i.e. not capable of holding pressure) may be connected to the exhausts of pneumatic systems provided flow is not significantly impeded (i.e. no significant back pressure builds up).

(Asked by **2177** at Feb 14th 20)

Q287 Operator Console Computer

Q: Per the blue box of R88, teams are permitted to use a "portable computing device of their choice" on their operator console. Does this prevent teams from installing a "stationary" computer such as a desktop PC on their operator console or permanently mounting a "portable" computer to the console?

A: *FIRST* recommends the use of a portable computing device in the blue box of !R88 because they are generally more convenient and include a battery which allows the machine to be powered on prior to arriving at the FIELD. However, there are no rules prohibiting the use of a desktop or other style of computer provided that it can run the software required by !R88, be powered (along with any other OPERATOR CONSOLE elements) by the 2-Amp outlet on the PLAYER STATION shelf (per 3.4.1.1) and that using such computer does not violate !C7 by introducing delays to the start of a MATCH or the FIELD reset process.

(Asked by **8262** at Feb 13th 20)

Q288 Allowed extent of embroidery backing/stabilizer material

Q: Our understanding is that TU11 & Q264 made it OK (thank you!) to use backing/stabilizer material behind embroidered bumper numbers, given that this additional layer of backing fabric is required to meet R22. How closely to the numbers should we trim the excess backer material to ensure compliance with R23D?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. As general guidance, the excess backer material should be trimmed.

(Asked by **2363** at Feb 13th 20)

Q289 Wheel delamination and safety wire

Q: Some teams are using "0.032 stainless safety wire" to prevent wheels from delaminating from their hubs - by wrapping it around the wheel, twisting it on itself, and sticking the end into the rubber of the wheel, it prevents the wheel from expanding. However, if not done right or with the right material, the wire can break and create an extremely unsafe condition. Are wheels spun so fast they delaminate safe per R8? Is adding "safety wire" to prevent this safe per R8?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. Teams should be cautious of !G26 and !R7 when considering ROBOT designs.

(Asked by **2177** at Feb 13th 20)

Q290 2nd VRM on PDP instead of PCM

Q: If you are not using the PCM connection on the PDP can you use it to connect a 2nd VRM. We need power for our limelight but Per R47 we can't hook it to the VRM with the radio and we are out of PDP slots.

A: No, per !R48 other than the VRM powering the Wireless Bridge, "With the exception of a single CTR Electronics Pneumatics Control Module (PCM, P/N: am-2858), no other electrical load shall be connected to these PDP terminals."

(Asked by **4216** at Feb 14th 20)

Q291 Field Light Sources and Calibration - Followup to Q268

Q: As it seems unreasonable to ask a team to develop CSI-like software for enhancing the field photos and field tour videos to ascertain all the information they might need about the light sources on the outer port and the shield generator, would it be possible for a team to measure the needed characteristics of those light sources utilizing the calibration time outlined in section 11.4 of the manual?

A: Please note that FIELD lighting is only intended to be aesthetic and illustrative for human observers and not expected to be consistent re: power level, intensity, or other specifications that may be needed for sophisticated sensing. That being said, there are no rules prohibiting teams from using lights in that way, and measuring characteristics during the FIELD Measurement/Calibration time is permitted (assuming no other complications arise re: safety, integrity of the FIELD, burden on FIELD staff to configure FIELD lighting on demand, etc.)

(Asked by **900** at Feb 14th 20)

Q292 What does "a level sufficient to be a distraction" mean?

Q: We wanted to have a Star Wars character rise out of a box when our robot climbs and the laugh. The rule says, "Speakers, sirens, air horns, or other audio devices that generate sound at a level sufficient to be a distraction." If it is during the climb, and only makes noise when our robot is done hanging is a laugh sound ok, or would there be some kind of penalty?

A: We cannot rule absolutely on hypothetical ROBOT designs or parts, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. Generally FRC ROBOTS make significant noise due to ROBOT components (e.g. gears, chains, etc.). "Sound at a level sufficient to be a distraction" is sound that exceeds this baseline level to a sufficient degree that is distracting.

(Asked by **1529** at Feb 17th 20)

Q293 Bumper Color Clarification

Q: As per rule R21 'Each ROBOT must be able to display Red or Blue BUMPERS to MATCH their ALLIANCE color'. Maroon/Burgundy is classified as a dark red color. Would it satisfy the red bumper requirement in R21?

