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VEX ROBOTICS COMPETITION

CHANGE UP

2020 - 2021
Game Manual

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Introduction

Overview

This section provides an introduction to the VEX Robotics Competition and VRC Change Up.

The VEX Robotics Competition

Our world faces a serious problem. It's a problem that, without explicit and intentional action, will eventually stagnate global progress and lead to a workforce that is unmotivated and ill-equipped to solve its future problems. As the world grows more technologically complex, the challenges we face every day will continue to escalate along with it. A cell phone has more failure modes than a landline. The internals of an electric car are more difficult to comprehend than a V8 combustion engine. Unmanned drone legislation is more nuanced than defining a maximum speed limit.

Dubbed "the STEM problem", the situation is equally simple to understand, yet difficult to solve. In many cases, the traditional methods of teaching science, technology, engineering, and math (STEM) will not be enough to adequately prepare students for this complex world. This is often coupled with the unfortunate reality that by the time they reach an age capable of grasping these critical topics, students may have already determined that they are "not cool" or "boring". Without the skills or passion necessary to approach these problems in an educated manner, you cannot possibly expect to be productive in making forward progress or even sustaining the status quo.

The VEX Robotics Competition exists to solve this problem. Through its uniquely engaging combination of teamwork, problem solving, and scientific discovery, the study of competitive robotics encompasses aspects of STEM. You're not building VEX V5 robots because your future job will involve tightening shaft collars on a metal bar – you're executing an engineering design and problem-solving process that resembles the same mindset used by rocket scientists, brain surgeons, and inventors around the world. VEX Robotics Competition Change Up is not just a game that we invented because it is fun to play – it is a vehicle for teaching (and testing) teamwork, perseverance in the face of hardship, and provides a methodology to approach and solve new challenges with confidence.

Contained in this manual are the rules that shape VRC Change Up. These rules are designed to simulate the constraints that will outline any real-world project. They are intended to promote creativity without punishing innovation. They are balanced to promote fair play while encouraging competition.

We encourage you to keep in mind that a VEX Robotics Competition game is more than just a set of game objects worth varying amounts of points. It is an opportunity to hone the life-long skills that will characterize the problem-solving leaders of tomorrow.

Good luck, and we'll see you on the playing field!

Sincerely,

The VEX Robotics Game Design Committee, comprised of members from the Robotics Education & Competition Foundation, DWAB Technology, and VEX Robotics.

VEX Robotics Competition Change Up: A Primer

VEX Robotics Competition Change Up is played on a 12'x12' square field configured as seen below. Two (2) *Alliances* - one (1) "red" and one (1) "blue" - composed of two (2) *Teams* each, compete in *Matches* consisting of a fifteen second (0:15) *Autonomous Period*, followed by a one minute and forty-five second (1:45) *Driver Controlled Period*.

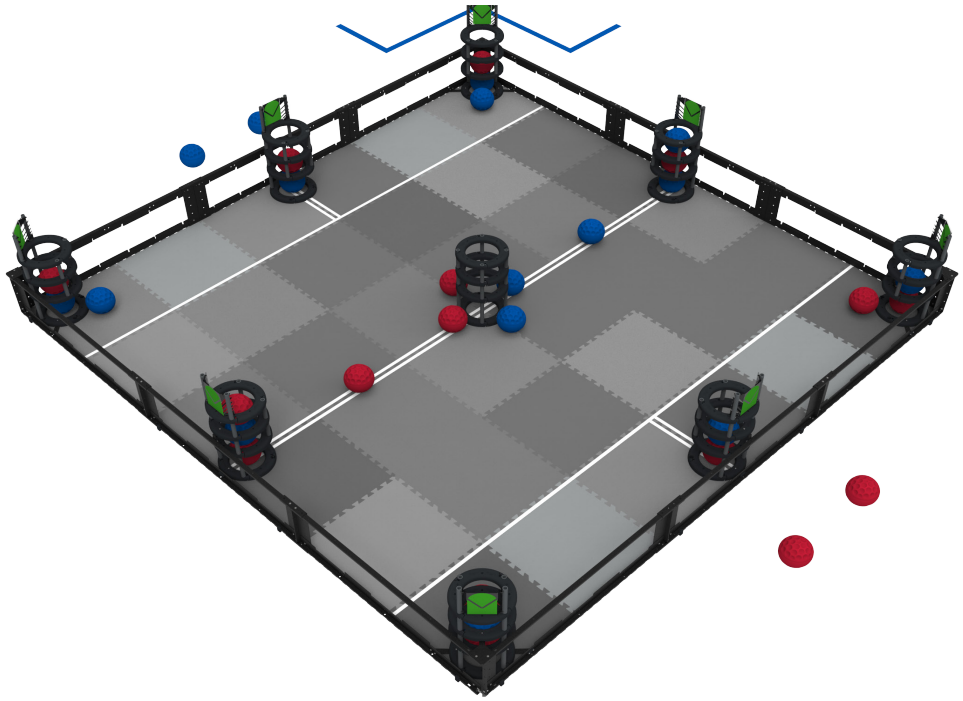
The object of the game is to attain a higher score than the opposing *Alliance* by Scoring *Balls* and *Connecting Rows*.

For more details and specific game-play rules, see "Section 2" – The Game.

For more information about VEX, visit www.vexrobotics.com. Follow us on Instagram, Twitter or Snapchat @VEXRobotics. Like us on Facebook at www.facebook.com/vexrobotics.

For more information about the Robotics Education & Competition Foundation, visit www.roboticseducation.org. Follow us on Twitter @REC_Foundation. Like us on Facebook at www.facebook.com/RECFoundation.

Visit www.RobotEvents.com for more information about the VEX Robotics Competition, including team registration, event listings, and results.



Section 2
The Game

Overview

This section describes the 2020-2021 VEX Robotics Competition game entitled VEX Robotics Competition Change Up. It also lists the game definitions and game rules.

Game Description

Matches are played on a field set up as illustrated in the figures throughout. Two *Alliances* – one "red" and one "blue" – composed of two *Teams* each, compete in each *Match*. The object of the game is to attain a higher score than the opposing *Alliance* by Scoring *Balls* and *Connecting Rows*.

An Autonomous Win Point is awarded to any *Alliance* that completes a *Connected Row* using their *Alliance* Home Row at the end of the *Autonomous Period*.

A point bonus is awarded to the *Alliance* that has the most points at the end of the *Autonomous Period*.

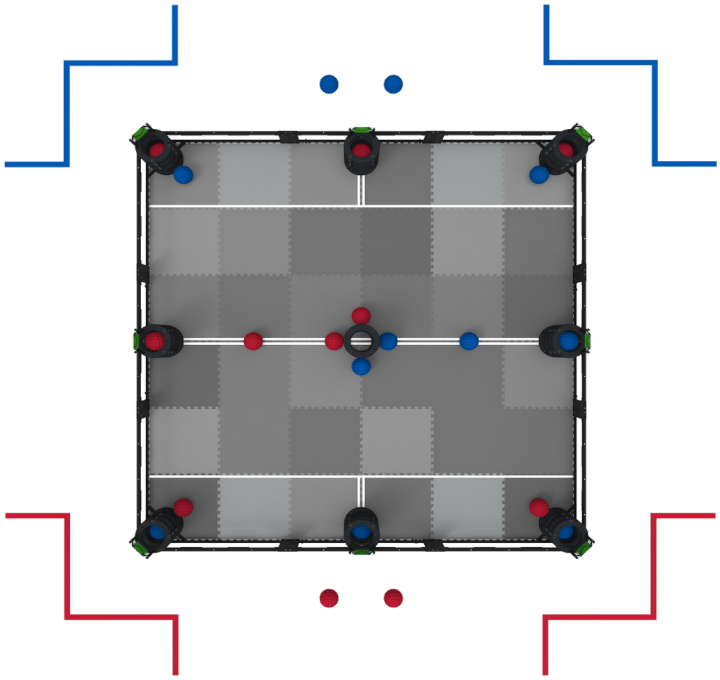


Figure 1: Top view of the field in its initial setup configuration.

*Note: The illustrations in this section of the manual are intended to provide a general visual understanding of the game. **Teams** should refer to official field specifications, found in Appendix A, for exact field dimensions, a full field bill of materials, and exact details of field construction.*

The VEX Robotics Competition Change Up field consists of the following:

- Thirty-two (32) *Balls*
  - Sixteen (16) red *Balls*, including two (2) used as *Preloads* by the red *Alliance*
  - Sixteen (16) blue *Balls*, including two (2) used as *Preloads* by the blue *Alliance*
- Nine (9) *Goals*, used for Scoring *Balls*

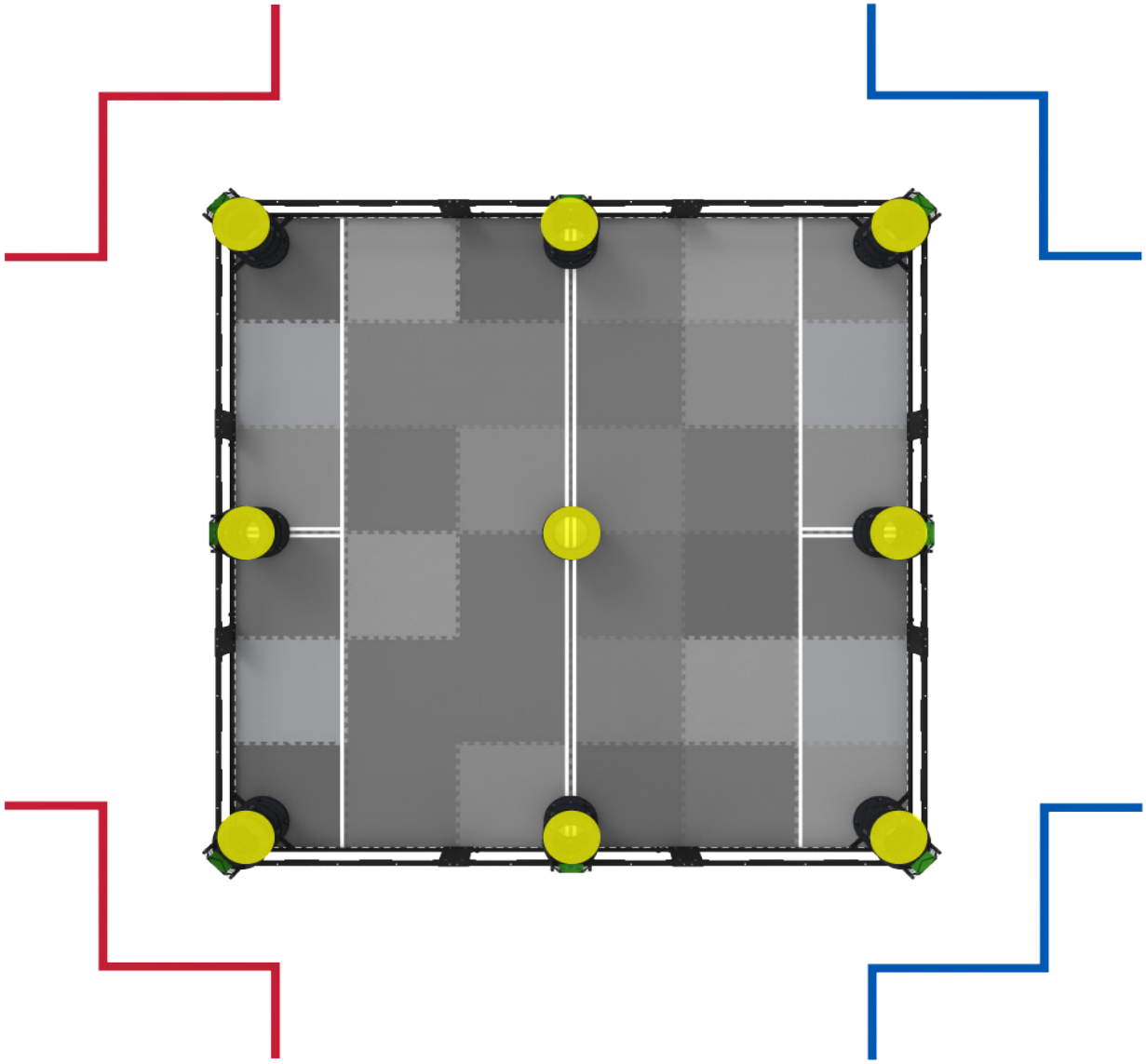


Figure 2: Top view of the field with **Goals** *highlighted.*

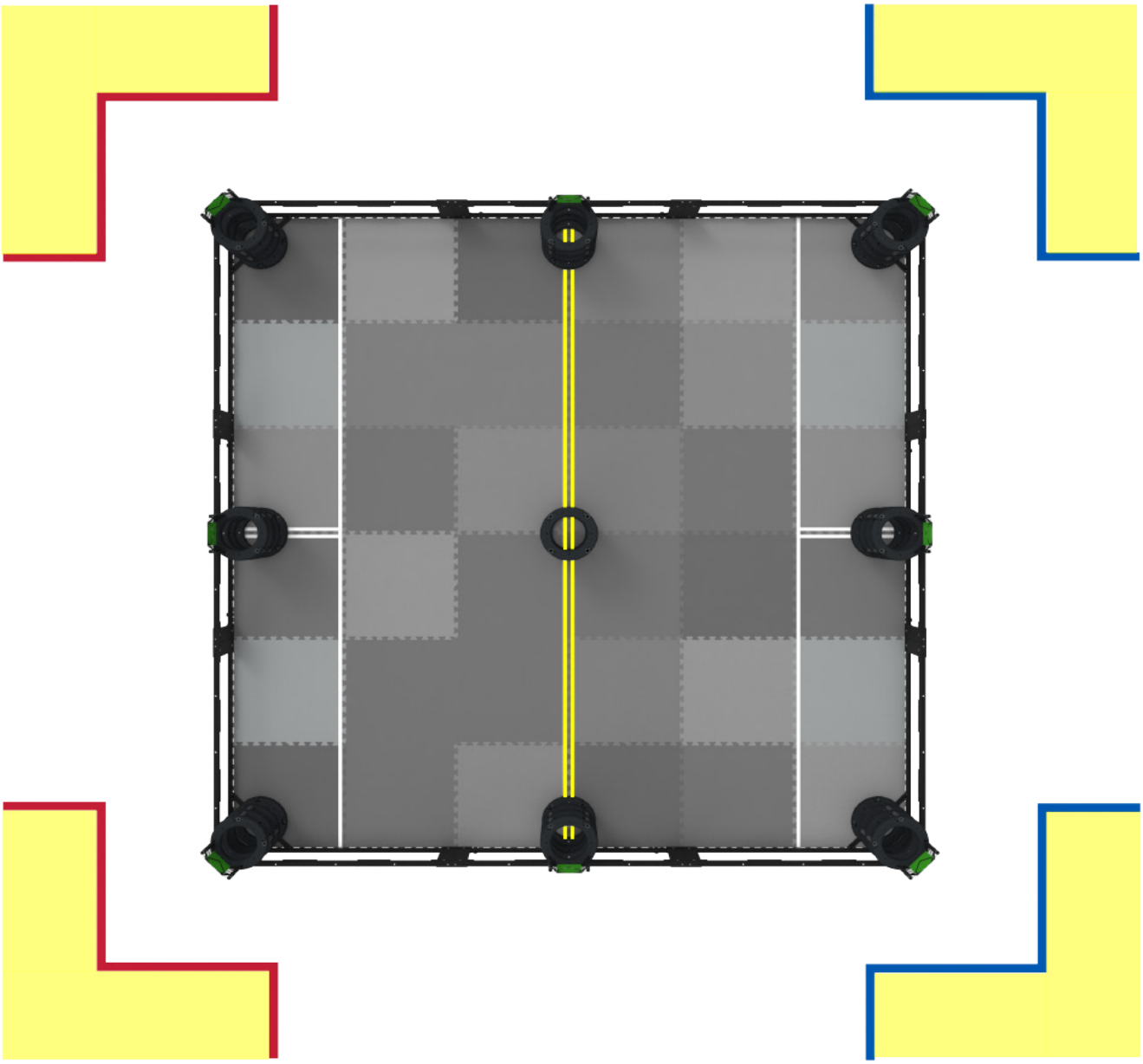


Figure 3: Top view of the field with ***Alliance Stations*** *and* ***Autonomous Line*** *highlighted.*

Game Definitions

Adult – Anyone who is not a *Student*.

Alliance – A pre-assigned grouping of two (2) *Teams* that are paired together during a given *Match*.

Alliance Home Row – The three (3) *Goals* in each *Alliance's Home Zone.*

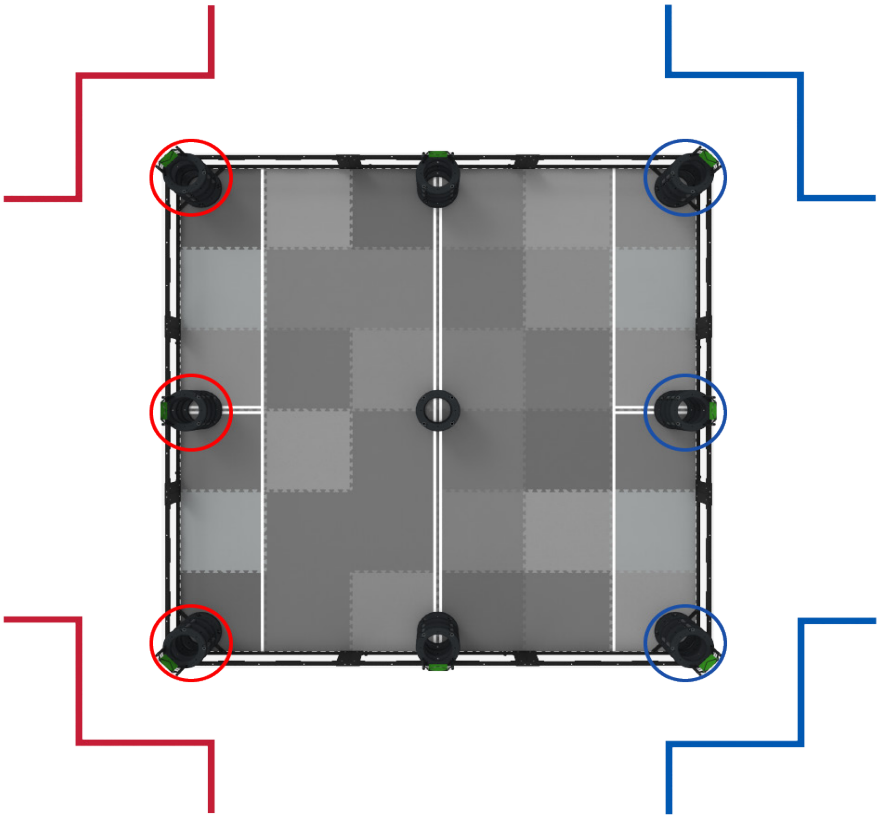


Figure 4: Top view of the field with Home Row ***Goals*** *highlighted.*

Alliance Station – The designated regions where the *Drive Team Members* must remain for the duration of the *Match*.

