VEX ROBOTICS COMPETITION

(IN THE ZONE)

vexrobotics.com

VEX EDR
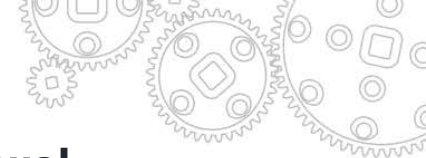
VEX Robotics Competition *In the Zone* – Game Manual

Table of Contents

vexrobotics.com

VEX EDR

Section 1 – Introduction

Overview

This section provides an introduction to the VEX Robotics Competition and VRC In the Zone.
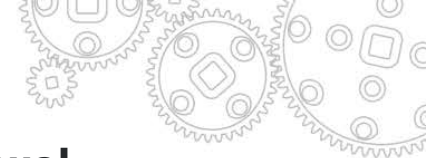
The VEX Robotics Competition

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 EDR 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 In the Zone 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 In the Zone. 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.

🌐 vexrobotics.com

VEX Robotics Competition In the Zone – Game Manual

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 to 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, Robomatter, DWAB Technologies, and VEX Robotics.

VEX Robotics Competition In the Zone: A Primer

VEX Robotics Competition In the Zone is played on a 12 ft x 12 ft foam-mat, surrounded by a sheet-metal and lexan perimeter. There are eighty *Cones* that can be *Stacked* on ten *Goals*, while some *Goals* can be *Scored* into *Zones*; teams also score points for having different types of *Highest Stacks* and by *Parking* at the end of the *Match*.