A: We cannot rule absolutely on hypothetical ROBOT designs or parts, and the final decision as to legality lies with the Lead ROBOT Inspector (LRI) at each event. If colors are dark enough that they're close to black and not easily distinguishable, they're likely not to satisfy the requirements of !R21.

(Asked by **7427** at Feb 17th 20)

Q294 PDP visibility

Q: R44 states that the PDP and fuses need to be visible during inspection. Are we allowed to disassemble other components before/during inspection for visibility of the PDP and its fuses? If it is not clear what we mean, contact us by email and we will send images for reference.

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. !R44 doesn't prohibit designs that make it such that the PDP and its fuses can be quickly revealed for inspection by moving components, but cover the PDP and its fuses during a MATCH.

(Asked by **6920** at Feb 18th 20)

Q295 Vacuum Under Robot Clarificaiton

Q: The answer to Q277 appears to state that any vacuum under the robot would be considered "attaching," which appears to be inconsistent with the update to G26 in the manual (which Q277 refers to) discussing attaching and anchoring. We seek clarification: If the robot can still roll and drive freely is G26 violated if a robot generates negative air pressure between itself and what is beneath the robot? This does not appear to violate the dictionary definition of "attach."

A: You are correct that!Q277 states that any vacuum under a ROBOT is considered attaching.

(Asked by **95** at Feb 20th 20)

Q296 Glued Bumper corners

Q: Can the corners of bumpers be glued together? It is not listed as an example or alternative.

A: Thank you, please see [Team Update 15](<https://firstfrc.blob.core.windows.net/frc2020/Manual/TeamUpdates/TeamUpdate15.pdf>). If that doesn't answer your question, please rephrase and resubmit.

(Asked by **2468** at Feb 25th 20)

Q297 defensive blocker a violation of I1?

Q: Teams RED1, RED2, and RED3 form a playoff alliance. At the time of alliance selection, all three of these robots are short enough to fit under the trench. The three teams work together to add a makeshift non-articulated cardboard structure to RED3's robot that brings its height close to the 45" maximum. In playoff matches RED3 uses this new-found height to block Power Cells being shot by the opposing alliance. For the purpose of I1, is defensive shot-blocking considered a game challenge?

A: An assembly used to deflect POWER CELLS is a MAJOR MECHANISM because it "address[es] at least one (1) game challenge" e.g. "game piece control" and/or "field element manipulation." !I1 requires that the MAJOR MECHANISM was built by the ROBOT's team, but does not prohibit assistance from other teams. From the Blue Box under !I1, "Neither I1 nor the language in its Blue Box define specific thresholds for how much of a MAJOR MECHANISM must be the result of the team's effort. I1 expects and requires the team's honest assessment of whether they built the MAJOR MECHANISMS of their ROBOT."

(Asked by 4039 at Feb 21st 20)

Q298 Distribution Panel on CUSTOM CIRCUIT

Q: If a team has multiple CUSTOM CIRCUITS that they wish to install on their robot (vision coprocessor, lighting, sensors, etc.), may a secondary fuse / circuit breaker panel be installed and fed off one PDP slot to ensure that each CUSTOM CIRCUIT is adequately protected?

A: Yes, per the Blue Box below !R52, the rule does not prohibit "any fuses or breakers within CUSTOM CIRCUITS for additional protection".

(Asked by 8262 at Feb 19th 20)

Q299 Wireless Bridge Light Visibility

Q: Per R64, the Wireless Bridge must be mounted such that its indicator lights are visible to arena staff. Does this imply that the lights must be visible while the robot is in its normal standing configuration, or can this rule be satisfied by making the lights easily accessible (such as opening a cover or tilting the robot)?

A: !R64 requires the lights be visible, which is not the same as easily accessible.

(Asked by 8262 at Feb 18th 20)

Q300 Cost Accounting of Bulk Purchases

Q: If a team purchases an item in bulk that has a scaled FMV of less than \$5 but cannot be purchased individually from a VENDOR for less than \$5, must the item be counted on the Bill of Materials?

A: No, the scaled Fair Market Value may be used to assess the cost of the item purchased from the VENDOR, qualifying the item for the !R11-A exemption.

(Asked by 8262 at Feb 19th 20)

Q301 Table 4-5 DRIVE TEAM roles - can a team have 1 driver and 2 Human Players?