Autonomous Bonus - A point bonus of six (6) points awarded to the *Alliance* that has earned the most points at the end of the *Autonomous Period*.

Note: If the *Autonomous Period* ends in a tie, including a zero-to-zero tie, each *Alliance* will receive an *Autonomous Bonus* of three (3) points.

Autonomous Line – The pair of white tape lines that run across the center of the field. Per <SG2>, *Robots* may not contact the foam field tiles on the opposite *Alliance's* side of the *Autonomous Line* during the *Autonomous Period*.

Ball – A hollow plastic spherical-shaped, dimpled object, with a diameter of 6.3" (160mm), that can be Scored in *Goals*.

*Figure 5: A **Ball***

Builder – The *Student*(s) on the *Team* who assemble(s) the *Robot*. An *Adult* cannot be the *Builder* on a *Team*. *Adult* are permitted to teach the *Builder* associated concepts, but may never be working on the *Robot* without the *Builder* present and actively participating.

Connected Row – A *Row* where all three (3) *Goals* in the *Row* are *Owned* by the same *Alliance*.

Designer – The *Student*(s) on the *Team* who design(s) the *Robot* to be built for competition. An *Adult* cannot be the *Designer* on a *Team*. *Adults* are permitted to teach the *Designer* associated concepts, but may never be working on the design of the *Robot* without the *Designer* present and actively participating.

Disablement – A penalty applied to a *Team* for a rule violation. A *Team* that is Disabled is not allowed to operate their *Robot* for the remainder of the *Match*, and the *Drive Team Members* will be asked to place their controller(s) on the ground.

Disqualification – A penalty applied to a *Team* for a rule violation. A *Team* that is Disqualified in a Qualification *Match* receives zero (0) *Win Points*, *Autonomous Win Point*, *Autonomous Points*, and *Strength of Schedule Points*. When a *Team* is Disqualified in an Elimination Match, the entire *Alliance* is Disqualified and they receive a loss for the *Match*. At the Head Referee's discretion, repeated violations and *Disqualifications* for a single *Team* may lead to its *Disqualification* for the entire tournament. (see *<T11>*)

Drive Team Member(s) – A *Student* who stands in the *Alliance Station* during a *Match* for each *Team* per <G7> . Only *Drive Team Members* are permitted to stand in the *Alliance Station* and allowed to touch the controls during the *Match* or interact with the *Robot* as per *<G9>*. *Adults* are not allowed to be *Drive Team Members*.

Entanglement – A *Robot* status. A *Robot* is Entangled if it has grabbed, hooked, or attached to an opposing *Robot* or a *Field Element*.

Field Element– The foam field tiles, field perimeter, white tape, *Goal*, and all supporting structures or accessories (such as driver station posts, field monitors, etc).

Goal - One of nine (9) cylinders in which *Robots* can Score and remove *Scored Balls*. The *Goals* are all 18.41" (467.6mm) tall and have an inside diameter of 7.02" (178.3mm). The *Goal* consists of four (4) retaining rings and four (4) PVC pipes. The outer edge of the ring is considered to be the outer edge of the *Goal*. The upper edge of the top ring is considered to be the upper edge of the *Goal*.

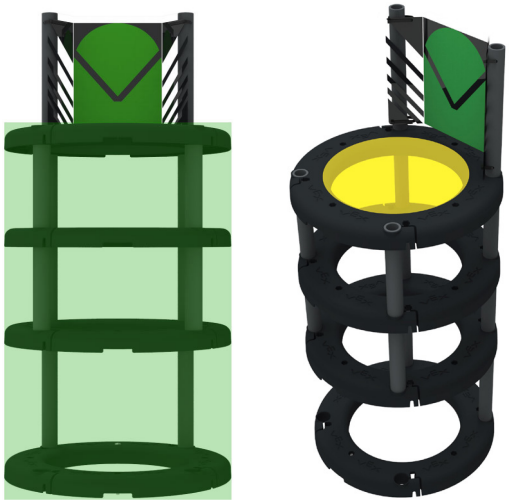


Figure 6: Close-up of a **Goal***, depicting the outer and upper edges of the* **Goal***.*

Home Zone – One of two (2) areas, one (1) for each *Alliance*, where *Robots* start the match and defines the location of the *Alliance Home Row*. The *Home Zones* are defined by the inner edges of the field perimeter and the outer edge of the tape line that runs across the field adjacent to the *Alliance Stations*, i.e. the tape line is part of the *Home Zone*. The *Alliance Home Zone* is closest to their *Alliance Stations* The *Home Zone* refers to the foam field tiles; it is not a 3-dimensional volume.

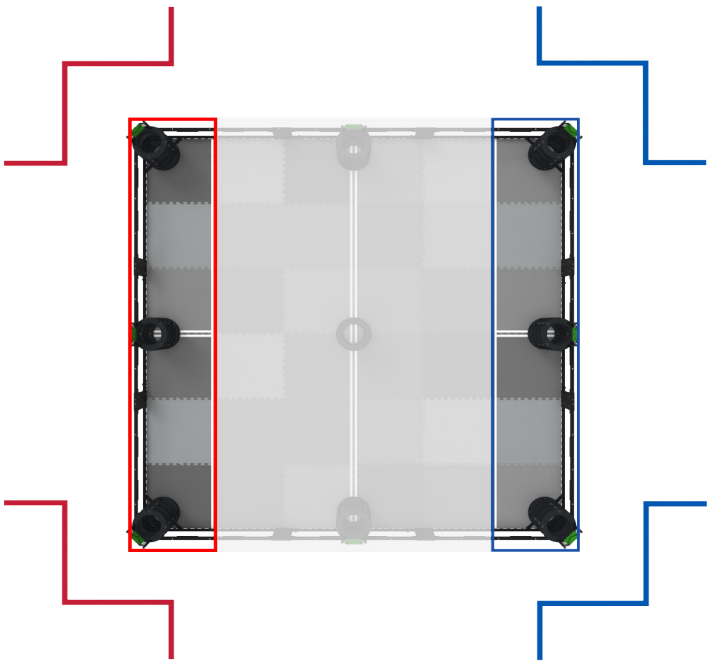


Figure 7: Top view of the field, with the **Home Zone** *highlighted.*

Match – A *Match* consists of an *Autonomous Period* followed by a *Driver Controlled Period* for a total time of two minutes (2:00).

- **Autonomous Period** – A fifteen second (0:15) time period during which *Robots* operate and react only to sensor inputs and to commands pre-programmed by the *Students* into the *Robot* control system.
- **Driver Controlled Period** – The one minute and forty-five second (1:45) time period during which *Drive Team Members* operate their *Robots*.

Match Affecting – A rule violation status determined by the head referee. A rule violation is *Match Affecting* if it changes the winning and losing *Alliances* in the *Match*. Multiple rule violations within a *Match* can cumulatively become *Match Affecting*.

Owned - A *Goal* status. A *Goal* is considered *Owned* by an *Alliance* if its colored *Ball* is the vertically highest *Scored Ball* in that *Goal*.

*Figure 8: This **Goal** is **Owned** by the blue **Alliance**, as the top-most **Ball** is completely within the upper edge of the **Goal**.*

*Figure 9: This **Goal** is owned by the Red **Alliance**, as the top-most **Ball** is not completely within the upper edge of the **Goal**. The top red **Ball** is **Scored** because it is below the upper edge of the **Goal**.*

*Figure 10: This **Goal** is owned by the Blue **Alliance**, as the top-most **Ball** is not completely within the upper edge of the **Goal**. The two bottom-most **Balls** would both be considered **Scored**, as they are partially within the outer edge of the **Goal***

Possession – A *Robot* is considered to be *Possessing* a *Ball* if a *Ball* is in an unscored position and any one of the following criteria are met:

- The *Robot* is carrying, holding or controlling the movement of a *Ball* such that if the *Robot* changes direction, the *Ball* will move with the *Robot*. Pushing/plowing *Balls* is not considered *Possession*, however using concave portions of your *Robot* to control the movement of *Balls* is considered *Possession*.
- The *Robot* is blocking opposing *Robots*' access to *Balls*, such as by expanding horizontally and restricting access to a portion of the field (e.g. a "wallbot").
- *Robots* on the same *Alliance* working in tandem to block access to *Balls* would share the *Possession* of the *Balls*.

See <SG8> for more details regarding Possession limits.

Note: *Balls* that are *Scored* in *Goals* cannot be considered Possessed until the *Robot* removes the *Ball* from that *Scored* position and is carrying, holding, controlling or blocking opposing Robots' access to that *Ball*.

Preload– The *Ball*, one (1) per *Robot*, that must be placed on the field such that it satisfies the conditions in *<SG1>* prior to the start of the *Match*.

Note: The red *Alliance* always uses red *Balls* as their *Preloads*. The blue *Alliance* always uses blue *Balls* as their *Preloads*.

Programmer – The *Student(s)* on the *Team* who write(s) the computer code that is downloaded onto the *Robot*. An *Adult* cannot be the *Programmer* on a *Team*. *Adults* are permitted to teach the *Programmer* associated concepts, but may never be working on the code that goes on the *Robot* without the *Programmer* present and actively participating.

Robot – A machine that has passed inspection, designed to execute one or more tasks autonomously and/or by remote control from a human operator.

Row - Three (3) *Goals* that make up a straight line. There are a total of eight (8) *Rows* including two (2) Alliance Home Rows.

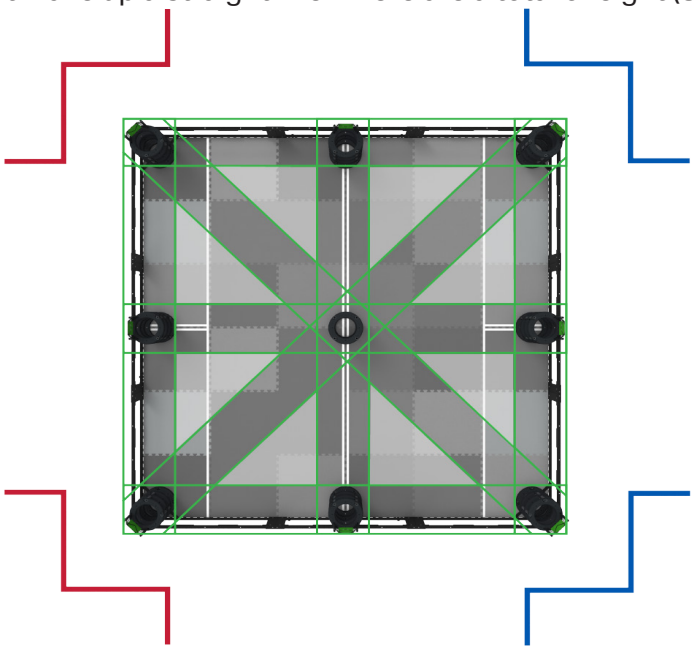


Figure 11: Top view of the field, with the 8 possible Connected ***Row*** *options highlighted*

Scored - A *Ball* status. A *Ball* is considered *Scored* in a *Goal* if it is not touching a *Robot* of the same color as the *Ball* and meets all of the following criteria.

- The *Ball* is fully or partially within the outer edge of the *Goal*.
- The *Ball* is fully below the upper edge of the *Goal*.
- The *Ball* is not contacting the foam tiles outside of the *Goal*.

Note: In the act of removing a *Ball* from the bottom of a *Goal* with three *Scored Balls* inside, it is possible for the top *Ball* to momentarily break criteria 2 above. If this occurs at the end of the *Match*, this *Ball* should still be considered *Scored*. The intent of this note is to avoid unintended de-scoring via the top of the *Goal*. The intent is not to encourage *Teams* to seek unique scenarios that would not typically be considered *Scored*. This would be considered a violation of rule *<SG5>*.

*Figure 12: Close-up of a **Goal**, depicting the volume in which a **Ball** would be considered **Scored**.*

Student - A person is considered a *Student* if he or she meets both of the following criteria:

1. Anyone who is earning or has earned credit toward a high school diploma/certificate or its equivalent during the six (6) months preceding the VEX Robotics World Championship. Courses earning credits leading up to high school would satisfy this requirement.
2. Anyone born after May 1, 2001 (i.e. who will be 19 or younger at VEX Worlds 2021). Eligibility may also be granted based on a disability that has delayed education by at least one year.

- **Middle School Student** - A *Student* born after May 1, 2005 (i.e. who will be 15 or younger at VEX Worlds 2021). *Middle School Students* may "play up" and compete as a *High School Student.*

- **High School Student** - Any eligible *Student* that is not a *Middle School Student*.

Team - One or more *Students* make up a *Team*. A *Team* is classified as a Middle School *Team* if all members are *Middle School Students*. A *Team* is classified as a High School *Team* if any of its members are *High School Students*, or made up of *Middle School Students* who declare themselves "playing up" as *High School Students* by registering their *Team* as a High School *Team*.

Once declared and playing as a High School *Team*, that *Team* may not change back to a Middle School *Team* for the remainder of the season. *Teams* may be associated with schools, community/youth organizations, or a group of neighborhood *Students*.

Trapping – A *Robot* status. A *Robot* is *Trapping* if it has restricted an opposing *Robot* into a small, confined area of the field, approximately the size of one foam field tile or less, and has not provided an avenue for escape. *Trapping* can be direct (e.g. pinning an opponent to a field perimeter wall) or indirect (e.g. preventing a *Robot* from escaping from a corner of the field).

Note: If a *Robot* is not attempting to escape, that *Robot* has not been Trapped.

Scoring

- A *Ball Scored* in a *Goal* is worth one (1) point for the *Alliance* of the color of the *Ball*.
- A *Connected Row* is worth six (6) points for that *Alliance*.
- The winner of the Autonomous Bonus receives a six (6) point bonus. In the case of a tie, both *Alliances* receive a three (3) point bonus.

Safety Rules

<S1> Be safe out there. If at any time the *Robot* operation or *Team* actions are deemed unsafe or have damaged any *Field Elements* or Game Objects, the offending *Teams* may be Disabled and/or Disqualified at the discretion of the *Head Referee*. The *Robot* will require re-inspection before it may take the field again.

<S2> Stay inside the field. If a *Robot* is completely out-of-bounds (outside the playing field), it will be Disabled for the remainder of the *Match*.

Note: The intent is NOT to penalize *Robots* for having mechanisms that inadvertently cross the field perimeter during normal game play.

<S3> Wear safety glasses. All *Drive Team Members* must wear safety glasses or glasses with side shields while in the *Alliance Stations* during *Matches*. While in the pit area, it is highly recommended that all *Team* members wear safety glasses.

General Game Rules

<G1> Treat everyone with respect. All *Teams* are expected to conduct themselves in a respectful and professional manner while competing in VEX Robotics Competition events. If a *Team* or any of its members (*Students* or any *Adults* associated with the *Team*) are disrespectful or uncivil to event staff, volunteers, or fellow competitors, they may be Disqualified from a current or upcoming *Match*. *Team* conduct pertaining to <G1> may also impact a *Team's* eligibility for judged awards. Repeated or extreme violations of <G1> could result in a *Team* being Disqualified from an entire event, depending on the severity of the situation.

Robotics competitions often induce intense, high stress situations. These are good opportunities to model and/or gain experience in handling these situations in a positive and productive manner. It is important that we all exhibit maturity and class when dealing with any difficult situations that may present themselves in both the VEX Robotics Competition and our lives in general.

This rule exists alongside the REC Foundation Code of Conduct. Violation of the Code of Conduct can be considered a violation of <G1> and can result in *Disqualification* from a current *Match*, an upcoming *Match*, an entire event, or (in extreme cases) an entire competition season. The Code of Conduct can be found at https://www.roboticseducation.org/competition-teams/vex-robotics-competition

For the 2020-2021 season, some events may establish additional Health & Safety guidelines beyond the scope of this Game Manual. These guidelines will be communicated to all *Teams* in advance via Health & Safety notes associated with the event registration in RobotEvents. All *Teams* (including *Students* or any *Adults* associated with the *Team*) must abide by these guidelines as written. Violation of an event-specific Health & Safety rule may be considered a violation of <G1> and/or the REC Foundation Code of Conduct.

<G2>VRC is a student-centered program. *Adults* may assist *Students* in urgent situations, but *Adults* may never work on or program a *Robot* without Students on that *Team* being present and actively participating. *Students* must be prepared to demonstrate an active understanding of their *Robot's* construction and programming to judges or event staff.

Some amount of *Adult* mentorship, teaching, and/or guidance is an expected and encouraged facet of VEX competitions. No one is born an expert in robotics! However, obstacles should always be viewed as teaching opportunities, not tasks for an *Adult* to solve without *Students* present and actively participating.

When a mechanism falls off, it is...
...okay for an *Adult* to help a *Student* investigate why it failed, so it can be improved.
...not okay for an *Adult* to put the *Robot* back together.

When a *Team* encounters a complex programming concept, it is...
...okay for an *Adult* to guide a *Student* through a flowchart to understand its logic.
...not okay for an *Adult* to write a pre-made command for that *Student* to copy/paste.

During *Match* play, it is...
...okay for an *Adult* to provide cheerful, positive encouragement as a spectator.
...not okay for an *Adult* to explicitly shout step-by-step commands from the audience.