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

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

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

🌐 vexrobotics.com
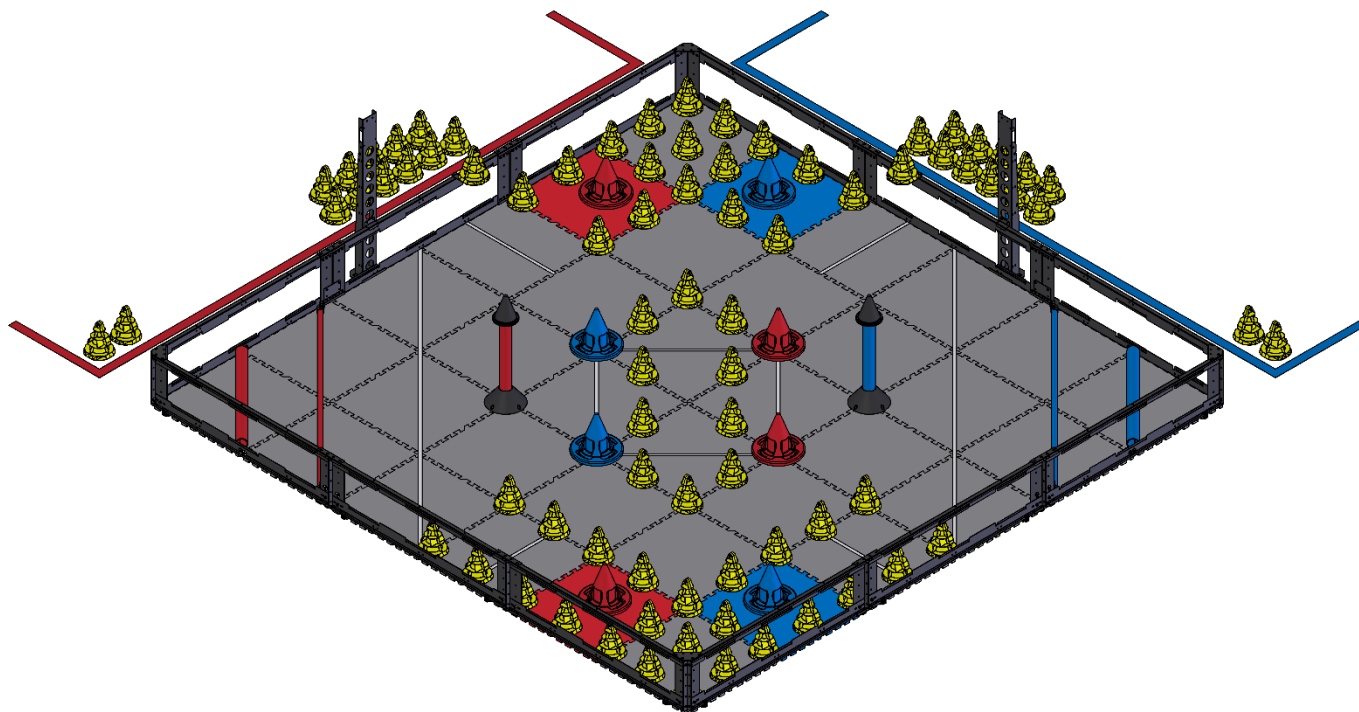
Section 2 – The Game

Overview

This section describes the 2017-2018 VEX Robotics Competition game entitled *VEX Robotics Competition In the Zone*. 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 *Stacking Cones* on *Goals*, by *Scoring Mobile Goals* in *Goal Zones*, by having the *Highest Stacks*, and by *Parking Robots*.

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

Figure 1: *View of the field at starting configuration*
Note: *The illustrations in this section of the manual are only provided to give a general visual understanding of the game. Teams should refer to the official field specifications available in Appendix A for exact field dimensions, a full field bill of materials, exact details of field construction, and lower cost field options.*

vexrobotics.com

VEX Robotics Competition In the Zone – Game Manual

Each VEX Robotics Competition In the Zone *Match* includes the following:

- Ninety (90) *Scoring Objects*
  - Eighty (80) *Cones*
    - Four (4) *Cones*, one (1) per *Robot*, as *Preloads*
    - Twenty-four (24) *Cones*, twelve (12) per *Alliance*, as *Match Loads*
    - Fifty-two (52) start at designated locations on the field
  - Eight (8) *Mobile Goals*, four (4) per *Alliance*
  - Two (2) *Stationary Goals*, one (1) per *Alliance*
  - Six (6) *Goal* Zones, three (3) per *Alliance*, for *Scoring Goals*
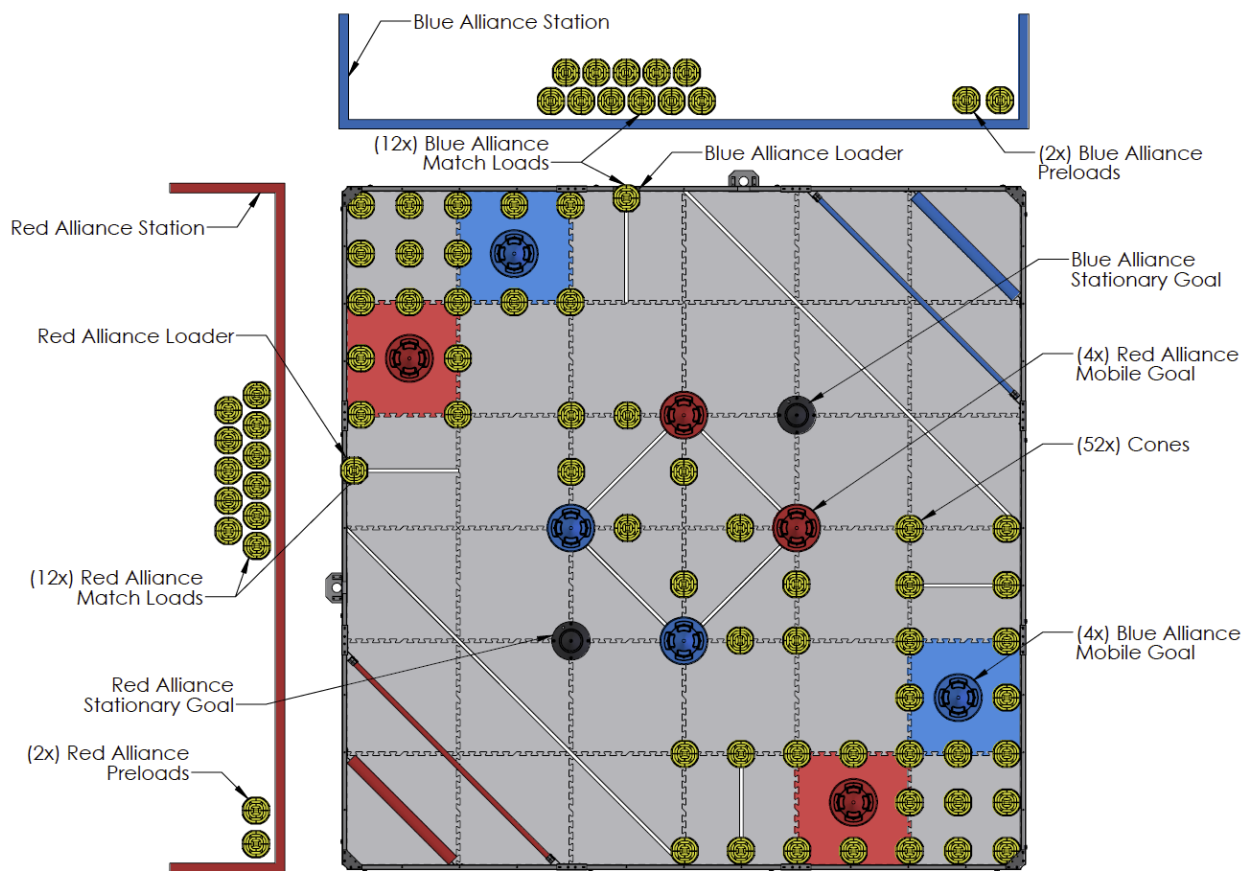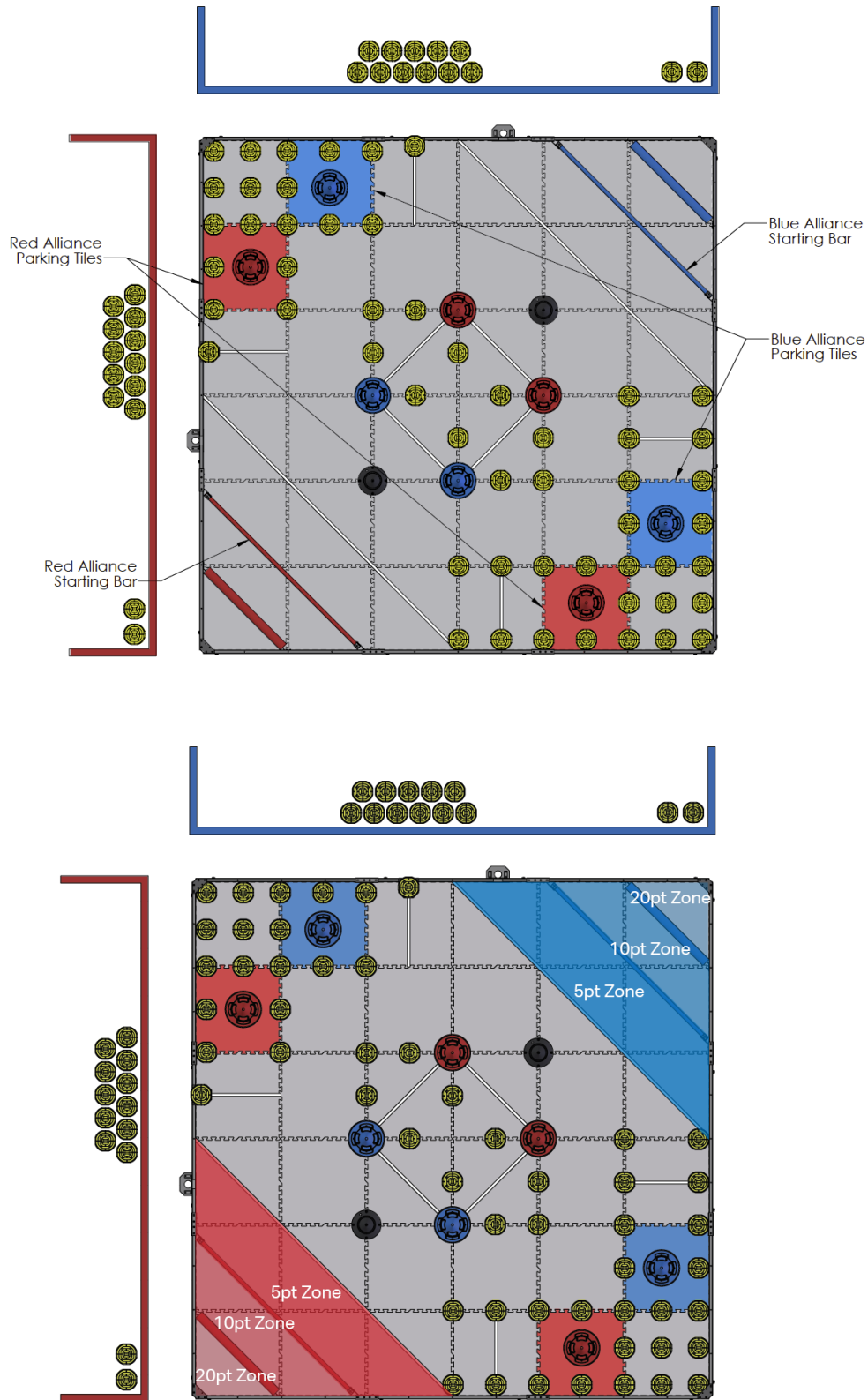 - Four (4) *Parking Tiles*, two (2) per *Alliance*, for *Parking Robots*