Q: Table 4-5 DRIVE TEAM roles states that a drive team can have up to 3 people that are either Driver or Human Players. Does this mean one team could have 0 Drivers and 3 Human Players, and an Alliance could have up to 9 Human Players?

A: Yes, a team may have up to 3 total DRIVERS/HUMAN PLAYERS and may allocate those 3 people between those roles however they choose.

(Asked by 5675 at Feb 19th 20)

Q302 Dry Film Lubricant Applied to a Mechanism Outside Frame Perimeter - Protecting Power Cells

Q: Would a spray-on coat of Teflon (labeled dry-lubricant) applied to a piece of polycarbonate that is intended to go over the bumpers at the beginning of the match (like a mud flap) be legal? After the lubricant dries it will become like the completely legal ptfe coated tape and it will not contaminate the field. R10 states that you must only use lubricant WITHIN the robot to reduce friction, but is a mechanism sticking out that has a coating on it to reduce friction with the game pieces legal?

A: No, if an item is sold as a "lubricant", per !R10 it may only be used to "reduce friction within the ROBOT." The friction between a POWER CELL outside the ROBOT and the surfaces of the ROBOT is not "within the ROBOT".

(Asked by 1825 at Feb 19th 20)

Q303 G12 Includes Stage 1 Being at Capacity?

Q: G12 states that A ROBOT may not contact the opponent's CONTROL PANEL, either directly, or transitively through a POWER CELL, if A. the opponent ROBOT is contacting that CONTROL PANEL, and B. the opponent's POWER PORT has reached CAPACITY The power port has 3 stages of reaching capacity, but stage one does not include the control panel in any way. Does G12 come into effect regardless of which stage is at capacity?

A: Yes, if Stage 1 is at CAPACITY, but not yet ACTIVATED it is possible to violate !G12.

(Asked by 694 at Feb 20th 20)

Q304 Bumper length requirement

Q: A ROBOT has a FRAME PERIMETER side greater than 12 inches, but with a gap such that the contiguous frame material adjacent to the corners on each side is between 6 and 12 inches. We believe that the frame must only be covered with 6 inches of BUMPERS on each side to protect the corners per R17. Is this correct, or are the entire frame segments required to be covered as they are less than 12 inches in length?

A: We cannot rule absolutely on hypothetical ROBOT designs, and the final decision as to legality of a particular ROBOT lies with the Lead ROBOT Inspector (LRI) at each event. !R17 requires 6 in. of BUMPER to be placed on each outside corner of the FRAME PERIMETER. FRAME PERIMETER sides less than 12 in. must be fully covered as the 6 in measurement from each outside corner meets or overlaps. A corner or edge of the "frame" that is not an outside corner of the FRAME PERIMETER has no BUMPER coverage requirements. See the top right corner of the top ROBOT in Figure 9-2 for an example.

(Asked by 4611 at Feb 19th 20)

Q305 Is access/availability a consideration when accounting for IFR parts?

Q: Can a functionally identical COTS replacement part be used for the purposes of BOM accounting if the IFR part is not available for sale in my country? What if it is just inconvenient to purchase (e.g. exorbitant shipping costs, long lead times)?

A: We believe !Q119 answers your question. If it does not, please rephrase your question and resubmit. Please use the Search Q&A button on the navigation bar before posing a new question.

(Asked by 2363 at Feb 19th 20)

Q306 custom panel for starting position

Q: Our team wants to utilize a lidar system for a dynamic starting position. Unfortunately the bounding walls of the arena are constructed from polycarbonate which is transparent in the infrared range. So would it be legal to bring our own rectangular prism (probably made out of wood) and place it behind the poly carb just for the beginning set up period, to provide a reflective surface to accurately detect distance?

A: External alignment devices that do not cause a delay to the start of a MATCH, or reset of the FIELD following a MATCH, are acceptable. If use of the device causes a delay, or operation of the device creates an unsafe environment, event staff may request that its use be discontinued.

(Asked by 6918 at Feb 20th 20)

Q307 Loctite on Falcon shaft retaining screws

Q: Vex Robotics is now recommending that teams with Falcon 500s from lot date codes beginning with 19 and 20 Loctite the Falcon 500 shaft retaining screws with Loctite 243 due to a manufacturing defect (<https://www.vexrobotics.com/217-6515.html>). Would applying the Loctite per the manufacturer recommendation be considered a violation of R28?