This rule operates in tandem with the REC Foundation Student Centered Policy, which is available on the REC Foundation website for *Teams* to reference throughout the season:

https://www.roboticseducation.org/documents/2019/08/student-centered-policy-rec-foundation.pdf/

Violation of this rule could be considered a violation of <G1> and/or the REC Foundation Code of Conduct.

<G3> Use common sense. When reading and applying the various rules in this document, please remember that common sense always applies in the VEX Robotics Competition.

<G4> Robots begin the Match in the starting volume. At the beginning of a *Match*, each *Robot* must be smaller than a volume of 18" (457.2 mm) long by 18" (457.2 mm) wide by 18" (457.2 mm) tall. Using *Field Elements*, such as the field perimeter wall, to maintain starting size is only acceptable if the *Robot* would still satisfy the constraints of <R5> and pass inspection without the *Field Element*. *Robots* in violation of this limit will be removed from the field prior to the start of the *Match*, at the *Head Referee's* discretion.

<G5> Keep your Robots together. *Robots* may not intentionally detach parts during the *Match* or leave mechanisms on the field.

Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion. Multiple intentional infractions may result in *Disqualification* for the entire competition.

<G6> The Robot must represent the skill level of the Team. Each *Team* must include Drivers, *Programmer*(s), *Designer*(s), and *Builder*(s). No *Student* may fulfill any of these roles for more than one VEX Robotics Competition *Team* in a given competition season. *Students* may have more than one role on the *Team*, e.g. the *Designer* can also be the *Builder*, the *Programmer* and a Driver.

a. *Team* members may move from one *Team* to another for non-strategic reasons outside of the *Team's* control.
   i. Examples of permissible moves may include, but are not limited to, illness, changing schools, conflicts within a *Team*, or combining / splitting *Teams*.
   ii. Examples of strategic moves in violation of this rule may include, but are not limited to, one *Programmer* "switching" *Teams* in order to write the same program for multiple *Robots*, or one *Student* writing the Engineering Notebook for multiple *Teams*.
   iii. If a *Student* leaves a *Team* to join another *Team*, <G6> still applies to the *Students* remaining on the previous *Team*. For example, if a *Programmer* leaves a *Team*, then that *Team's Robot* must still represent the skill level of the *Team* without that *Student*. One way to accomplish this would be to ensure that the *Programmer* teaches or trains a "replacement" *Programmer* in their absence.

b. When a *Team* qualifies for a Championship event (e.g., States, Nationals, Worlds, etc) the *Students* on the team attending the Championship event are expected to be the same *Students* on the *Team* that was awarded the spot. *Students* can be added as support to the *Team*, but may not be added as Drivers or *Programmers* for the team.
   i. An exception is allowed if one (1) Driver and/or one (1) *Programmer* on the *Team* cannot attend the event. The *Team* can make a single substitution of a Driver or *Programmer* for the Championship event with another *Student*, even if that *Student* has competed on a different *Team*. This *Student* will now be on this new *Team* and may not substitute back to the original *Team*.

Violations of this rule will be evaluated on a case-by-case basis, in tandem with the REC Foundation Student Centered Policy as noted in <G2>, and the REC Foundation Code of Conduct as noted in <G1>.

Event Partners should bear in mind <G3>, and use common sense when enforcing this rule. It is not the intent to punish a *Team* who may change *Team* members over the course of a season due to illness, changing schools, conflicts within a *Team*, etc. *Event Partners* and referees are not expected to keep a roster of any *Students* who has ever driven for a day. This rule is intended to block any instance of loaning or sharing *Team* members for the sole purpose of gaining a competitive advantage.

<G7> Only Drivers, and only in the Alliance Station. During a *Match*, each *Team* may have up to three (3) *Drive Team Members* in their *Alliance Station* and all *Drive Team Members* must remain in their *Alliance Station* for the duration of the *Match*. *Drive Team Members* are not allowed to use any sort of communication devices while in the *Alliance Station*. Devices with communication features turned off (e.g. a phone in airplane mode) are allowed.

Note 1: *Drive Team Members* are the only *Team* members that are allowed to be in the *Alliance Station* during a *Match*.

Note 2: During a *Match*, *Robots* may be operated only by the *Drive Team Members* and/or by software running on the *Robot's* control system, in accordance with <R28> and <G8>. Violations or refusal to comply with this rule could be considered a violation of <G1> and is up to the discretion of the *Head Referee*.

<G8> Controllers must stay connected to the field towers. Prior to the beginning of each *Match*, *Drive Team Members* must plug their VEXnet Joystick or V5 Controller into the VEXnet Field Controller's Cat-5 cable via their controller's competition port. This cable must remain plugged in for the duration of the *Match*, and may not be removed until the "all-clear" has been given for *Drive Team Members* to retrieve their *Robots*.

Minor violations of these rules that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

Note: The intent of this rule is to ensure that *Robots* abide by commands sent by the tournament software. Temporarily removing the cable to assist with mid-Match troubleshooting, with an *Event Partner* or other event technical staff present and assisting, would not be considered a violation.

<G9> Hands out of the field. *Drive Team Members* may only touch the *Team's* controls and *Robot* at specified times during a *Match* as per <G9a>. *Drive Team Members* are prohibited from making intentional contact with any Game Object, *Field Element*, or *Robot* during a *Match*, apart from the contact specified in <G9a>.

a. During the *Driver Controlled Period*, *Drive Team Members* may only touch their own *Robot* if the *Robot* has not moved at all during the *Match*. Touching the *Robot* in this case is permitted only for the following reasons:
   i. Turning the *Robot* on or off.
   ii. Plugging in a battery and/or power expander.
   iii. Plugging in a VEXnet Key or V5 Robot Radio.
   iv. Touching the V5 Robot Brain screen, such as to start a program.

b. *Drive Team Members* are not permitted to break the plane of the field perimeter at any time during the *Match*, apart from the actions described in <G9a>.

c. Transitive contact, such as contact with the field perimeter that causes the field perimeter to contact *Balls* inside of the field, would be considered a violation of this rule.

Minor violations of these rules that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

Note: Any concerns regarding the *Ball*(s) starting positions should be raised with the *Head Referee* prior to the *Match*; *Team* members may never adjust the *Balls* or *Field Elements* themselves.

<G10> Autonomous means "no humans". During the *Autonomous Period*, *Drive Team Members* are not permitted to interact with the *Robots* in any way, directly or indirectly. This could include, but is not limited to:

- Activating any controls on their VEXnet Joysticks or V5 Controllers.
- Unplugging or otherwise manually interfering with the field connection in any way.
- Triggering sensors (including the Vision Sensor) in any way, even without touching them.

Minor violations of this rule will result in a Warning. Violations of this rule that affect the outcome of the Autonomous winner or disrupt the autonomous routine of their opponent will result in the *Autonomous Bonus* being awarded to the opposing *Alliance*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<G11> All rules still apply in the Autonomous Period. Any infractions committed during the *Autonomous Period* that are not *Match Affecting*, but do affect the outcome of the *Autonomous Bonus*, will result in the *Autonomous Bonus* being automatically awarded to the opposing *Alliance*.

a. *Teams* are responsible for the actions of their *Robots* at all times, including during the *Autonomous Period*. Any infractions committed during the *Autonomous Period* that are *Match Affecting* can result in a *Disqualification*, if warranted by the rule.

b. If both *Alliances* cause infractions during the *Autonomous Period* that would have affected the outcome of the *Autonomous Bonus*, then no *Autonomous Bonus* will be awarded.

<G12> Don't destroy other Robots. But, be prepared to encounter defense. Strategies aimed solely at the destruction, damage, tipping over, or Entanglement of opposing *Robots* are not part of the ethos of the VEX Robotics Competition and are not allowed. If the tipping, Entanglement, or damage is ruled to be intentional or egregious, the offending *Team* may be Disqualified from that *Match*. Repeated offenses could result in *Disqualification* from the entirety of the competition.

a. VEX Robotics Competition Change Up is intended to be an offensive game. *Teams* that partake in solely defensive or destructive strategies will not have the protections implied by <G12> (see <G13>). However, defensive play which does not involve destructive or illegal strategies is still within the spirit of this rule.

b. VEX Robotics Competition Change Up is an interactive game. Some incidental tipping, *Entanglement*, and damage may occur as a part of normal gameplay without violation. It will be up to the Head Referee's discretion whether the interaction was incidental or intentional.

c. A *Team* is responsible for the actions of its *Robot* at all times, including the *Autonomous Period*. This applies both to *Teams* that are driving recklessly or potentially causing damage, and to *Teams* that drive around with a small wheel base. A *Team* should design its *Robot* such that it is not easily tipped over or damaged by minor contact.

Note: A *Robot* which has expanded horizontally in an effort to obstruct the field, or is legally covering the top of a *Goal* in a solely defensive manner, should expect vigorous interactions from opponent *Robots*. Damage that is caused by opponent *Robots* pushing, tipping, or Entangling with them would not be considered a violation of <G12>. Gratuitous damage or dangerous mechanisms may still be considered a violation of <R4>, <S1>, or <G1> at the *Head Referee's* discretion.

Put simply: "wall-bots" and "cap-bots" are legal, but they are to be attempted at your own risk.

<G13> Offensive Robots get the "benefit of the doubt". In the case where referees are forced to make a judgment call regarding a destructive interaction between a defensive and offensive *Robot*, or an interaction which results in a questionable rules violation, the referees will err on the side of the offensive *Robot*.

<G14> You can't force an opponent into a penalty. Intentional strategies that cause an opponent to violate a rule are not permitted, and will not result in an infraction on the opposing *Alliance*. Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<G3> should be used when enforcing this rule. In most cases, if a *Robot* causes their opponent to break a rule, the referee will simply not enforce the penalty on that opponent. Only in extreme cases, where the act of forcing the opponent into breaking a rule changes the outcome of the match for the benefit of the *Robot*, should that *Robot* who caused the opponent to break a rule receive a *Disqualification*.

<G15>No Trapping for more than five seconds (0:05). A *Robot* may not Trap an opposing *Robot* for more than five seconds (0:05) during the *Driver Controlled Period*. A Trap is officially over once the *Trapping Robot* has moved away and the *Robots* are separated by at least two (2) feet (approximately one [1] foam tile). After ending a Trap, a *Robot* may not Trap the same *Robot* again for a duration of five seconds (0:05). If a *Team* does Trap the same *Robot* again, the count will resume from where it left off when the *Trapping Robot* initially backed off.

Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<G16> Don't clamp your Robot to the field. *Robots* may not intentionally grasp, grapple or attach to any *Field Elements*. Strategies with mechanisms that react against multiple sides of a *Field Element* in an effort to latch or clamp onto said *Field Element* are prohibited. The intent of this rule is to prevent *Teams* from both unintentionally damaging the field and/or from anchoring themselves to the field.

Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<G17> Let go of Game Objects after the Match. *Robots* must be designed to permit easy removal of *Balls* from any mechanism without requiring the *Robot* to have power after a *Match*.

<G18> It's not over until it's over. Scores will be calculated for all *Matches* immediately after the *Match* ends, once all *Balls*, *Field Elements*, and *Robots* on the field come to rest.

a. The determination of the *Autonomous Bonus* will occur for all *Matches* immediately after the *Autonomous Period* ends, after all *Balls*, *Field Elements*, and *Robots* come to rest.

b. The determination of any Autonomous Win Point(s) will occur for all *Matches* immediately after the *Autonomous Period* ends, after all *Balls*, *Field Elements*, and *Robots* come to rest.

<G19> Be prepared for minor field variance. *Field Element* tolerances may vary from nominal by ±1.0", unless otherwise specified. *Ball* tolerances and weights may vary from nominal to ±0.10" and 10 grams respectively. *Ball* placement at the beginning of *Matches* may vary from nominal to ±1.5". The bottom opening of Goals between the lowest two rings has a dimensional tolerance of -0.0 / +0.5". *Teams* are encouraged to design their *Robots* accordingly. Please make sure to check Appendix A for more specific nominal dimensions and tolerances.

Note: The field perimeter must always be resting upon the Field Perimeter Rubber Feet, regardless of whether or not the tabs have been cut from the foam field tiles.

As per the May 25th Game Manual Update, Option A: (1x) 4" Standoff (276-1021) or Option B: (2x) 11" Zipties (275-0125) are added to the four corner Goals to aid in proper function of the Goal. One of these options will be required for official match play, with option A being preferred.

<G20> Match Replays are allowed, but rare. Match Replays, i.e. playing a match over again from its start, are at the discretion of the *Event Partner* and *Head Referee*, and will only be issued in the most extreme circumstances listed but not limited to the following:

a. Field Fault issues that have directly affected *Match* play.
   i. Game Elements not in the correct positions
   ii. Tape lines lifting
   iii. *Field Elements* detaching or moving beyond normal tolerances that is not a result of team play violations.
   iv. *Autonomous Period* or *Driver Controlled Period* ending early
   v. Field Control disconnecting and disabling *Robots*. Not to be confused with a *Robot* that trips its own PTC and has to reboot to reconnect the robot to controller, or teams with controllers that have bent pins that affect only their alliance Field Control tower.

b. Game Rule issues that affect the outcome of a match.
   i. Referee disables a robot for a misinterpretation of a rule violation.
   ii. Referee starts the *Driver Controlled Period* without determining the outcome of the Autonomous winner.
   iii. The field is reset before a score is determined.

<G21> This manual will have four scheduled updates. All rules in this manual are subject to change on the following dates: May 25, 2020, August 17, 2020, December 1, 2020, and March 26, 2021 . Each version is official and must be used in official VRC events until the release of the newest version making the previous version void. Areas of focus for each update are as follows:

a. The May update will include rule changes from input from the community that post questions and responses on the official Q&A.
   i. A portion of this update, regarding Robot Skills and Appendix B, will be released separately on June 15, 2020
b. The August update will include rule changes to improve game play from early season events along with input from the community that post questions and responses on the official Q&A.
c. The December update will include clarifications that were posted on the official Q&A.
d. The March update will be specific to the VEX World Championship.

<G22> The Q&A system is an extension of this Game Manual. All *Teams* must adhere to all VEX Robotics Competition rules as written in this Game Manual, and must abide by any stated intent of these rules. Officially registered *Teams* have the opportunity to ask for official rule interpretations in the VEX Robotics Competition Question & Answer system. All responses in this system must be treated as official rulings from the VEX Robotics Competition Game Design Committee (GDC), and they represent the correct and official interpretation of the VEX Robotics Competition Rules.

Previous Definitions, Rules and Rulings found in documents and Q&A's from previous seasons do not apply to the current game. If clarification is needed, the question should be asked on the current Q&A.

The 2020 - 2021 Q&A is the ONLY official source for rulings besides the Game Manual. If there are any conflicts between the Game Manual and other supplemental materials (e.g. Referee Training videos, VRC Hub app, etc), the most current version of the Game Manual takes precedent.

The VRC Q&A system can be found at https://www.robotevents.com/VRC/2020-2021/QA

Specific Game Rules

<SG1> Starting a Match. Prior to the start of each *Match*, the *Robot* must be placed such that it is:

a. Contacting its *Home Zone*.

b. Not contacting the gray foam field tiles outside of the *Alliance's Home Zone*.

c. Not contacting any *Balls* other than the *Preload*.

d. Not contacting another *Robot*.

e. Contacting exactly one (1) *Preload*.
   i. The *Preload* must be contacting exactly one (1) *Robot*.
   ii. The *Preload* must be fully within the field perimeter.
   iii. The *Preload* must not be breaking the vertical projection of the *Goal*, i.e. the *Preload* must not be inside or above the *Goal*.

Note: If a *Robot* is not present for their *Match*, then their *Preload* will instead be placed in the center of the gray foam tile that is closest to the double tape line that bisects the *Home Zone* and is opposite the half of the *Home Zone* from the placed *Robot* as shown below.

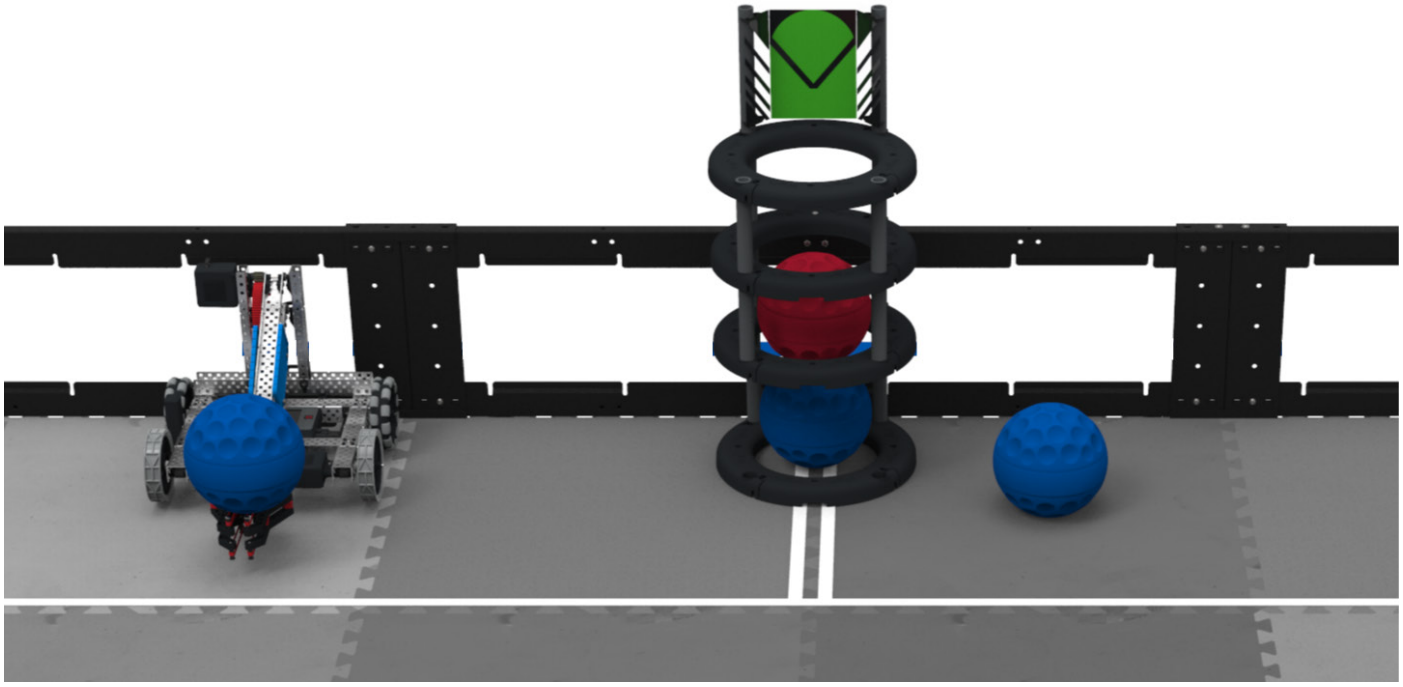


Figure 13: Example of a placed **Robot** *with* **Preload**, *and one* **Preload** *correctly placed for a non-present* **Robot**.