Figure 2: *Annotated view of the field*

Figures 3 & 4: *Annotated views of the field*

vexrobotics.com

Game Definitions

5 Point Zone – One of two (2) areas of foam field tiles, one (1) for each alliance, in which *Robots* can *Score Mobile Goals*. The *5 Point Zone* is defined by the inner edges of the playing field walls, the *Starting Bar*, and the diagonal white tape line.
Note: The tape and *Starting Bar* are considered to be a part of *the 5 Point Zone*

10 Point Zone – One of two (2) areas of foam field tiles, one (1) for each alliance, in which *Robots* can *Score Mobile Goals*. The *10 Point Zone* is defined by the inner edges of the playing field walls, the *Starting Bar*, and the large ~2.375" (60.325 mm) pipe that separates *the 10 Point Zone* and the *20 Point Zone*.
Note 1: The *Starting Bar* is not considered to be a part of the *10 Point Zone*
Note 2: The large pipe is considered to be part of the *10 Point Zone*

20 Point Zone – One of two (2) areas of foam field tiles, one (1) for each alliance, in which *Robots* can *Score* a *Mobile Goal*. The *20 Point Zone* is defined by the inner edges of the playing field walls and the large ~2.375" (60.325 mm) pipe that separates The *10 Point Zone* and *20 Point Zone*.
Note 1: The large pipe is not considered to be in the *20 Point Zone.*
Note 2: Only one *Mobile Goal* can be *Scored* in each *20 Point Zone.*

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

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

Autonomous Bonus – A bonus awarded to the *Alliance* that *Scores* the most *Cone & Goal* points during the *Autonomous Period*.

Autonomous Period – A 15-second (0:15) time period at the start of the *Match* during which *Robots* operate and react only to sensor inputs and to commands pre-programmed by the *Students* into the *Robot* control system.

Cone – A yellow plastic conical shaped *Scoring Object* with an overall height of approximately 7" (177.8mm) and a base diameter of approximately 6" (152.4 mm). *Cones* may be *Stacked* on *Goals* to earn points. Each *Cone* weighs approximately 0.26 lbs (117.9g)

Disablement – A penalty applied to a *Team* for a rule violation. During *Disablement* a *Team* is no longer allowed to operate their robot 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 *Qualifying Match* receives zero (0) *Win Points, 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. Please see Section 3 – The Tournament for further details and associated definitions.

Drive Team Member – Any of the three (3) *Students* allowed in the *Alliance Station* during a *Match* for each *Team*. Only *Drive Team Members* are allowed to touch the controls at any time during the *Match*, interact with the *Robot* as per <G5>, and interact with *Scoring Objects* as per <SG3>. Adults are not allowed to be *Drive Team Members*.

Driver Controlled Period – The one minute and forty-five second (1:45) time period during which the *Student Drive Team Members* operate the *Robots*.

Entanglement – A *Robot* is considered to have *Entangled* an opposing *Robot* if it has grabbed or hooked the opponent *Robot*, as per <G12>.