A: Per !Q112, modification of the Falcon output shaft is a modification of the output shaft/interface and permitted per !R28-A.

(Asked by 1410 at Feb 20th 20)

Q308 West Coast Chassis Bumpers

Q: Our team is using a west coast style chassis and are getting mixed opinions on what part of the robot they have to cover with bumpers. Other have said in the past a bumper on the front and back was all that was required. Do you have to cover the open wheel sides of the robot when there is no structure to attach to,

A: Per !R17 all outside corners of the FRAME PERIMETER must be covered with at least 6 in. of BUMPER on each side of the corner, a FRAME PERIMETER side with no BUMPERS is not permitted. All BUMPER segments must be properly supported as defined in !R26.

(Asked by **5547** at Feb 20th 20)

Q310 Pneumatics Regen Circuit

Q: Are Pneumatic Regen Circuits allowed on the pneumatics system? (i.e we take the pressure vented to atmosphere from the solenoid and re-route that pressure back into the system, essentially making the pneumatics system a closed loop.)

A: There are no rules specifically prohibiting a pneumatic regeneration circuit provided it is constructed from components allowed per !R77 which meet !R75 and that all other pneumatics rules are followed (!R86-A is of particular concern with a circuit described as "closed loop").

(Asked by **313** at Feb 21st 20)

Q311 Time Between Illuminations for High Intensity Light Sources

Q: If "high intensity light sources ... may only be illuminated for a brief time" is there be a minimum time that high intensity light sources must be turned off before they may be turned on again? If our high intensity light repeatedly turns on for three seconds and then off for 10 milliseconds would that be sufficiently brief illumination to not run afoul of R8?

A: There is no specified minimum time, however note that the Blue Box in !R8 is a guideline of items that are "unsafe, cause an unsafe condition, or interfere with the operation of other ROBOTS", the final decision as to the legality of a particular ROBOT lies with the Lead Robot Inspector (LRI) at each event. ROBOT items that attempt to loophole their way out of one of the listed examples will likely still be judged to "interfere with the operation of other ROBOTS" and not be permitted.

(Asked by **401** at Feb 21st 20)

Q312 Using Star Wars copyrighted materials?

Q: We would like to request clarification on the use of intellectual property assets on team materials. Per an email sent by FIRST Marketing, teams are allowed to incorporate "Star Wars characters and elements of the galaxy" into non-sold items. What exactly constitutes an "element of the galaxy"? Does this imply that teams are allowed to use all Star Wars intellectual property assets on non-sold items (e.g. the Imperial insignia on pit decorations, ROBOT decorations, shirts, giveaways, etc.)?

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. Please contact [firstroboticscompetition@firstinspires.org](mailto: firstroboticscompetition@firstinspires.org).

(Asked by **5480** at Feb 21st 20)

Q313 Time outs used before any match or just "their" match?

Q: May an alliance call a time out prior to a match in which they are not competing? | Section 11.7.4 states " however an ALLIANCE may use their own coupon for any purpose they wish." Does this include calling a timeout prior to a match they are not in? | T2 does have language that states an alliance must call a time out within a time frame after the "GENERATOR SWITCH Clear signal preceding their MATCH". Does the "their" in that sentence require the alliance to be competing in the next match?

A: The use of "their" at the end of the first sentence of !T2 means that an ALLIANCE can only call a timeout before a MATCH in which they're competing.

(Asked by **3847** at Feb 24th 20)

Q314 Small team

Q: We are already a small rookie team getting ready for competition and our first regional is out of state. Our problem is only two member look like they will be able to attend this regional, however, we have several students from a team who has helped us including one who is a sibling who want to go to help us at our first regional. We are wondering if this is allowed or if there is any rule against it.

A: Getting help from other teams at competitions is encouraged. As long as you meet the requirements of !I1 related to ROBOT ownership and Section 4.6 related to DRIVE TEAMS, you will not be in violation by getting help. Note that the blue box in section 4.6 mentions flexibility in exceptional circumstances. If you feel you have an exceptional circumstance that would prevent you from meeting the definition of DRIVE TEAM, please send an email to Team Support at firstroboticscompetition@firstinspires.org.

(Asked by **8043** at Feb 23rd 20)

Q315 G16 and Power Cells

Q: Hello, G16. States, "Keep your BUMPERS low. BUMPERS must be in the BUMPER ZONE (see R18) during the MATCH..." What happens if a robot accidentally drives over a power cell (it happened to us yesterday during practice)? Is this an automatic violation? If you can drive right off it, does this change anything?