<SG2> Stay on your side in Autonomous. During the *Autonomous Period*, *Robots* may not contact the foam tiles or *Balls* which are on the opposing *Alliance's* side of the *Autonomous Line*. *Robots* may not contact the *Goals* that are in the opposing *Alliance's Home Zone*.

Violations of this rule will result in the Autonomous Bonus being awarded to the opposing *Alliance*. Intentional, strategic, or egregious violations, such as intentional contact with an opposing *Robot* while completely across the *Autonomous Line*, will result in a *Disqualification*.

Note: The three (3) *Goals* contacting the *Autonomous Line* are not considered to be on either side, and may be utilized by either *Alliance* during the *Autonomous Period*. If attempting to utilize these *Goals*, *Teams* should be cognizant of the possibility that opponent *Robots* may attempt to do the same. <SG7>, <G10>, <G11>, and <G12> will be taken into account when these types of *Robot* interactions occur.

<SG3> Keep Balls on your side in Autonomous. *Balls* that start fully on one side of the *Autonomous Line* may not contact the foam tiles on the opposite side of the *Autonomous Line* during the *Autonomous Period*.

Incidental violations of this rule and have no impact on the opposing *Alliance* will result in a Warning. Violations of this rule that affect the opposing *Alliance's* autonomous routine will result in the *Autonomous Bonus* being awarded to the opposing *Alliance*. Examples of affecting the opposing *Alliance* could include, but are not limited to, a *Ball* moving another *Ball* or getting in the path of a *Robot*.

Note: *Balls* that start on the *Autonomous Line* are not included in this rule.

<SG4> Keep Game Objects to yourself. *Robots* may not intentionally drop or place Game Objects on an opponent *Robot*.

Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<SG5> Balls may not be de-scored from the top of Goals. *Balls* that are *Scored* may not be lifted by any means such that the *Ball* goes above the top edge of the *Goal*.

It is expected that while removing *Balls* from the bottom of the *Goal*, this may cause the top *Ball* to momentarily go above the top edge of the *Goal*. This would not be a violation of this rule and is considered to be normal game play.

If the *Match* ends while a *Robot* is removing a *Ball* from the bottom of the *Goal* that contains three (3) *Balls* and the top *Ball* remains partially above the top edge of the *Goal*, that *Ball* will be considered *Scored* and no penalty to the *Team* will be assessed.

Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

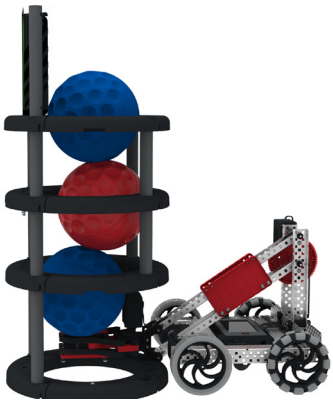


*Figure 14: If this situation occurs at the end of a **Match**, this **Goal** would still be **Owned** by the Blue **Alliance**, and the top-most **Ball** would be **Scored**, even though it is not completely within the upper edge of the **Goal**. No penalty is assessed to the Red **Alliance**.*

<SG6> Keep Balls in the field. *Teams* may not intentionally remove *Balls* from the field. While *Balls* may accidentally leave the field when attempting to Score, doing so intentionally or repeatedly would be a violation of this rule. *Balls* that leave the field during *Match* play, intentionally or unintentionally, will be returned to the field at the location nearest the point at which they exited. Referees will return the *Balls* to the field when it is deemed safe to do so, at the leisure of the referee.

Minor violations of this rule that do not affect the *Match* will result in a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<SG7> Use Balls to play the game. *Balls* may not be used to accomplish actions that would be otherwise illegal if they were attempted by *Robot* mechanisms (e.g., Interfering with an opponent's *Autonomous Period* per <SG2>.)

The intent of this rule is to prohibit teams from using game objects as "gloves" to loophole any rule that states "a *Robot* may not [do some action]". This rule is not intended to be taken in its most extreme literal interpretation, where any interaction between a *Ball* and a *Robot* needs to be scrutinized with the same intensity as if it were a *Robot*.

<SG8> Possession is limited. *Robots* may not have greater-than-momentary *Possession* of more than three (3) *Balls* of its opposing *Alliance's* color at once. When two *Robots* from the same *Alliance* are working in tandem and blocking *Balls*, those *Robots* may not possess a total of more than six (6) *Balls* of its opposing *Alliance's* color at once.

Robots that violate this rule must stop all *Robot* actions except for those actions that are attempting to remove the excess *Ball*.

Minor violations of this rule that are not *Match Affecting* will receive a warning. *Match Affecting* offenses will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

The overarching intent of this rule is to prohibit each *Robot* from keeping more than 3 of the opposing *Balls* from being used by the opposing *Alliance*.

One definition of *Possession* is "blocking opposing *Robots'* access to *Balls*, such as by expanding horizontally and restricting access to a portion of the field (e.g. a "wallbot")." Put simply - as far as *Possession* is concerned, a defensive "wallbot" does not violate <SG8>, as long as 3 or more of the offensive *Alliance's Balls* are not being blocked.

Similarly, if two *Robots* work in tandem to prevent access to an opposing *Alliance's Balls*, they are not in violation of <SG8> as long as they are not blocking access to more than 6 of the opposing *Alliance's Balls* in total, and each *Robot* is not carrying or controlling more than 3 *Balls* each.

Section 3
The Robot

Overview

This section provides rules and requirements for the design and construction of your *Robot*. A VEX Robotics Competition *Robot* is a remotely operated and/or autonomous vehicle designed and built by a registered VEX Robotics Competition *Student Team* to perform specific tasks when competing in VEX Robotics Competition Change Up. Prior to competing at each event, all *Robots* will have to pass an inspection.

There are specific rules and limitations that apply to the design and construction of your *Robot*. Please ensure that you are familiar with these *Robot* rules before proceeding with *Robot* design.

Inspection Rules

<R1> One Robot per Team. Only one (1) *Robot* will be allowed to compete per *Team* in the VEX Robotics Competition. Though it is expected that *Teams* will make changes to their *Robot* at the competition, a *Team* is limited to only one (1) *Robot*. As such, a VEX *Robot*, for the purposes of the VEX Robotics Competition, has the following subsystems:

- Subsystem 1: Mobile robotic base including wheels, tracks, legs, or any other mechanism that allows the *Robot* to navigate the majority of the flat playing field surface. For a stationary *Robot*, the robotic base without wheels would be considered Subsystem 1.

- Subsystem 2: Power and control system that includes a legal VEX battery, a legal VEX control system, and associated motors for the mobile robotic base.

- Subsystem 3: Additional mechanisms (and associated motors) that allow manipulation of game objects or navigation of field obstacles.

Given the above definitions, a minimum *Robot* for use in any VEX Robotics Competition event (including Skills Challenges) must consist of 1 and 2 above. Thus, if you are swapping out an entire subsystem of either item 1 or 2, you have now created a second *Robot* and are no longer legal.

a. *Teams* may not compete with one *Robot* while a second is being modified or assembled.

b. *Teams* may not have an assembled second *Robot* to be used to repair or swap parts to the first *Robot*.

c. *Teams* may not switch back and forth between multiple *Robots* during a competition. This includes using different *Robots* for Skills Challenge, Qualification and/or *Elimination Matches*.

d. Multiple *Teams* may not use the same *Robot*. Once a *Robot* has competed under a given team number at an event, it is "their" *Robot* - no other *Teams* may compete with it for the duration of the competition season.

The intent of <R1a>, <R1b>, and <R1c> are to ensure an unambiguous level playing field for all *Teams*. *Teams* are welcome (and encouraged) to improve or modify their *Robots* between events, or to collaborate with other *Teams* to develop the best possible game solution.

However, a *Team* who brings and/or competes with two separate *Robots* at the same tournament has diminished the efforts of a *Team* who spent extra design time making sure that their one *Robot* can accomplish all of the game's tasks. A multi-Team organization that shares a single *Robot* has diminished the efforts of a multi-Team organization who puts in the time, effort, and resources to undergo separate individual design processes and develop their own *Robots*.

To help determine if a *Robot* is a "separate *Robot*" or not, use the Subsystem definitions found in <R1>. Above that, use common sense as referenced in <G3>. If you can place two *Robots* on a table next to each other, and they look like two separate legal/complete *Robots* (i.e. each have the 3 Subsystems defined by <R1>), then they are two *Robots*. Trying to decide if changing a screw, a wheel, or a microcontroller constitutes a separate *Robot* is missing the intent and spirit of this rule.

<R2> Robots must be a representation of the skill level of the team. The *Robot* must be designed, built and programmed by members of the *Team*. *Adults* are permitted to mentor and teach design, building and programming skills to the *Students* on the *Team*, but may not design, build or program that team's *Robot*.

In VRC, we expect *Adults* to teach different linkages, drive-trains, and manipulator applications to the *Students*, then allow the *Students* to determine which designs to implement and build on their *Robot*. *Adults* are encouraged to teach the *Students* how to code various functions involving applicable sensors, then have the *Students* program the *Robot* from what they have learned.

<R3> Robots must pass inspection. Every *Robot* will be required to pass a full inspection before being cleared to compete. This inspection will ensure that all robot rules and regulations are met. Initial inspections will take place during team registration/practice time.

a. Significant changes to a *Robot*, such as a partial or full swap of Subsystem 3, must be re-inspected before the *Robot* may compete again.

b. All possible functional *Robot* configurations must be inspected before being used in competition.

c. *Teams* may be requested to submit to random spot-inspections by event personnel. Refusal to submit will result in *Disqualification*.

d. *Robots* which have not passed inspection (i.e. who are in violation of one or more *Robot* rules) will not be permitted to play in any *Matches* until they have done so. <T3> will apply to any *Matches* that occur until the *Robot* has passed inspection.

e. If a *Robot* has passed inspection, but is later found to be in violation of a *Robot* rule during a *Match*, then they will be Disqualified from that *Match* and <R2d> will apply until the violation is remedied and the *Team* is re-inspected.

The intent of this rule is to ensure that teams play *Matches* with legal *Robots*. If a *Robot* is determined to not be legal before the *Match* starts, the *Robot* will be removed from the field and a Drive Team member must remain so that the *Team* does not get assessed a "no-show". If the *Match* is played with an illegal *Robot* on the Field, that *Team* will receive a *Disqualification* for the *Match* (see <T11>).

<R4> Robots must be safe. The following types of mechanisms and components are NOT allowed:

a. Those that could potentially damage *Field Elements* or *Balls*.

b. Those that could potentially damage other competing *Robots*.

c. Those that pose an unnecessary risk of Entanglement.

<R5> Robots must fit in a sizing box. At the beginning of any *Match*, *Robots* must be smaller than 18" (457.2 mm) long by 18" (457.2 mm) wide by 18" (457.2 mm) tall.

a. *Robots* may expand beyond their starting size constraints after the start of a *Match*.

b. Any restraints used to maintain starting size (i.e. zip ties, rubber bands, etc.) MUST remain attached to the *Robot* for the duration of the *Match*.

Robots may be measured by either being placed in a "sizing box" with interior dimensions matching the above size constraints or by using the VEX Robotics Competition Robot Sizing Tool while the *Robot* is placed on a flat surface. A *Robot* may not touch the box walls or ceiling or the Robot Sizing Tool sides when being measured.

There are two VEX Robotics Competition Robot Sizing Tools that may be used: https://www.vexrobotics.com/276-2086.html and https://www.vexrobotics.com/276-5942.html

<R6> Robots are built from the VEX V5 or Cortex system. *Robots* may be built ONLY using official VEX V5 and Cortex components, unless otherwise specifically noted within these rules. *Teams* are responsible for providing documentation proving a part's legality in the event of a question. Examples of documentation include receipts, part numbers, official VEX websites, or other printed documentation.

a. Products from the VEXpro, VEX IQ, or VEX Robotics by HEXBUG product line cannot be used for *Robot* construction, unless specifically allowed by a clause of <R7> or cross-listed as part of the VEX V5 or Cortex Product lines. For example, the Rubber Shaft Collar (228-3510) is a VEX IQ component that can be found on the VEX "Shafts & Hardware" page, and is thus legal: https://www.vexrobotics.com/shafts-and-hardware.html

b. VEX IQ pins used solely for the purpose of attaching VEX Team Identification Number Plates are permitted.

c. Official VEX V5 and Cortex components which have been discontinued are still legal for competition use. *Teams* must be cognizant of <R6> if attempting to use a discontinued part.

d. Any parts which are identical to legal VEX parts are permitted. For the purposes of this rule, products which are identical in all ways except for color are permissible. It is up to inspectors to determine whether a component is "identical" to an official VEX component.

e. Components obtained from the V5 beta program, including V5 beta firmware, are not legal for competition use.
   i. All V5 beta hardware can be identified by its lighter gray pre-production color. Robot Brains, Robot Batteries, Controllers, and Vision Sensors from the V5 beta have a "BETA TEST" stamp on them. Smart Motors and Radios do not have this stamp, but can still be identified by color.

Using VEX apparel, competition support materials, packaging, or other non-robot products on a VEX Robotics Competition Robot goes against the spirit of this rule and is not permitted.

<R7> VEX products come from VEX Robotics or VEX Robotics Resellers. Official VEX products are ONLY available from VEX Robotics & official VEX Resellers. To determine whether a product is "official" or not, consult www.vexrobotics.com. A complete list of authorized VEX Resellers can be found at https://www.vexrobotics.com/how-to-order.

<R8> Certain non-VEX components are allowed. *Robots* are allowed the following additional "non-VEX" components:

a. Any material strictly used as a color filter or a color marker for a VEX Light Sensor.

b. Any non-aerosol based grease or lubricating compound, when used in extreme moderation on surfaces and locations that do NOT contact the playing field walls, foam field surface, *Balls*, or other *Robots*.

c. Anti-static compound, when used in extreme moderation (i.e. such that it does not leave residue on playing field walls, the foam field surface, *Balls*, or other *Robots*).

d. Hot glue when used to secure cable connections.

e. An unlimited amount of 1/8" (or local metric equivalent), braided, nylon rope.

f. Commercially available items used solely for bundling or wrapping of 2-wire, 3-wire, 4-wire, or V5 Smart Cables, and pneumatic tubing are allowed. These items must solely be used for the purposes of cable protection, organization, or management. This includes but is not limited to electrical tape, cable carrier, cable track, etc. It is up to inspectors to determine whether a component is serving a function beyond protecting and managing cables.

Non-functional 3D printed license plates, per <R13> and <R27>, are permitted.

<R9> Give the radio some space. The V5 Radio or VEXnet Key 2.0 must be mounted such that no metal surrounds the radio symbol on the V5 Radio or touches the VEXnet logo on the VEXnet Key 2.0.

Teams may use a USB extension cable for the sole purpose of remote mounting of a VEXnet Key 2.0 to a VEX ARM® Cortex®-based Microcontroller.

Figure 15: A V5 Radio

Figure 16: A VEXnet Key 2.0

It is fine to loosely encapsulate the V5 Radio or VEXnet Key 2.0 in *Robot* structure. The intent of this rule is to minimize radio connection issues by minimizing obstructions between VEXnet devices. If a radio is buried in a *Robot*, VEXnet is not able to connect as well and may result in Robot communication issues.

<R10> A limited amount of custom plastic is allowed. *Robots* may use non-shattering plastic from the following list; polycarbonate (Lexan), acetal monopolymer (Delrin), acetal copolymer (Acetron GP), POM (acetal), ABS, PEEK, PET, HDPE, LDPE, Nylon (all grades), Polypropylene, FEP; as cut from a single 12" x 24" sheet up to 0.070" thick.

a. Shattering plastic, such as PMMA (also called Plexiglass, Acrylic, or Perspex), is prohibited.

b. Plastic may be mechanically altered by cutting, drilling, bending etc. It cannot be chemically treated, melted, or cast. Heating polycarbonate to aid in bending is acceptable.

<R11>A limited amount of tape is allowed. *Robots* may use a small amount of tape when used for the following purposes:

a. For the sole purpose of securing any connection between the ends of two (2) VEX cables.

b. For labeling wires and motors.

c. For covering the back of License Plates (i.e. the "wrong color").

d. For the purposes of preventing leaks on the threaded portions of pneumatic fittings. This is the only acceptable use of Teflon tape.

e. For securing and retaining a VEXnet Key 2.0 to the VEX ARM® Cortex®-based Microcontroller. Using tape in this manner is highly recommended to ensure a robust connection.

f. In any other application that would be considered a "non-functional decoration" per <R13>.

<R12> Certain non-VEX screws, nuts, and washers are allowed. *Robots* may use any commercially available #4, #6, #8, M3, M3.5, or M4 screw up to 2" (50.8mm) long (nominal), and any commercially available nut, washer, and/or spacer (up to 2" / 50.8mm long) to fit these screws.

The intent of the rule is to allow teams to purchase their own commodity hardware without introducing additional functionality not found in standard VEX equipment. It is up to inspectors to determine whether the non-VEX hardware has introduced additional functionality or not.

<R13> Decorations are allowed. *Teams* may add non-functional decorations, provided that they do not affect *Robot* performance in any significant way or affect the outcome of the *Match*. These decorations must be in the spirit of the competition. Inspectors will have final say in what is considered "non-functional". Unless otherwise specified below, non-functional decorations are governed by all standard *Robot* rules.

In order to be "non-functional," any guards, decals, or other decorations must be backed by legal materials that provide the same functionality. For example, if your *Robot* has a giant decal that prevents *Balls* from falling out of the *Robot*, the decal must be backed by VEX material that would also prevent the *Balls* from falling out.

a. Anodizing and painting of parts is considered a legal nonfunctional decoration.

b. If using the VEX speaker (276-1504), the chosen audio must not be distracting and must be in good taste. The Head Inspector and *Head Referee* will make the final decision on the appropriateness of the audio.

c. Small cameras are permitted as non-functional decorations, provided that any transmitting functions or wireless communications are disabled. Unusually large cameras being used as ballast are not permitted.

d. VEX electronics may not be used as non-functional decorations.

e. Decorations that visually mimic field elements or could otherwise interfere with an opponent's Vision Sensor are considered functional and are not permitted. This includes lights, such as the VEX Flashlight. The Head Inspector and *Head Referee* will make the final decision on whether a given decoration or mechanism violates this rule.

f. Internal power sources (e.g. for a small blinking light) are permitted, provided that no other rules are violated and this source only provides power to the non-functional decoration (e.g. does not directly or indirectly influence any functional portions of the *Robot*).

g. Decorations which provide feedback to the *Robot* (e.g. by influencing legal sensors) or to *Drive Team Members* (e.g. status indicators) would be considered "functional" and are not permitted.

<R14> No Wi-Fi. The Vision Sensor must have its wireless transmitting functionality disabled.

<R15> New VEX parts are legal. Additional VEX components released during the competition season on www.vexrobotics.com are considered legal for use.

Some "new" components may have certain restrictions placed on them upon their release. These restrictions will be documented in the official Q&A forums, in a Game Manual Update, or on their respective product web pages.

<R16> Robots have one microcontroller. *Robots* must ONLY use one (1) VEX V5 Robot Brain (276-4810), or one (1) VEX ARM ® Cortex ®-based Microcontroller (276-2194).

a. Any other microcontrollers or processing devices are not allowed, even as non-functional decorations. This includes microcontrollers that are part of other VEX product lines, such as VEXpro, VEX RCR, VEX IQ, VEX GO, or VEX Robotics by HEXBUG; this also includes devices that are unrelated to VEX, such as Raspberry Pi or Arduino devices.

<R17> Robots use VEXnet. *Robots* must ONLY utilize the VEXnet system for all *Robot* communication.

a. VEX 75Mhz Crystal Radios are prohibited. (Some events may allow the use of 75Mhz Crystal Radios, please see the Special Event Rule Modifications later in this section.)

b. Electronics from the VEXpro, VEX RCR, VEXplorer, VEX IQ, VEX GO, or VEX Robotics by HEXBUG product line are prohibited.

c. Mixing and matching of VEXnet transmitters and receivers is prohibited. The VEXnet Joystick may only be used in conjunction with a VEX ARM® Cortex®-based Microcontroller. A VEXnet upgraded 75MHz Transmitter may only be used in conjunction with a PIC Microcontroller. A V5 Controller may only be used in conjunction with a V5 Robot Brain.

Teams are permitted to use the Bluetooth® capabilities of the V5 Robot Brain and/or V5 Controller in team pits or outside of Matches. However, VEXnet must be used for wireless communication during *Matches*.

<R18> Robots use one control system. *Robots* may use exactly one (1) of the following four (4) options:

- Option 1: A VEX ARM® Cortex®-based Microcontroller, up to ten (10) 2-Wire Motors or VEX Servos (in any combination up to ten) and a legal VRC pneumatic system.

- Option 2: A VEX ARM® Cortex®-based Microcontroller, up to twelve (12) 2-Wire Motors or VEX Servos (in any combination up to twelve) and no pneumatic components, excluding pneumatic tubing.

- Option 3: A V5 Robot Brain, up to six (6) V5 Smart Motors, and a legal VRC pneumatic system.

- Option 4: A V5 Robot Brain, up to eight (8) V5 Smart Motors, and no pneumatic components, excluding pneumatic tubing.

a. 2-Wire Motors must be controlled by a 2-Wire Motor Port, either directly on a VEX microcontroller, or on a VEX Motor Controller 29 module (276-2193).

b. *Teams* may NOT use multiple 2-wire Motor Ports, 3-wire PWM Motor Ports, or Motor Controller 29 modules on a single motor.

V5 Smart Motors, connected to Smart Ports, are the only motors that may be used with a V5 Robot Brain. The 3-wire ports may not be used to control motors of any kind.

Option	Control System	Pneumatics	2-Wire Motors or Servos	V5 Smart Motors
1	Cortex	Y	10	0
2	Cortex	N	12	0
3	V5	Y	0	6
4	V5	N	0	8

Table 1: The four combinations of control system, motors and pneumatics that are legal

<R19> One motor or Y cable per motor port. If using a VEX ARM® Cortex®-based Microcontroller, a maximum of one (1) VEX Y-cable can be used per Motor Port of the Microcontroller or Power Expander, i.e. you cannot "Y off a Y" to have more than two (2) motors controlled by the same Motor Port.

a. *Teams* using the VEX ARM® Cortex®-based Microcontroller may only power one (1) 2-wire Motor per each of the two 2-wire motor ports on the Microcontroller. It is illegal to "Y" off a 2-wire Motor Port.

b. *Teams* may not "Y" off of a Motor Controller 29 (276-2193).

<R20> Electrical power comes from VEX batteries only. The only allowable source(s) of electrical power are as follows:

a. If using a VEX ARM® Cortex®-based Microcontroller, robots may use (1) VEX 7.2V Robot Battery Pack of any type.
   i. *Robots* utilizing the VEX Power Expander may use a second VEX 7.2V Robot Battery of any type. *Robots* are permitted to use a maximum of one (1) VEX Power Expander.
   ii. The only legal means for charging a VEX 7.2V Battery Pack is via one of the following VEX Battery Chargers: Smart Charger (276-1445); Smart Charger v2 (276-2519); 276-2221 (discontinued), 276-2235 (discontinued). All other chargers are strictly prohibited.
   iii. *Teams* must connect a charged 9V backup battery to their VEXnet system using the VEXnet Backup Battery Holder (276-2243).
   iv. VEXnet Joysticks must only be powered by AAA batteries.
   v. Some events may provide field power for VEXnet Joysticks. If this is provided for all *Teams* at the event, this is a legal source of power for VEXnet Joysticks.

b. If using a V5 Robot Brain, robots may use (1) V5 Robot Battery (276-4811).
   i. There are no legal power expanders for the V5 Robot Battery.
   ii. V5 Robot Batteries may only be charged by the V5 Robot Battery Charger (276-4812) or (276-4841).
   iii. V5 Wireless Controllers may only be powered by their internal rechargeable battery.

c. *Teams* are permitted to have an external power source (such as a rechargeable battery pack) plugged into their V5 Controller during a *Match*, provided that this power source is connected safely and does not violate any other rules, such as <G8> or <R22>.

	VEX ARM® Cortex®-based Microcontroller			V5 Robot Brain		
Component	Legal Parts	Legal Chargers	Maximum Quantity	Legal Parts	Legal Chargers	Maximum Quantity
Robot Battery	276-1456 276-1491	276-1445 276-2519 276-2221 276-2235	1 (2 with Power Expander)	276-4811	276-4812 276-4841	1
Power Expander	276-2271	N/A	1	None	None	0
Transmitter Battery	AAA Battery	Any safe AAA charger	6 (per transmitter)	276-4820 (internal)	Any safe Micro-USB cable	1 (per transmitter)
Transmitter Field Power	276-1701	N/A	1	None	None	0
Backup Battery	9V battery	N/A	1	None	None	0

*Table 2: The legal sources of electrical power for **Robots***

<R21> One or two controllers per Robot. No more than two (2) VEX wireless remotes may control a single *Robot* during the tournament.

a. No modification of these transmitters is allowed of ANY kind.

b. No other methods of controlling the Robot (light, sound, etc) are permissible.
   i. Using sensor feedback to augment driver control (such as motor encoders or the Vision Sensor) is acceptable.

c. Teams may not "mix-and-match" wireless remote types, such as using a VEXnet Joystick and V5 Controller at the same time.

Note: This rule does not prohibit objects attached to the controller that assist the Driver in holding the controller or manipulating buttons/joysticks on the controller.

<R22> No modifications to electronic components are allowed. Motors (including the internal PTC or Smart Motor firmware), microcontrollers (including V5 Robot Brain firmware), extension cords, sensors, controllers, battery packs, reservoirs, solenoids, pneumatic cylinders, and any other electrical component or pneumatics component of the VEX platform may NOT be altered from their original state in ANY way.

a. External wires on VEX electrical components may be repaired by soldering, using twist/crimp connectors, electrical tape or shrink tubing such that the original functionality / length is not modified in any way. Wire used in repairs must be identical to VEX wire. *Teams* may make these repairs at their own risk; incorrect wiring may have undesired results.

b. *Teams* must use the latest official VEXos firmware updates, found at www.vexrobotics.com. Custom firmware modifications are not permitted.

c. *Teams* may change or replace the gears in the "2-Wire 393" or "2-Wire 269" motors with the corresponding official VEX Replacement Gears.

d. *Teams* may change or replace the gear cartridge in the V5 Smart Motor with other official replacement gear cartridges.

<R23> Most modifications and repairs to non-electrical components are allowed. Physical modifications such as bending or cutting are permitted and may be done to legal VEX Robotics Competition metal structure or plastic components.

a. Physical modifications to electrical components such as a legal microcontroller or radio is prohibited unless otherwise explicitly permitted, per <G21>.

b. Internal or external mechanical repairs of VEX Limit and Bumper switches are permitted. Modifying the metal arm on the Limit Switch is permitted. Using components from these devices in other applications is prohibited.

c. Metallurgical modifications that change fundamental material properties, such as heat treating, are not permitted.

d. *Teams* may cut pneumatic tubing to a desired length.

e. *Teams* are permitted to fuse/melt the end of the 1/8" nylon rope to prevent fraying.

f. Welding, soldering, brazing, gluing, or attaching in any way that is not provided within the VEX platform is NOT permitted.

<R24> Custom V5 Smart Cables are allowed. *Teams* must use official V5 Smart Cable Stock but may use commodity 4P4C connectors and 4P4C crimping tools. *Teams* who create custom cables acknowledge that incorrect wiring may have undesired results.

<R25> Keep the power switch accessible. The *Robot* on/off switch or button must be accessible without moving or lifting the *Robot*. All microcontroller lights and/or screens must also be easily visible by competition personnel to assist in diagnosing *Robot* problems.

<R26> Pneumatics are limited. Pneumatic devices may only be charged to a maximum of 100 psi. *Teams* may only use a maximum of two (2) legal VEX pneumatic air reservoirs on a *Robot*.

The intent of this rule is to limit *Robots* to the air pressure stored in two reservoir tanks, as well as the normal working air pressure contained in their pneumatic cylinders and tubing on the *Robot*. *Teams* may not use other elements (e.g. surgical tubing) for the purposes of storing or generating air pressure. *Teams* who use cylinders and additional pneumatic tubing for no purpose other than additional storage are in violation of the spirit of this rule and will fail inspection.

<R27> Only registered Teams may compete in the VEX Robotics Competition. To participate in an official VEX Robotics Competition (VRC) event, a *Team* must first register on robotevents.com. Upon registering they will receive their VRC Team Number and four (4) VRC License Plates. *Teams* may choose to use the VRC License Plate Kit that comes in the VRC Team Welcome Kit, or may create their own, including one made from 3D printed parts. Plates must follow the following requirements.

a. *Robots* must use the colored plates that match their *Alliance* color for each *Match* (i.e. red *Alliance Robots* must have their red plates on for the *Match*). It must be abundantly clear which color *Alliance* the *Robot* belongs to.

   Note: If the plates are attached to opposite-color plates, then the incorrect color must be covered, taped over, or otherwise obscured to ensure that the correct *Alliance* color is abundantly clear to Head Referees during a *Match*. Since License Plates are considered non-functional decorations, this is a legal non-functional use of tape.

b. License Plates must fulfill all *Robot* rules (i.e. they must fit within the 18" cube per <R4>, they cannot cause entanglement, not functionally change the stability of rigidity of the *Robot*, etc.)

c. Plates must be at least 2.48 inches (63.2mm) tall and 4.48 inches (114mm) wide, i.e. at least the size of the plates in the VRC License Plate Kit ignoring thickness.

The intent of this rule is to make it very easy for *Head Referees* to know which *Alliance* and which *Team* each *Robot* belongs to. Being able to "see through" a *Robot* arm to the wrong color License Plate on the opposite side of the *Robot* would be considered a violation of <R27a>.

It will be at the full discretion of the *Head Referee* and inspector at a given event to determine whether a given custom license plate satisfies the criteria listed in <R27>. *Teams* wishing to utilize custom plates should be prepared for the possibility of this judgment, and ensure that they are prepared to replace any custom parts with official VEX License Plates if requested. Not bringing official replacement plates to an event will not be an acceptable reason for overlooking a violation of one or more points in <R27>.

<R28>Use the "Competition Template" for programming. The *Robots* must be programmed to follow control directions provided by the VEXnet Field Controllers.

During the *Autonomous Period*, *Drive Team Members* will not be allowed to use their hand-held controllers. As such, *Teams* are responsible for programming their *Robot* with custom software if they want to perform in the *Autonomous Period*. *Robots* must be programmed to follow control directions provided by the VEXnet Field Controllers (i.e. ignore wireless input during the *Autonomous Period*, disable at the end of the *Driver Controlled Period*, etc).

Teams must use a provided "competition template", or functional equivalent, to accomplish this. All *Robots* will be required to pass a functional enable/disable test as part of inspection. For more information on this, *Teams* should consult the help guides produced by the developers of their chosen programming software.

<R29> There is a difference between accidentally and willfully violating a Robot rule. Any violation of *Robot* rules will result in a *Team* being unable to play until they pass inspection (per <R3d>). In addition, *Teams* who intentionally or knowingly circumvent or violate rules to gain an advantage over their fellow competitors are in violation of the spirit and ethos of the competition. Any violation of this sort may be considered a violation of <G1> and/or the REC Foundation Code of Conduct.

<R30> Special event modifications. Some events may choose to make the following rule exceptions to fit their unique circumstances:

a. Utilize the VEX 75 MHz Crystal Radio Transmitter & Receiver instead of or in conjunction with the VEXnet Wireless link.

b. Allow AA batteries to power the robot instead of a VEX 7.2V Battery Pack.

Note: If an event makes these changes, they must inform all attending *Teams*. It is especially important that any 75 MHz events make sure their *Teams* are using the correct communication type.

Section 4
The Tournament

Overview

The main challenge of the VEX Robotics Competition will be played in a tournament format. Each tournament consists of *Qualification Matches* and *Elimination Matches* and may include *Practice Matches*. After the *Qualification Matches*, *Teams* are ranked based on their *Win Points*, *Autonomous Points*, and *Strength of Schedule Points*. The top ranked *Teams* will then participate in *Elimination Matches* to determine the tournament champions.

Tournament Definitions

Alliance Captain - The *Team Representative* of the highest ranked Team in an *Alliance* during *Elimination Matches*. The *Alliance Captain* invites available *Teams* to join his or her *Alliance* until the *Alliance* is formed.

Alliance Selection - The process of choosing the permanent *Alliances* for the *Elimination Matches*. *Alliance Selection* proceeds as follows:

1. The highest ranked *Team* at the end of *Qualification Matches* becomes the first *Alliance Captain*.
2. The *Alliance Captain* invites another *Team* to join their *Alliance*.
3. The invited *Team Representative* either accepts or declines as outlined in <T13>.
4. The next highest ranked *Team* at the end of *Qualification Matches* becomes the next *Alliance Captain*.

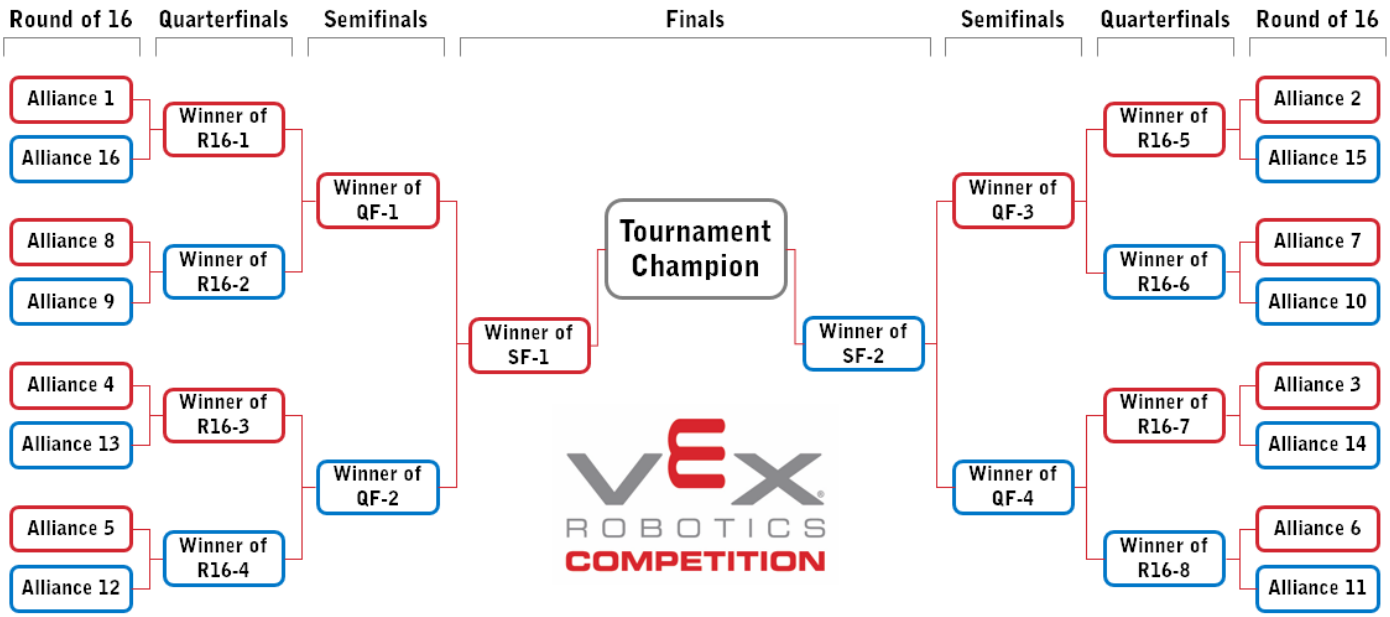
Alliance Captains continue to select their *Alliances* in this order until all *Alliances* are formed for the *Elimination Matches*

Autonomous Points (AP) - The second basis of ranking *Teams*. An *Alliance* who wins the *Autonomous Bonus* during a *Qualification Match* earns six (6) *Autonomous Points*. In the event of a tie at the end of the *Autonomous Period*, both *Alliances* will receive three (3) *Autonomous Points*.