A: Hello!! R18 defines the BUMPER ZONE in relation to the ROBOT 'standing normally on a flat floor.' In addition, please see the blue box in R18. A ROBOT lifted off the carpet by driving over a POWER CELL will not put the ROBOT out of compliance with G16 assuming it was in compliance to start with.

(Asked by 6762 at Feb 23rd 20)

Q317 Can we bring a measuring tape to the field to set up for a match?

Q: Per the list in H1, tools like measuring devices are not allowed to be brought to the ARENA. However, the box in C7 seems to indicate that external measurements are allowed as long as they do not delay gameplay -- " (e.g. a DRIVE TEAM could bring and use a measuring tape, as long as there is no delay to the MATCH by doing so)". Are measuring devices allowed into the ARENA to position a robot during pre-match set-up?

A: H1 applies to items that can be brought to the ARENA *and* used during a MATCH; there are no rules that legislate items that can be brought to the ARENA and *won't* be used during the MATCH. Please refer to C7; it may affect if/how you use any pre-MATCH alignment devices.

(Asked by 1089 at Feb 24th 20)

Q318 Alliance Station Team Sign Team LED Dimensions

Q: According to 3.4.1.1 PLAYER STATION, the alliance station includes the following elements: One team sign and one team led. The manual states they are located at the top of the player station. What is the precise location and dimensions of these elements? I could not find this inside the official field drawings.

A: The size and location of the team LEDs, signs, and timers are not part of the ARENA specification. Generally, this equipment doesn't block more than the top 1 ft. of the PLAYER STATION window. This equipment is also visible in the [Field Tour Videos] (<https://www.youtube.com/playlist?list=PLZT9pIgNOV6aqZuX1DLzkWq8lvccwnanF>).

(Asked by 488 at Feb 24th 20)

Q319 Shipping to FIRST Championship

Q: Because there is no longer Stop Build Day, will there be an update about shipping to FIRST Championship. In the past, you were asked to ship to FIRST Championship around Tuesday following your last event. Teams qualifying later in the season have a significant advantage of access to their robot for a longer period of time if a week 1 qualifier has their robot sequestered in drayage for 5 weeks. Has this shipping schedule been updated? If so, what should we expect? Thank you.

A: The purpose of this Q&A is to answer questions regarding the rules of INFINITE RECHARGE. For questions about ROBOT shipping, please contact Team Support at firstroboticscompetition@firstinspires.org. Also, you may want to review [this blog] (<https://www.firstinspires.org/robotics/frc/blog/2020-bring-your-robot-championship>).

(Asked by 3314 at Feb 24th 20)

Q320 Rookie KOP

Q: Per R11B, a team may exclude all items from the current KOP from their \$5000 cost limit, including items in the Rookie KOP. Since veteran teams do not receive the Rookie KOP tote, may a veteran team reuse parts received in the Rookie KOP their first season and exclude them from their robot cost?

A: That's correct, all teams may exempt "rookie KOP items" even if the team was not a rookie, and therefore did not receive those items in the KOP this season. Teams may use any identical functional replacement (i.e. it does not have to be the physical item that was received in a previous rookie KOP) to meet the criteria for this exemption.

(Asked by 8262 at Feb 23rd 20)

Q321 Rule E16: Wireless USB peripherals legal in stands?

Q: Rule E16 states "No wireless communication. Teams may not set up their own 802.11a/b/g/n/ac/ax (2.4GHz or 5GHz) wireless communication (e.g. access points or ad-hoc networks) in the venue." We intend to use a wireless mouse and QR code scanner in the stands, both of which use a USB dongle that operates at 2.4GHz. Are we allowed to use these in the stands and/or pit area?

A: If these devices use one of the listed protocols they are a violation of E16 and are not permitted. If they use Bluetooth or other protocols that operate in the 2.4GHz spectrum they are permitted.

(Asked by **6829** at Feb 24th 20)

Q322 Use of 1 gallon air tank allowed?

Q: My team wants to use the 1 gallon VIAIR tank found at <https://www.viaircorp.com/air-tanks/1gallon>. It is rated at 150 psi, which satisfies R75. And air storage tanks are listed in R77.J with no size requirements specified. My concern is that all examples and discussions I have found refer to the smaller tanks, such as those made by Clippard. Can you confirm that use of this larger, metal tank is consistent with the rules?