Autonomous Win Point - One (1) Win Point (WP) given to an *Alliance* that has completed their *Alliance Home Row* at the end of the *Autonomous Period*. Both *Alliances* can earn this WP if both *Alliances* complete their *Alliance* Home Row.

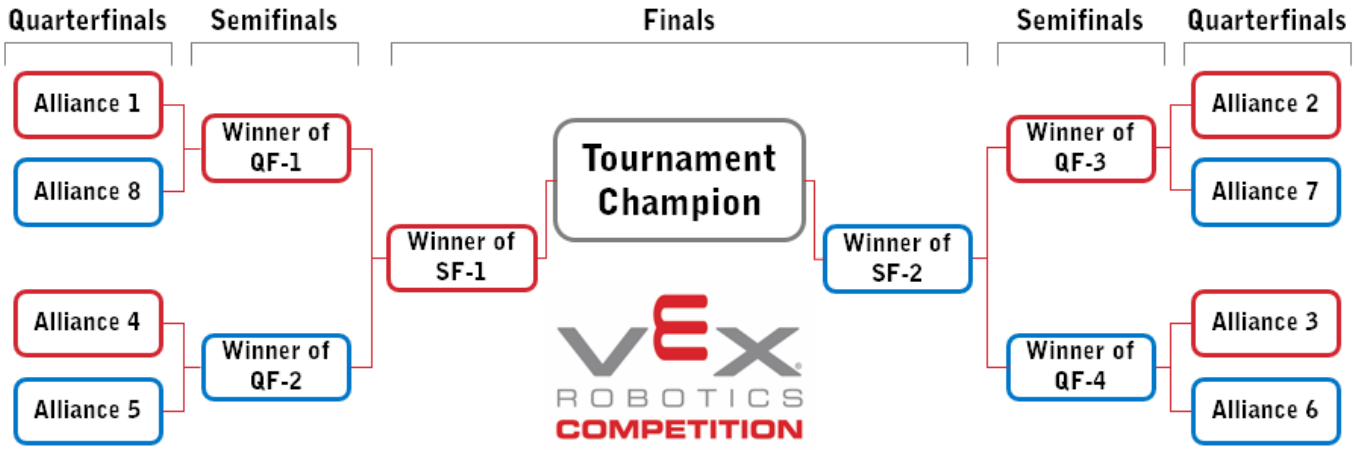
Elimination Bracket - A schedule of *Elimination Matches*. Between eight (8) and sixteen (16) *Alliances* are used to fill the *Elimination Bracket*. The exact quantity of *Alliances* in an *Elimination Bracket* is determined by the *Event Partner* per <T16>.

A sixteen (16) *Alliance* bracket would play as follows:



If an event is run with fewer than sixteen (16) *Alliances*, then they will use the bracket shown above, with byes awarded when there is no applicable *Alliance*. For example, in a tournament with fourteen (14) *Alliances*, *Alliances* 1 and 2 would automatically advance.

Thus, an eight (8) *Alliance* bracket would run as follows:



Elimination Match - A *Match* used in the process of determining the champion *Alliance*. *Alliances* of two (2) *Teams* face off according to the *Elimination Bracket*; the winning *Alliance* moves on to the next round.

Event Partner - The VEX Robotics Competition tournament coordinator who serves as an overall manager for the volunteers, venue, event materials, and all other event considerations. *Event Partners* serve as the official liaison between the REC Foundation, the event volunteers, and event attendees.

Head Referee - An impartial volunteer responsible for enforcing the rules in this manual as written. *Head Referees* are the only people who may discuss ruling interpretations or scoring questions with *Teams* at an event.

Practice Match - A *Match* used to provide time for *Teams* and volunteers to get acquainted with the official playing field. *Practice Matches* earn Teams zero (0) WP, AP, and SP.

Qualification Match - A *Match* used to determine the rankings for the *Alliance Selection*. *Alliances* compete to earn *Win Points*, *Autonomous Points*, and *Strength of Schedule Points*.

Strength of Schedule Points (SP) - The third basis of ranking *Teams*. *Strength of Schedule Points* are equivalent to the score of the losing *Alliance* in a *Qualification Match*. In the event of a tie, both *Alliances* receive SP equal to the tie score. If both *Teams* on an *Alliance* are Disqualified, the *Teams* on the losing (not Disqualified) *Alliance* will receive their own score as SP for that *Match*.

Time Out - A break period no greater than three minutes (3:00) allotted for each *Alliance* during *Elimination Matches.*

Team Representative - A *Student* chosen to represent his or her *Team* during *Alliance Selection* for *Elimination Matches.*

Win Points (WP) - The first basis of ranking *Teams*. *Teams* will receive zero (0), one (1), two (2) or three (3) *Win Points* for each *Qualification Match*.

- One (1) WP is awarded at the end of the *Autonomous Period* for any *Team* in an *Alliance* earning the *Autonomous Win Point*.
- Two (2) WP are awarded for winning a *Qualification Match*.
- One (1) WP is awarded for tying a *Qualification Match*.
- Zero (0) WP are awarded for losing a *Qualification Match*.

Tournament Rules

<T1> The Head Referee has ultimate authority on ruling decisions during the competition.

a. *Head Referees* must have the following qualifications.
   i. Be at least 20 years of age
   ii. Be approved by the *Event Partner*
   iii. Contain the following attributes:
      1. Thorough knowledge of the current game and rules of play
      2. Effective decision making
      3. Attention to detail
      4. Ability to work effectively as a member of a team
      5. Ability to be confident and assertive when necessary
      6. Strong communication and diplomacy skills
   iv. The *Head Referee* must be an REC Foundation Certified VRC Head Referee for the current season.

b. *Head Referees* may not review any photo or video *Match* recordings to determine a score or ruling.

c. *Head Referees* are the only people permitted to explain a rule, *Disqualification* or warning to the *Teams*.

d. The *Head Referee* must give the rule number of the rule violated when issuing a *Disqualification* or warning to a *Team*.

Violations of the REC Foundation Code of Conduct may involve additional escalation beyond the *Head Referee's* initial ruling, including (but not limited to) investigation by an REC Foundation representative. Rules <S1>, <G1>, and <G2> are the only rules for which this escalation may be required.

Note: Scorekeeper Referees score the *Match*, serve as observers for the *Head Referees* and advise the *Head Referee*, but may not communicate any rules or infractions directly to the *Teams*. Scorekeeper Referees must be at least 15 years of age.

<T2>The Drive Team is permitted to immediately appeal the Head Referee's ruling. If the Drivers wish to dispute a score or ruling, those Drivers must stay in the *Alliance Station* until the *Head Referee* talks with them. The *Head Referee* may choose to meet with the Drivers at another location and/or at a later time so that the *Head Referee* has time to reference materials or resources to help with the decision. Once the *Head Referee* announces that his or her decision has been made final, the issue is over and no more appeals may be made. The *Event Partner* may not overrule the *Head Referee's* decision.

Violations of this rule may result in the *Team* being disqualified from the *Match* in question and/or the event and is up to the discretion of the *Head Referee*.

Communication and conflict resolution skills are an important life skill for *Students* to practice and learn. In VEX Robotics Competitions, we expect *Students* to practice proper conflict resolution using the proper chain of command. See <G1>.

<T3> The Team's Robot or a Drive Team Member should attend every Match. A *Robot* or a *Student* member of the *Team* must report to the field for the *Team's* assigned *Match*. If no *Student* Team members report to the field, the *Team* will be considered a "no-show" and receive zero (0) *Win Points*, *Autonomous Points*, and *Strength of Schedule Points*.

<T4> Robots at the field must be ready to play. *Teams* must bring their *Robots* to the field prepared to play. *Teams* who use VEX pneumatics must have their systems charged before they place the *Robot* on the field.

a. *Robots* must be placed on the field promptly. Repeated failure to do so could result in a violation of <G1>.

The exact definition of the term "promptly" is at the discretion of the *Head Referee* and the *Event Partner*, who will consider event schedule, previous warnings or delays, etc.

<T5> Practice Matches may be run at some events. If *Practice Matches* are run, they will be conducted on a first-come, first-served basis with every effort made to equalize practice match time for all *Teams*.

<T6> The red alliance, or the highest seed, places last. In *Qualification Matches*, the red *Alliance* has the right to place its *Robots* on the field last. In *Elimination Matches*, the higher (better) seeded *Alliance* has the right to place its *Robots* on the field last. Once a *Team* has placed its *Robot* on the field, its position cannot be readjusted prior to the *Match*. If a *Team* violates this rule, the opposing *Alliance* will be given the opportunity to reposition their *Robots* promptly.

<T7> Qualification Matches follow the Qualification Match schedule. A *Qualification Match* schedule will be available on the day of competition. The *Qualification Match* schedule will indicate *Alliance* partners, Match pairings, and *Alliance* color. For tournaments with multiple fields, the schedule will indicate which field the *Match* will take place on.

a. *Alliances* are randomly assigned during *Qualification Matches*.

Note: The official *Match* schedule is subject to changes at the *Event Partner's* discretion.

<T8> Each Team will be scheduled Qualification Matches as follows.

a. When in a tournament, the tournament must have a minimum of four (4) *Qualification Matches* per Team. The suggested amount of *Qualification Matches* per *Team* for a standard tournament is six (6) and up to ten (10) for a championship event.

b. When in a league, there must be at least three (3) league ranking sessions and each session must have a minimum of two (2) *Qualification Matches* per *Team*. The suggested amount of *Qualification Matches* per *Team* for a standard league ranking session is four (4). Leagues will have a league finals session where elimination rounds will be played. *Event Partners* may choose to have *Qualification Matches* as part of their league finals session.

<T9> Team rankings are determined during Qualification Matches as outlined below.

a. When in a tournament, every *Team* will be ranked based on the same number of *Qualification Matches*.

b. When in a league, every *Team* will be ranked based on the number of *Matches* played. Teams that participate at least 60% of the total *Matches* available will be ranked above *Teams* that participate in less than 60% of the total *Matches* available, e.g. if the league offers 3 ranking sessions with 4 *Qualification Matches* per *Team*, teams that participate in 8 or more *Matches* will be ranked higher than *Teams* who participate in 7 or fewer *Matches*. Being a no-show to a match that a *Team* is scheduled in still constitutes participation for these calculations.

c. In some cases, a *Team* will be asked to play an additional *Qualification Match*. The extra *Match* will be identified on the *Match* Schedule with an asterisk and will not impact the *Team's* ranking, *Win Points*, *Autonomous Points* or *Strength of Schedule Points* for that *Qualification Match* (and will not affect participation percentage for leagues). *Teams* are reminded that <G1> is always in effect and *Teams* are expected to behave as if the additional *Qualification Match* counted.

<T10> Qualification Match tiebreakers. *Team* rankings are determined throughout *Qualification Matches* as follows:

1. Average *Win Points* (*Win Points* / Number of *Matches* played)

2. Average *Autonomous Points* (*Autonomous Points* / Number of *Matches* played)

3. Average *Strength of Schedule Points* (*Strength of Schedule Points* / Number of *Matches* played)

4. Highest *Match* score

5. Second highest *Match* score

6. Random electronic draw

<T11> Disqualifications.

a. When a *Team* is Disqualified in a *Qualification Match*, they receive zero (0) *Win Points*, *Autonomous Win Point*, *Autonomous Points*, and *Strength of Schedule Points*.
   i. If the *Team* receiving the *Disqualification* is on the winning *Alliance*, then *Teams* on the opposing *Alliance* who are not also Disqualified will receive the win for the *Match* and two (2) *Win Points*.
   ii. If the *Match* was a tie, then each *Team* on the opposing *Alliance* (the *Alliance* that did not receive the *Disqualification*) will receive the win for the *Match* and two (2) *Win Points*.
   iii. If both *Alliances* have a *Team* receiving a *Disqualification*, then all non-Disqualified *Teams* will receive a tie for the *Match* and one (1) *WP*.

Note: *Autonomous Win Points* are not given to teams that are Disqualified, and are not automatically awarded to the opposing *Alliance*.

When a *Team* is Disqualified in an *Elimination Match*, the entire *Alliance* is Disqualified and they receive a loss for the *Match* and the opposing *Alliance* is awarded the win. If both *Alliances* receive a *Disqualification* in an *Elimination Match*, both *Alliances* receive a loss and will play another *Elimination Match* to determine a winner.

<T12> Send a Team Representative to Alliance Selection. Each *Team* must send one (1) *Team Representative* to the playing field for *Alliance Selection*. If the *Team Representative* fails to report to the playing field for *Alliance Selection*, their *Team* will be ineligible for participation in the *Alliance Selection* process.

<T13> Each Team may only be invited once to join an Alliance. If a *Team Representative* declines an *Alliance Captain's* invitation during *Alliance Selection*, that *Team* is no longer eligible to be selected by another *Alliance Captain*. However, they are still eligible to play *Elimination Matches* as an *Alliance Captain*.

For example:

- *Alliance Captain* 1 invites Team ABC to join their *Alliance*.
- Team ABC declines the invitation.
- No other *Alliance Captains* may invite Team ABC to join their *Alliance*.
- However, Team ABC may still form their own *Alliance*, if Team ABC ranked high enough after *Qualification Matches* to become an *Alliance Captain*.

<T14> Each Alliance gets one Timeout. Each *Alliance* may request one (1) *Time Out* during the elimination Bracket between *Elimination Matches*, as permitted by the *Head Referee* and *Event Partner*. *Alliances* may not use their *Time Outs* during a *Match*.

<T15> Elimination Matches are a blend of "Best of 1" and "Best of 3".

a. In Tournaments that do not directly qualify teams to VEX Worlds,
   i. In Tournaments that only have one division - The first *Alliance* to win a *Match* advances to the next round of the *Elimination Bracket*. Any ties will result in additional *Matches* until one *Alliance* wins and advances or wins and receives the title of "Tournament Champion." i.e. *Elimination Matches* are all Best of 1
   ii. In Tournaments that have multiple divisions -
      1. In the Division *Elimination Matches* - *Elimination Matches* are all Best of 1 and the *Alliance* that wins the Division Finals will be declared the "Division Champion."
      2. When the Division Champions play each other – If there are more than two divisions and thus will have Quarterfinals and/or Semifinals, these *Matches* will be played as "Best of 1". The Finals Matches for any size multi-division event are played as a "Best of 3" where an *Alliance* needs two wins to receive the title of "Tournament Champion."

b. In Tournaments that directly qualify teams to VEX Worlds,
   i. In Tournaments that only have one division - *Elimination Matches* are "Best of 1" from Round-of-16 up through the Semi-Finals Matches. The Finals Matches are played as a "Best of 3" where an *Alliance* needs two wins to receive the title of "Tournament Champion."

   ii. In Tournaments that have multiple divisions -
      1. In the Division *Elimination Matches* - *Elimination Matches* are "Best of 1" from Round-of-16 up through the Semi-Finals Matches. The Division Finals *Matches* are played as a "Best of 3" where an *Alliance* needs two wins to receive the title of "Division Champion.

2. When the Division Champions play each other – If there are more than two divisions and thus will have Quarterfinals and/or Semifinals, these *Matches* will be played as "Best of 1". The Finals *Matches* for any size multi-division event are played as a "Best of 3" where an *Alliance* needs two wins to receive the title of "Tournament Champion."

<T16> Small tournaments may have fewer Alliances. Events with 32 or more teams must use 16-team alliances when starting *Elimination Matches*. Events with fewer than 32 Teams (i.e. the requisite amount for sixteen full *Alliances*) must limit the number of *Alliances* by dividing the number of *Teams* by two, less any remainder.

<T17> Fields may be raised or on the floor. Some tournaments may choose to place the playing field on the floor, or elevated off the floor (common heights are 12" to 24" [30.5cm to 61cm]). No *Drive Team Members* may stand on any sort of object during a *Match*, regardless of whether the field is on the floor or elevated.

The 2021 VEX Robotics World Championship field will be elevated 24" (61cm) from the floor.

<T18> Students must be accompanied by an Adult. - No *Student* may attend a VRC event without a responsible *Adult* supervising them. The *Adult* must obey all rules and be careful to not violate student-centered policies, but must be present at the event in the case of an emergency.

vexrobotics.com

VEX ROBOTICS COMPETITION CHANGE UP

2020 - 2021
Appendix B - Skills Challenge

Appendix B
Robot Skills Challenge

Overview

This Appendix describes the combined Robot Skills Challenge rules for VEX Robotics Competition Change Up.

Please note that the Robot Skills Challenge may not be offered at all tournaments. Please check with your local Event Partner or www.robotevents.com for more information.

Robot Skills Challenge Description

In this challenge, *Teams* will compete in a *Match* lasting a maximum of sixty seconds (1:00) in an effort to score as many points as possible. These Matches consist of *Driving Skills Matches*, which will be entirely driver controlled, and *Programming Skills Matches*, which will be autonomous with no human interaction. *Teams* will be ranked based on their combined score in the two types of *Matches*.

The playing field will have *Field Elements* setup exactly the same as a normal VEX Robotics Competition Change Up Match, however, the *Balls* will start as displayed below.

Note: Only (15) of each colored *Ball* is used in a *Robot Skills Match*.