A: We cannot rule absolutely on the legality of specific ROBOT COMPONENTS, and the final decision as to legality of a particular COMPONENT lies with the Lead ROBOT Inspector (LRI) at each event. However, you are correct that the rules do not limit the size of pneumatic storage tanks.

(Asked by **1649** at Feb 25th 20)

Q323 Is Pneumatic Pre-Charging Allowed

Q: R80 requires pressurized air to be supplied on-board. But two rules seem to indicate that the storage tanks may be charged prior to the start of a match. R39.A lists "compressed air stored in the pneumatic system that has been charged in compliance with R79 and R80" as an allowable source of energy that "has been stored at the start of a match". And Section 4.6 lists one of the technician's jobs as "charging pneumatics". May storage tanks be charged before the match begins?

A: Yes, storage tanks may be charged before the MATCH begins.

(Asked by **1649** at Feb 25th 20)

Q324 Use of large pneumatic cylinders

Q: R77 allows "Pneumatic cylinders, pneumatic linear actuators, and rotary actuators". And R75.B requires items to be rated at least 70 psi when installed downstream. I don't see any other rules addressing the size and power of pneumatic actuators. Our design includes two 2-inch diameter pneumatic pistons, each with a throw of 24 inches. The are manufactured by Bimba and meet the 70 psi requirement. Are these components compliant with the rules?

A: We cannot rule absolutely on the legality of specific ROBOT COMPONENTS, and the final decision as to legality of a particular COMPONENT lies with the Lead ROBOT Inspector (LRI) at each event. However, you are correct that the rules do not limit the size of pneumatic actuators.

(Asked by **1649** at Feb 25th 20)

Q325 G17 Clarification

Q: G17 gives an exception for ROBOTS intersecting their ALLIANCE'S RENDEZVOUS POINT during the ENDGAME. Does this mean any part of the robot, even extensions beyond the frame perimeter? Most other rules have to do with bumper intersections, but this one states ROBOT instead. If indeed it is any part of the robot, is it a vertical projection like with bumpers or contact within the rendezvous point?

A: Yes, ROBOT means any part of the ROBOT. The RENDEZVOUS POINT is defined as an infinitely tall volume so intersection with it can occur at any height.

(Asked by **694** at Feb 25th 20)

Q326 Task coach is allowed to perform

Q: Our team is and new veteran team made up of 3 students in total, our drive coach is a former FRC driver that is in college. We do not have the ability to have 2 drivers, a human player and a technician. We are concerned with loading and unloading to/from the field with out the added personnel. Can the college student coach assist the high school students in bringing the robot on/off the field? Can this person setup/disconnect the driver's console before/after the match?

A: There are no rules that prohibit a COACH from 1) helping load the ROBOT on the FIELD and prepare it for its MATCH and 2) helping setup/remove the OPERATOR CONSOLE outside the MATCH. Please have your COACH pay particular attention to !H4 and !H7 for restrictions *during* the MATCH.

(Asked by **4420** at Feb 26th 20)

Q327 Continuous Rotation Servo

Q: Are continuous rotation servos, such as the REV Robotics REV-41-1097 legal for use in FRC?

A: Specific servos and features are not allowed/prohibited. Table 9-1 specifies that "PWM COTS servos with a retail cost < \$75." If a servo does not meet those criteria, it's not permitted.

(Asked by **4466** at Feb 28th 20)

Q328 Control Panel Manipulation

Q: Is it legal to rotate the control panel disk by putting a wheel on top of the control panel disk instead of on the outside edge of the disk?

A: There is no specified way to interact with the CONTROL PANEL.

(Asked by **2523** at Feb 27th 20)

Q329 Exceptions to R76

Q: Can the clevis attachment threads on the end of a piston be filed if there is no clevis attachment?

A: Filing of attachment threads is not one of the exceptions in !R76 and is not permitted. Please see the blue box under !R76 for further details.

(Asked by **291** at Mar 2nd 20)

Q330 Power cell compression

Q: What is the standard deviation for power cells from normal? What is considered a good power cell?

A: We believe !Q136 answers your question. If it does not, please rephrase your question and resubmit. Please use the Search Q&A button on the navigation bar before posing a new question.