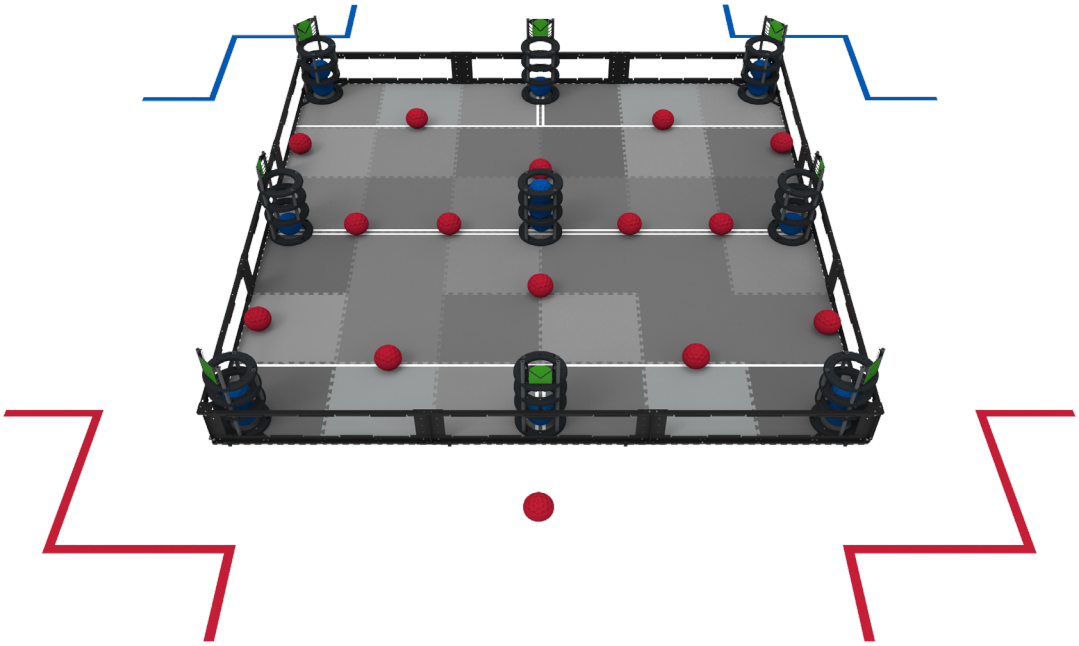


Figure 1: View of the Robot Skills Challenge field in its initial setup configuration.

Game Definitions

Please note that all definitions from "The Game" section of the manual apply to the Robot Skills Challenge, unless otherwise specified.

Driving Skills Match – A *Driving Skills Match* consists of a sixty second (1:00) *Driver Controlled Period*. There is no *Autonomous Period*.

Programming Skills Match – A *Programming Skills Match* consists of a sixty second (1:00) *Autonomous Period*. There is no *Driver Controlled Period*.

Robot Skills Match – A *Driving Skills Match* or *Programming Skills Match*

Skills Stop Time – The time remaining in a *Robot Skills Match* when a *Team* ends the *Match* early. If a *Team* does not end the *Match* early, they receive a default *Skills Stop Time* of 0.

a. The moment when the *Match* ends early is defined as the moment when the *Robot* is "disabled" by the field control system. See the "Skills Stop Time" section for more details.
b. If a V5 Robot Brain or Tournament Manager display is being used for field control, then the *Skills Stop Time* is the time shown on the display when the *Match* is ended early (i.e. in 1-second increments).
c. If a VEXnet Competition Switch is being used for field control, in conjunction with a manual timer that counts down to 0 with greater accuracy than 1-second increments, then the time shown on the timer should be rounded up to the nearest second.
    i. For example, if the *Robot* is disabled and the stopwatch shows 25.2 seconds, then the *Skills Stop Time* should be recorded as 26.

Robot Skills Challenge Rules

Please note that all rules from "The Game" section of the manual apply to the Robot Skills Challenge, unless otherwise specified.

<RSC1> *Robots* may start the *Robot Skills Match* per <SG1> in either *Home Zone* with the *Drive Team Members* standing in the *Alliance Station* that corresponds with that *Home Zone*.

Note: The other three (3) *Preloads* are not used in a *Robot Skills Match*.

<RSC2> In *Robot Skills Matches*, *Teams* play as if they are on the red *Alliance* Scoring only red *Balls* and Owning only red *Goals*.

<RSC3> Rules <SG2> and <SG3> do not apply in *Programming Skills Matches*.

Robot Skills Challenge Scoring

Teams receive points according to the same Scoring rules in VEX Robotics Competition Change Up when Scoring for the red *Alliance*.

Additionally, *Teams* receive points for any blue *Balls* that are removed from their starting positions in *Goals*. These points are equal to how many points would have been "de-scored" from the blue *Alliance* by removing that *Ball*.

To calculate this, all *Balls* will be scored at the end of a *Robot Skills Match* for their respective *Alliance*, with the same scoring rules as a standard VRC Change Up *Match*. The *Team's Robot Skills Match* score will then be calculated as follows:

(Red *Alliance* Score) - (Blue *Alliance* Score) + 63

One intent of this scoring method is to simulate a standard VRC Change Up Match that has already begun. The *Team* represents a member of the red *Alliance*, competing against a blue *Alliance* who has scored all of their *Balls*. The final score can be interpreted as how far the red *Robot* has been able to overcome this deficit in their 60-second *Robot Skills Match*.

Skills Stop Time

If a *Team* wishes to end their *Robot Skills Match* early, they may elect to record a *Skills Stop Time*. This may be used as a tiebreaker for *Robot Skills Challenge* rankings. A *Skills Stop Time* does not affect a *Team's* score for a given *Robot Skills Match*.

- *Teams* who intend to attempt a *Skills Stop Time* must "opt-in" by verbally confirming with the scorekeeper referee prior to the *Robot Skills Match*. If no notification is given prior to the start of the *Match*, then the *Team* forfeits their option for recording a *Skills Stop Time*.
  - This conversation should include informing the scorekeeper referee which *Drive Team Member* will be signaling the stop. The *Match* may only be ended early by a *Drive Team Member* standing in the *Alliance Station*.
  - If a *Team* is running multiple *Robot Skills Matches* in a row, they must reconfirm their *Skills Stop Time* choice with the scorekeeper referee prior to each *Match*.
  - Any questions regarding a *Skills Stop Time* should be reviewed and settled immediately following the *Match*. <T1> and <T2> apply to *Robot Skills Matches*.

- If the event is utilizing a V5 Robot Brain or TM Mobile app for Robot Skills Challenge field control, a *Drive Team Member* may elect to start and stop their own *Robot Skills Match*.
  - This V5 Robot Brain, or device running the TM Mobile app, will be used to start the *Robot Skills Match* (i.e. "enable" the *Robot*), end the *Robot Skills Match* (i.e. "disable" the *Robot*), and display the official *Skills Stop Time* to be recorded.
  - This V5 Robot Brain must be running the official field control user program.
  - For more information regarding the use of a V5 Robot Brain for Robot Skills Challenge field control, and to download the official field control user program, visit this VEX Knowledge Base article.
  - For more information regarding the use of TM Mobile for field control, see the Tournament Manager documentation.

- At events which do not have a V5 Robot Brain or TM Mobile available for Robot Skills Challenge field control, *Drive Team Members* and field staff must agree prior to the *Match* on the signal that will be used to end the *Match* early.
  - As noted in the definition of *Skills Stop Time*, the moment when the *Match* ends early is defined as the moment when the *Robot* is "disabled" by the field control system.
  - The agreed-upon signal must be both verbal and visual, such as *Drive Team Members* crossing their arms in an "X", or placing their V5 Controller(s) / VEXnet Joystick(s) on the ground.
  - The signal must be given by a *Drive Team Member* standing in the *Alliance Station*.
  - *Drive Team Members* are also recommended to provide verbal notice that they are approaching their *Skills Stop Times*, such as by counting out "3-2-1-stop".

- It is at the *Event Partner's* discretion which method will be used to record *Skills Stop Times* at a given event. The chosen method must be communicated prior to the event (such as during a drivers' meeting), and made equally available to all *Teams*.
  - If an event intends to use a manual timekeeping method, a *Team* may not bring their own V5 Robot Brain just for use during their own *Robot Skills Match*.
  - If an event intends to utilize a V5 Robot Brain, all *Teams* must use the same V5 Robot Brain for all *Robot Skills Matches* on a given field.
  - If an event is using multiple fields for *Robot Skills Matches*, the same method must be used at all fields. Multiple V5 Robot Brains may be used as needed, e.g. a "Field 1 Brain" and a "Field 2 Brain".
  - The default "Drive" program accessed from a V5 Controller is intended for practice only, and may not be used for an official *Robot Skills Match*.

Robot Skills Challenge Ranking at Events

For each *Robot Skills Match*, *Teams* are awarded a score as described in the Robot Skills Challenge Scoring section, and a *Skills Stop Time* as described in the Skills Stop Time section. *Teams* will be ranked based on the following tiebreakers:

1. Sum of highest *Programming Skills Match* score and highest *Driving Skills Match* score.
2. Highest *Programming Skills Match* score.
3. Second-highest *Programming Skills Match* score.
4. Second-highest *Driving Skills Match* score.
5. Highest sum of *Skills Stop Times* from a *Team's* highest *Programming Skills Match* and highest *Driving Skills Match* (i.e. the *Matches* in point 1).
6. Highest *Skills Stop Time* from a *Team's* highest *Programming Skills Match* (i.e. the *Match* in point 2).
7. Third-highest *Programming Skills Match* score.
8. Third-highest *Driving Skills Match* score.

- If a tie cannot be broken after all above criteria, then the following ordered criteria will be used to determine which *Team* had the "best" *Programming Skills Match*:

1. Number of *Connected Rows*.
2. Number of *Scored Balls*.

- If the tie still cannot be broken, the same process in the step above will be applied to the *Teams*' best *Driving Skills Match*.

- If the tie still isn't broken, events may choose to allow *Teams* to have one more deciding *Driving Skills Match*, to be ranked according to the standard criteria above, or declare both *Teams* the Robot Skills Challenge Winner.

Robot Skills Challenge Ranking Globally

Teams will be ranked Globally based on their Robot Skills scores from Tournaments and Leagues that upload results to robotevents.com according to the following tiebreakers.

1. Highest Robot Skills score (combined *Programming Skills Match* and *Driving Skills Match* Score from a single event).
2. Highest *Programming Skills Match* score (from any event).
3. Highest sum of *Skills Stop Times* from the *Robot Skills Matches* used for point 1.
4. Highest *Skills Stop Time* from the *Programming Skills Match* used for point 2.
5. Highest *Driving Skills Match* score (from any event).
6. Highest *Skills Stop Time* from the *Driving Skills Match* score used for point 5.
7. Earliest posting of the Highest *Programming Skills Match* score.
   a. The first *Team* to post a score ranks ahead of other *Teams* that post the same score at a later time, all else being equal.
8. Earliest posting of the Highest *Driving Skills Match* score.
   a. The first *Team* to post a score ranks ahead of other *Teams* that post the same score at a later time, all else being equal.

Robot Skills Challenge Format Options

To better accommodate varying health & safety circumstances in different regions, the 2020-2021 season will feature several different avenues for *Event Partners* to host Robot Skills Challenge competitions. Regardless of the format chosen for a given event, all rules, scoring, and rankings listed in this Appendix apply. However, some formats will have additional rules in place to ensure fair and consistent gameplay.

Robot Skills Challenge at a Standard Qualifying Tournament

- The Robot Skills Challenge is an optional event. *Teams* who do not compete will not be penalized in the main tournament.

- *Teams* may play *Robot Skills Matches* on a "first come, first serve" basis, or by a pre-scheduled method determined by the *Event Partner*.

- *Teams* will be given the opportunity to play exactly three (3) *Programming Skills Matches* and three (3) *Driving Skills Matches*. *Teams* should be aware of when the Robot Skills fields are open so that they do not miss their opportunity, e.g. if a *Team* waits until five minutes before the Robot Skills fields close, then they have not used the opportunity given to them and will not be able to compete in all six matches.

Skills-Only Event: In-Person, Live

- *Teams* may play *Robot Skills Matches* on a "first come, first serve" basis, or by a pre-scheduled method determined by the *Event Partner*.
- Further details regarding Skills-Only Event logistics can be found in the REC Foundation Qualification Criteria document.

Skills-Only Event: Remote, Live

A "Remote, Live" Skills-Only Event is an event held exclusively via a live online video platform organized by the *Event Partner*. The intent of a Remote, Live event is to replicate the competition experience of an "In-Person, Live" Skills-Only Event as much as possible.

Additional rules and requirements have been established in an effort to help facilitate a fair and flexible experience for all *Teams* and *Event Partners*.

<RSE1> The Remote Skills Only environment (i.e. digital platform) may be chosen at *Event Partner* discretion.

a. All registered *Teams* must be able to view live the matches being played by all other registered *Teams*.
b. REC Foundation Staff must have access to view all matches while being played live.
c. The online meeting environment must not be accessed or viewed by the general online public while the event is live, e.g. the event must be password protected or invite-only.
    i. Guests invited by the *Event Partner* can be able to view, but may not have use of their microphone or camera or display anything for teams to see or hear.
    ii. One example that would satisfy this requirement would be to use an online video conferencing application that allows for a large number of people who must register to attend. The *Event Partner* would approve spectators who can view the matches, but would only give *Teams* the ability to share their screen, camera or microphone.
    iii. After the event is over, there are no such restrictions (i.e. the *Event Partner* may post a recording of the event if they wish).

<RSE2> Registered *Teams* will be assigned scheduled times to complete *Robot* Inspection and up to (3) *Programming Skills Matches* and (3) *Driving Skills Matches* over a live, online environment.

<RSE3> The minimum event staff must include one (1) *Event Partner* and at least one (1) certified *Head Referee*. A dedicated Tournament Manager operator is also recommended, but not required, if the *Head Referee* and/or *Event Partner* wish to fulfill this role.

<RSE4> At all times, there must be a minimum of (2) *Adults* over the age of 18 in the remote meeting environment before *Students* are allowed to connect. One of those *Adults* must be the *Event Partner*.

<RSE5> The *Team's* Primary Contact, or another designated *Adult Team* contact (over the age of 18), must be present in the remote meeting environment throughout the duration of the scheduled time for that *Team*. The *Team's* Primary Contact will be responsible for providing the *Adult* representative's contact information to the *Event Partner* prior to the event.

<RSE6> *Teams* will complete a full *Robot* inspection, in accordance with <R3>, live with the *Head Referee* prior to their first *Robot Skills Match*. This inspection process should follow the checklist on a standard inspection sheet, including a demonstration of sizing compliance as explained in <R5>.

<RSE7> All *Team* camera footage must be streamed live, from one camera feed, with no "cuts".

a. Pre-recorded *Robot Skills Matches* are strictly prohibited in a Live, Remote event.
b. The *Drive Team Member*(s), *Robot*(s), Controller(s) and complete competition field must remain on camera at all times during the match.
c. A Stopwatch / Tournament Manager display that shows the match time must be on video the entire time during the match.
d. The camera must be able to move around the field, with no breaks or "cuts", so that it can verify standard *Head Referee* checks before and after the *Match*. These could include (but are not limited to) Starting Position placement, game and field element placements, and any necessary scoring verification.
    i. If this is not feasible due to a *Team's* equipment or facility limitations, a second camera stream must be used for these close-up checks. This is the only permissible exception to the "single-camera" rule set forth by <RSE7>, and *Teams* utilizing this exception should expect additional scrutiny.

<RSE8> Live, Remote Robot Skills Matches must include some live interaction between the *Team* and the *Head Referee*.

a. A *Drive Team Member* must pair their Controller to their *Robot* on video prior to each *Match*.
b. The *Head Referee* must ask the *Team* if they are ready, and the *Team* must respond verbally/visually on video.
    i. If the *Head Referee* needs to see a closer or different angle of the Robot Starting Position or any field elements, the *Team* must be able to satisfy this request, per <RSE7>.
c. The *Match* will begin with the *Team* member who is controlling their clock to give a countdown for the *Match* to start. This person does not need to be a *Drive Team Member*.
d. After the *Match*, *Teams* must move the camera per the *Head Referee's* instructions to verify scored game elements before the field is reset, per <RSE7>. The *Head Referee* will confirm to the *Team* verbally what is being counted.
    i. <T1> still applies - the *Head Referee's* judgment based on what can be seen on camera is final, as it would if they were observing it in person. There are no video or photo replays in a Live, Remote Skills-Only Event.

One common example will be for a referee to ask a *Team* to move the camera over to a goal to show if *Balls* are properly scored in that *Goal*. The *Head Referee* will ask the *Team* a series of questions, and might ask for a couple of different camera angles, but once the referee makes a determination based on these questions and viewing angles, the referee's decision is final.

<RSE9> Match replays are at the discretion of the *Head Referee*. In addition to the examples provided in <G20>, live video circumstances (such as a video cutting out, or a *Match* timing error) could warrant a *Match* replay at the *Head Referee's* discretion.

<RSE10> Any violation of any rules will result in the *Match* score being recorded as zero. That *Match* will count as one of the *Team's* allotted *Matches*.

Skills-Only Event: Remote, Pre-Recorded

A "Remote, Pre-Recorded" Skills-Only Event is an event held exclusively via videos of *Robot Skills Matches* that are submitted to and scored by an *Event Partner* and/or *Head Referee*.

An official event utilizing this format requires prior approval from the REC Foundation, and should only be considered when no other event options are available in a given event region.

- Videos submitted for a Pre-Recorded Skills event must be recorded and submitted within the duration of the event set by the *Event Partner*. Videos recorded prior to the event's start date & time will not be acceptable.
- *Event Partners* will generate a set of unique, randomized alphanumeric code to be sent to each *Team* at the beginning of the Event.
- All video format rules set forth by <RSE7> apply. Furthermore, a second clock showing the current date / time must be on video during the entire *Match*.
- *Matches* should follow a standard procedure, done and shown on one video without any "cuts" or edits, in the following order:
  1. *Robot* Inspection is done by the *Team*, showing on video, the inspection sheet signed and completed. Measurements must be done using a measuring device such as a Robot Sizing Tool or tape measure.
  2. The *Team* says the random code that they were given by the *Event Partner* out loud on video while writing the code visibly on a paper or whiteboard.
  3. *Teams* pair the Controller to the *Robot*.
  4. The *Team* shows on video a closeup view of the Starting Position to provide video evidence that the *Robot* is in a legal starting position.
  5. The *Team* says out loud and writes on paper or whiteboard if they are attempting a *Programming Skills Match* or *Driving Skills Match*.
  6. The *Team* starts a *Match* when the clock begins.
  7. After the *Match*, the *Team* must move the camera to each of the *Goals* saying out loud what counts as scored and records onto an official referee scoresheet.
  8. The scoresheet is then shown clearly on video for a minimum of 10 seconds. While the scoresheet is being recorded, *Teams* can reset the field for the next *Match*.
  9. The *Team* can then repeat steps 3-8 for their remaining allotment of *Matches*, i.e. maximum of 3 *Programming Skills Matches* and 3 *Driving Skills Matches*, one after another on the same video recording.
  10. The video recording can now be stopped.

- *Teams* will need to upload their video on a publicly accessible platform like YouTube, Facebook Video, Google Classroom, SchoolTube, etc and submit the URL to the *Event Partner* per the instructions on the event site.

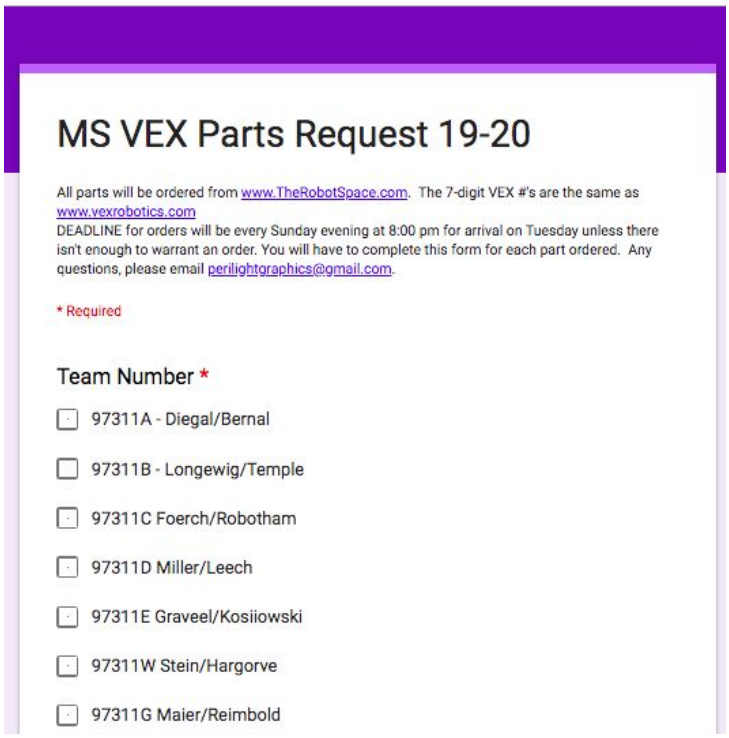
Parts Request Process:

Same information is on the Caledonia VEX Robotics Website. (Coaches Corner)

VEX PARTS REQUEST

To order parts for your team:

1. Research/look up parts at **www.vexrobotics.com** or **http://www.therobotspace.com** - take note of the 7 digit VEX part #
2. To order, complete and submit the High School google **form** or the Middle School google **form**. Orders will be submitted by the MS & HS parts coordinators for all teams. They will let you know when your parts order is expected to arrive.



MS VEX Parts Request 19-20

All parts will be ordered from www.TheRobotSpace.com. The 7-digit VEX #'s are the same as www.vexrobotics.com
DEADLINE for orders will be every Sunday evening at 8:00 pm for arrival on Tuesday unless there isn't enough to warrant an order. You will have to complete this form for each part ordered. Any questions, please email perilightgraphics@gmail.com.

* Required

Team Number *

- 97311A - Diegal/Bernal
- 97311B - Longewig/Temple
- 97311C Foerch/Robotham
- 97311D Miller/Leech
- 97311E Graveel/Kosiiowski
- 97311W Stein/Hargorve
- 97311G Maier/Reimbold

Pre-Event Checklist

Please use this checklist and the online resources linked here to assist you in planning and coordinating a successful VEX Robotics Competition (VRC) and/or VEX IQ Challenge event:

Two-Three Months Before Event:

- ☐ Reserve the venue, equipment, and services for event day and setup on the day before your event.
- ☐ Develop a layout for team pit areas, practice area, charging stations, check-in desk, inspection stations, queuing stations, game fields, judge deliberations area, volunteer and team lunch areas, and accessible audience seating. For VEX IQ events, also include STEM Research Project presentation area. See VEX IQ Sample Event Layouts.
- ☐ Create a safety plan and share with local emergency and/or security service providers and all participants. Provide a first aid kit for minor medical issues. For VRC, provide extra safety glasses for drive team use, and space to use small power tools.
- ☐ Reserve 2-way radios, use cell phones, or establish a method for event-day staff communications.
- ☐ Post complete event information on admin.robotevents.com/. Include your event agenda, travel details, food and lodging options, as well as your refund and event cancellation policy. See Getting Started as an Event Partner.
- ☐ Determine all awards to be offered and post the awards for your event on admin.robotevents.com/.
- ☐ Order trophies from www.vexrobotics.com/event-partners. Check with your Regional Support Manager to determine if your event qualifies for an Event Partner discount code to support the purchase of trophies, as well as VRC field(s) and game objects.
- ☐ Secure the required VEX field(s) and game objects. Field electronics are required only for VRC fields. To purchase these products, please visit: www.vexrobotics.com/event-partners.
- ☐ Secure inspection equipment, including robot sizing tools and competition switches for VRC events.
- ☐ Invite special guests and sponsors to the event, including any optional Welcome Ceremony speaker.
- ☐ Recruit key volunteers, including a Volunteer Coordinator, Judge Advisor, Head Referee, and Head Inspector. Share event details and training resources from the "Event Documents" site with your volunteer team, including:
  - 3 **Referees** per VRC game field and/or 1 per VEX IQ game field.
  - 2 design **Judges** for every 10-12 teams. 2 STEM Research Project Judges for every 10-12 VEX IQ teams.
  - 1 **Inspector** for every 6-8 VRC teams and/or 1 for every 10-12 VEX IQ teams
  - **Scorekeeper** and a backup to operate Tournament Manager from www.dwabtech.com/tm2/
  - Team and Volunteer check-in. Name tags, certificates from Tournament Manager Reports, and event shirts are optional ways to identify and recognize your volunteers.
  - Queuing, field re-set, and dependable setup and take down volunteers. Recruit team support!
  - Recruit more than the recommended number of volunteers to prepare for possible no-shows. Send frequent reminders to volunteers with training resources. For volunteer resources, visit:
    - **VRC:** www.roboticseducation.org/vex-robotics-competitionvrc/volunteer/
    - **VEX IQ:** www.roboticseducation.org/vex-iq-challenge/volunteering-for-vex-iq-challenge/
- ☐ Event Partner and key volunteers participate in live training calls to become familiar with jobs running event.

One Month Before the Event:

- ☐ Create a detailed agenda to guide teams and volunteers through the event day.
- ☐ Share your event agenda, parking and food options, and venue policies with all participating teams. Food options may range from brown bag to offering concessions as a fundraiser.
- ☐ Ensure that all event registration fees are paid by reviewing the team registration report on admin.robotevents.com/.
- ☐ Coordinate event-day custodial services to keep areas clean and well stocked with paper supplies.
- ☐ Secure one PC laptop, plus a backup, and a USB flash drive to save Tournament Manager data. Internet access is only required when uploading the event results to RobotEvents.com.
- ☐ Secure a printer to use at the scoring table, along with a connector cable, extra toner, and paper.
- ☐ A video projector, screen, and public announcer system will also enhance the audience experience.
- ☐ Ensure that all music played at your event can be shared legally and is appropriate for all ages.
- ☐ Secure tools to assemble VRC fields: 5/32" Allen wrench, 7/16" open ended wrench, #2 Phillips head screwdriver, tie wraps, gaffers tape, floor tarps, if needed, and white, blue, and red tape.
- ☐ Promote your event by using the media templates available on the Event Documents site.
- ☐ Arrange for event photography. Share photos with your Support Manager and your community.

One-Two Weeks Before the Event:

- ☐ Order food and beverages for your setup and event-day volunteers. Welcoming your volunteers with snacks and beverages and providing a nice lunch on event day demonstrates your appreciation of their volunteer service. Be sensitive to dietary restrictions. Local vendors may donate these supplies.
- ☐ Create a "Dummy" event in Tournament Manager to practice using the software and to finalize your event schedule. Do not upload your Tournament Manager or Event Codes or your practice results. Disconnect the internet to be safe.
- ☐ Print the following event documents, plus extras as needed:
  - Game Manual (VRC and/or VEX IQ) – At least 1 as reference for field volunteers
  - Inspection Guide and Checklist – (VRC and/or VEX IQ) 1 Guide for inspectors, 1 checklist per team
  - Referee Guide & Score Sheets (VRC and/or VEX IQ) – Score sheets for all matches plus 1 Guide
  - Judge Guide, Awards Appendix (VRC and/or VEX IQ) – 1 or more copies
  - Standard Award Descriptions (VRC and VEX IQ) – 1 copy
  - Interview Tips and Sample Questions (VRC and/or VEX IQ) – one copy per judge team (in Judge Guide)
  - Design Award Rubric – 1 rubric per team (in Judge Guide)
  - STEM Research Project document for judges and 1 rubric per VEX IQ team (VEX IQ only)
  - Judge note to missed teams (VRC and VEX IQ) – 1 for each 10 teams (large events)
  - Excellence Calculator – 1 for Judge Advisor (large events)
  - Awards Scripts – (VRC and/or VEX IQ) 1 for Head Judge (Now printable from Tournament Manager)
  - Registered team list for Team Check-In, Inspection, Emcee, and key volunteers – 6 or more copies
  - List of registered volunteers to support Volunteer Check-In – 1 or more copies
  - Drivers/Coaches meeting notes – 1 copy
  - Blank Participant Consent Forms – extras for all student and adult team participants and volunteers
  - Extra copies of the robot license plate template for teams who do not have official plates
  - Event signage and photography and recording notices to post at your event
  - Field and pits signage, reports, and certificates using Tournament Manager Reports functions
- ☐ Organize supplies: pens, self-stick notes, highlighters, paper, stapler, scissors, clipboards, and tape
- ☐ Assemble all trophies for display on a table in the event area.

One Day Before the Event:

- ☐ Download the list of registered teams (csv file in Tournament Manager) and save to your scoring computer and a USB drive.
- ☐ Create your Event in Tournament Manager using your Event and Tournament Manager Codes from admin.robotevents.com/. Your scorekeeper should maintain these codes for easy reference.
- ☐ Pre-assemble game and practice fields and game objects. For VRC and VEX IQ field specifications, please visit the Current Challenge pages on www.roboticseducation.org.
- ☐ Set up table(s) for scoring computer(s), printer, and optional projector, screen, and PA system. Test all equipment to ensure that it works properly with Tournament Manager. Tape all cords down for safety. Diagrams are available on www.roboticseducation.org.
- ☐ Set up the team pit areas with tables and chairs, as well as charging stations with power strips.
- ☐ Set up inspection stations with blank Inspection Checklists, pens, sizing tools, and competition switches for VRC teams. For VEX IQ, the game fields may be used for robot inspection.
- ☐ Set up the check-in desk with blank consent forms, program fliers, team and volunteer registration lists, containers to collect notebooks, and extra safety glasses for checkout to VRC participants.
- ☐ Set up queuing stations, judging areas, and volunteer areas.
- ☐ Post signage, tape, and/or stanchions to direct the safe and efficient traffic flow of all participants.

Thank you for your invaluable support! Enjoy a fun, successful VEX Robotics event!

Online Resources

VRC Event Documents: www.roboticseducation.org/vex-robotics-competitionvrc/game-day-running-an-event/
VEX IQ Event Documents: www.roboticseducation.org/vex-iq-challenge/viq-event-documents/
Tournament Manager Software Free Download: www.dwabtech.com/tm2/
To contact your Regional Support Manager, please visit: www.roboticseducation.org/contact-us/

Code of Conduct

The Robotics Education & Competition Foundation considers the positive, respectful, and ethical conduct of all students, teachers, mentors, parents, and other event attendees an important and essential component of all REC Foundation-sanctioned events.

We expect the following behavior and ethical standards at all REC Foundation-sanctioned events:

- Act with integrity, honesty, and reliability
- Behave in a respectful and professional manner with event staff, volunteers, and fellow competitors
- Exhibit maturity and class when dealing with difficult and stressful situations
- Respect individual differences
- Follow all rules as listed in the current game manual(s)
- Student-centered teams with limited adult assistance
- Safety as a top priority
- Good sportsmanship, which includes supporting your alliance partners

These expectations apply to all team members and all adults associated with a team including, but not limited to, teachers, mentors and parents. This Code may also apply to behavior outside of REC Foundation-sanctioned events where inappropriate actions are related to an event or participating individuals.

Judges will consider team conduct and ethics when determining awards.

Repeated or egregious violations of the expectations in this Code may result in consequences up to the disqualification of the team or organization from the current event and/or future events, and potentially removal from the program after review by the REC Foundation.

VEX Event Guide 2019-2020

Guide to Robotevents.com and Cal Robotics VEX registration process

Each team picks the tournament(s) and/or league dates they would like to attend. Teams can do any combination they choose..one league/one tournament, two tournaments/no leagues. Please keep in mind, the more teams compete, the better they get!

Registration Process

Coaches/Mentors/Captains - please DO NOT register your team on robotevents.com. The HS and MS coordinators will register and pay the fees for all teams. To inform us of which event(s) your team would like to participate, please complete this MS Event Request Form for Middle School teams and this HS Event Request Form for High School teams.

BEFORE completing the above Request Forms, please review the following criteria:

- WWW.ROBOTEVENTS.com -Please review the event on this website prior to signing up through Cal Robotics. Double check the price, type of event, location, awards, agenda, cancellation policy etc...to make sure this event is the right one for your team and that there have not been any last minute changes by the Event Provider. See below for tips on searching for events.

- FEES
  - Each High School team has a **maximum of $190** to spend towards regular-season leagues and tournaments. Fees and schedules are listed on the request form.
  - The Middle school teams have **$95** to attend one tournament and the Mega League.
  - Any event fees in excess of $190(HS) or $95(MS) will be collected at the end of the season from team members.
  - Post Season -State, Invitationals, Signature Events (Kalahari) and Worlds Tournament fees ARE the responsibility of the team as is all fundraising activities to pay for travel costs to and from these events. Team coaches/mentors need to complete a Fundraiser Request form and follow the Caledonia EnrichED's Fundraising Guidelines (page 3).
  - Please choose wisely as there are **no refunds** once the fee has been paid.
- EVENT SPECIFICS
  - Some events are HS or MS specific or are Blended (MS and HS competing against each other)
  - NO Regionals (all Michigan-based events qualify for State spots) or Skills-Only Events (teams MUST do Skills runs at Leagues or Tournaments)
  - The High School State Tournament is on 2/23/2020 (Sunday) in East Lansing. Fee is $300. This is by invitation-only as the team needs to qualify through a Tournament/League or by Skills scores.
  - The Middle School State Tournament is on Saturday, March 7th, 2020 in Monroe, Michigan. Fee is $250. This is by invitation-only as the team needs to qualify through a Tournament/League or by Skills scores

Mega League - The West Michigan Robotics Event Partners are hosting a "Mega League" again this year where up to 100 teams can register to complete. Area event partners will host 20 league nights over eight weeks and then the top ranked teams will complete in separate state qualifying HS and MS finals tournaments. No awards will be given from this event. See below for the League Finals information.

- **Finals Qualifications**
    - There will be a finals event for both the middle and high school ages.
    - The top 24 or top 30% of teams will be invited based on the combined ranking (by winning percentage) of all of the league nights as determined by the VEX Tournament Manager software.
    - To qualify for the finals, teams are required to compete on at least four league nights and must compete at least once in each section of the season. (Section A: 1-8, Section B: 9-16, Section C: 17-20).
    - The finals will be scheduled across two nights (Tuesday, November 19th and Wednesday, November 20th for High School, and Tuesday, December 3rd and Wednesday, December 4th for Middle School) and all league scores will be reset. The first night will have five qualification rounds, skills, and judging. The second night will have two qualification rounds, elimination alliance selection, elimination rounds, and awards

Early Bird Registration -

For more Information regarding the Early Bird Registration - click HERE for the FAQ

- Events will open for registration 8 weeks before the event
- The early bird registration period ends 6 weeks before the event
- During early bird registration, only host teams and teams who have registered for less than 2 events may register (Leagues, Workshops, Invitationals do not count towards this number)
- After the early bird period ends, all teams may register for the event

HOW TO SEARCH FOR EVENTS ON www.robotevents.com

- Click on Robotic Competition and a drop-down box will appear. Click on VEX Robotic Competitions.
- Click on State/Region then choose Michigan. Click on **FILTER.** All Michigan Events will be listed. If you are looking for a specific type of event ie...league then click on Event Type and choose an event type, then **FILTER** again.
- At this point, you can access the World Skills Rankings by clicking on the blue box
- You can also search for events via Map Search. Click on the blue box for Map Search. Click on Filter. Click on Programs and de-select all but VRC. Below United States, click on the drop-down and find and select Michigan. Click on **FILTER**. You can then search by map and/or click on LIST and see a list view on the side of the screen.

VEX Parts 10

1. NEVER throw any parts away UNLESS it is completely unusable
2. ALWAYS wear goggles when cutting metal
3. Only take what you need! (No hoarding of parts)
4. Put unused parts back in the right compartment
5. If you take the last part, FILL OUT THE PARTS REQUEST FORM on the website.
6. Try used metal pieces BEFORE cutting new metals
7. If you see a part on the floor, PICK IT UP, then follow #4
8. Metals can be bent back into place so try this before taking any new metals
9. Keep your work area organized, especially when working with tiny screws, nuts, etc.
10. CLEAN UP at the end of the day and HAVE FUN!