(Asked by **5436** at Mar 2nd 20)

Q331 Can you make a card to facilitate connections on roborio

Q: Is it possible that you want to make the card to facilitate connections on roborio?

A: As indicated in !R14-D: "passive PCBs such as those used to adapt motor terminals to connectors are considered connectors" and therefore comply with !R68 and !R69. Any custom board or "card" with active components could not be used to connect the devices specified in !R68 or !R69.

(Asked by **7444** at Mar 2nd 20)

Q332 Colors on the robot

Q: We are using red bumper material on our robot as a chute and I was wondering if this would be a problem when identifying what team color our robot is?

A: There are no rules prohibiting the use of BUMPER fabric on other areas of the ROBOT.

(Asked by **6484** at Mar 2nd 20)

Q333 Pneumatic Valves

Q: Per R77, may a team configure legal solenoid valves in a manner such that their "OFF" position pressurizes a pneumatic actuator, rather than requiring the valve to be energized by the PCM for actuator pressurization?

A: There are no rules against this.

(Asked by **8262** at Mar 2nd 20)

Q334 G14 and G15 -- transitively through robots?

Q: G14 and G15 prohibit contact "transitively through a POWER CELL" with robots entirely in the Rendezvous Point or contacting the Generator Switch. In those rules is a power cell merely just an example of prohibited transitive contact? For example, could Blue Robot 1 push Red Robot 2?

(which is not entirely in the RP) into Red Robot 3 (which is entirely in the RP) without violating this rule since there was no power cell involved?

A: !G14 and !G15 specify transitive contact through POWER CELLS. Transitive contact through other ROBOTS is not a violation.

(Asked by **5607** at Mar 3rd 20)

Q335 Soft guards on bumpers

Q: In effort to relieve the destruction of PCs we are looking to add a "soft" member beneath the bumper (AKA a brush) that would be fixed in place with the "soft" portion extending beyond the noodles to dissuade PCs from entering under the bumpers Below the 1" max for any "hard" parts Fig 9-6 of the manual is met Noodles/wood would still be covered (but not the attachment) R24 D is met R23 weight restriction is met Is this an acceptable build to be considered part of the bumpers and not the frame

A: No, a brush is not a described part of the BUMPERS per !R24 and is therefore not permitted.

(Asked by **4549** at Mar 3rd 20)

Q336 Robot cart usage while on the field

Q: Would we be allowed to utilize a small cart(like a furniture dolly or hand truck) to help transport the robot on/off the field, in addition to through the gates, provided that rule C7 is not violated?

A: There are no rules prohibiting this.

(Asked by **469** at Mar 5th 20)

Q337 H1 and ROBOT mounted passive signaling devices

Q: H1 prohibits the use of passive signaling devices in the ARENA by DRIVE TEAMS that, to a reasonably astute observer, mimic the vision targets used on the FIELD. Does this restriction also prohibit such devices mounted on a ROBOT?

A: !H1 does not restrict the use of such a device on a ROBOT. !R8 (specifically !R8-C) does restrict the use of devices or decorations on a ROBOT such as those that mimic the retro-reflective features of vision targets used on the FIELD.

(Asked by **900** at Mar 5th 20)

Q338 2019 formatted code in 2020?

Q: Are we allowed to use wpilib library 2019 for the 2020 frc game?

A: There are no rules that require a specific version of WPILib. To ask questions about how this would work, please visit the [FIRST Forums] (<https://forums.firstinspires.org/forum/general-discussions/first-programs/first-robotics-competition>).

(Asked by **8262** at Mar 9th 20)

Q339 Are electro magnets legal?

Q: Can we use electro magents to hold our intake system in an upright position so it stays inside the frame restrictions?

A: An electromagnet that operates without causing readily discernible motion would not be considered an actuator and would therefore not need to meet the requirements of !R27. Such a device would be considered a CUSTOM CIRCUIT, and must follow all the rules required of that classification.

(Asked by **8399** at Mar 9th 20)

Q340 Bumper/Ball Sanitation

Q: Would we be allowed to apply ample amounts of sanitizer to bumpers and or power cells, in order to ensure proper sanitation of the field?

A: Teams may use sanitizers on their ROBOT BUMPERS if they do not leave a residue, but there will be no opportunity to sanitize individual POWER CELLS. As always teams may wear gloves when handling their ROBOT or POWER CELLS.

(Asked by **469** at Mar 11th 20)