Field Element – The foam field tiles, field perimeter, *Loader*, *Stationary Goal*, *Starting Bar*, pipes that demarcate the *Goal Zones,* and all supporting structures.

Goal – A *Mobile Goal* or a *Stationary Goal.*

Goal Zone – A *5 Point Zone, 10 Point Zone, or 20 Point Zone.*

Highest Stack – A *Highest Stationary Goal, Highest 5 Point Zone, Highest 10 Point Zone, or Highest 20 Point Zone Stack*

Highest Stationary Goal Stack – The *Stack* on a *Stationary Goal* with the most *Cones.*

Highest 5 Point Zone Stack – The *Stack* on a *Scored Goal* in *5 Point Zone* with the most *Cones.*

Highest 10 Point Zone Stack – The *Stack* on a *Scored Goal* in *10 Point Zone* with the most *Cones.*

Highest 20 Point Zone Stack – The *Stack* on a *Scored Goal* in *20 Point Zone* with the most *Cones.*

Loader – A designated location where *Drive Team Members* may place *Match Loads* during a *Match*.

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

Match Affecting – A situation that results in a change of the winner and loser of a *Match*.

Match Loads – The twenty-four (24) *Cones,* twelve (12) per *Alliance*, that *Drive Team Members* may place onto their *Loader* at any point during the *Match*, one at a time.

🌐 vexrobotics.com

Mobile Goal – One of the eight (8) conical *Scoring Objects* with an overall height of approximately 10" (254 mm) and a maximal base diameter of 10" (254 mm). There are four (4) red and four (4) blue *Mobile Goals*. Each *Mobile Goal* weighs approximately 3.7 lbs (1.68 kg) *Cones* may be *Stacked* on *Mobile Goals* to earn points. *Mobile Goals* may also be *Scored* in *Goal Zones* to earn points.

Parked – A *Robot* is considered to be *Parked* if it is touching one of its *Alliance's Parking Tiles* at the end of the *Match*. Only one *Robot* can earn *Parking* points on a single *Parking Tile*.

Parking Tile – A red or blue tile that designates the location where *Robots* can earn points for *Parking* at the end of the *Match*.

Pinning – A *Robot* is considered to be *Pinning* an opposing *Robot* if it is inhibiting the movement of an opponent *Robot* while the opposing *Robot* is in contact with the foam playing surface and another *Field Element*.

Preload – The four (4) *Cones,* one (1) per robot, that must be placed on the field such they satisfy the following conditions, as per <SG2>, at the start of the *Match*:

- The *Preload* is touching its *Robot* and no other *Robot.*
- The *Preload* is fully within the field perimeter.

Possessing – A *Robot* is considered to be *Possessing* a *Cone* if it is carrying, holding, or controlling the movement of a *Cone* in the *Robot*. Pushing/plowing *Cones* is not considered *Possession*, however using concave portions of your *Robot* to control the movement of *Cones* is considered *Possession*.

Robot – Anything that has passed inspection that a *Team* places on the field prior to the start of a *Match*.

Scored – A *Mobile Goal* is *Scored* in a *Goal Zone* if it meets all of the following criteria:

1. The *Mobile Goal* is touching the *Goal Zone*
   a. If a *Mobile Goal* is touching multiple *Goal Zones* it is *Scored* in the higher point value *Goal Zone*
2. The *Mobile Goal* is not touching a *Robot* of the same color *Alliance*.
3. The *Mobile Goal* and the *Goal Zone* belong to the same *Alliance*.

Note 1: Only one *Mobile Goal* can be *Scored* in each *20 Point Zone.*
Note 2: If multiple *Mobile Goals* are in a scored position in a *20 Point Zone*, the *Mobile Goal* with the most *Cones Stacked* will be the one that is *Scored.*
Note 3: If a *Mobile Goal* is not touching a *Zone*, but is entirely *Supported* by other *Scoring Objects* it counts as being *Scored* in the highest value *Scoring Zone* of the *Supporting Scoring Objects*.

*Scoring Object –* A *Cone* or a *Mobile Goal.*

Stacked – A *Cone* is *Stacked* on a *Goal* if it is not touching a *Robot* of the same color *Alliance* as the *Goal* and either:

a)   Fully nested on a *Goal* (see Figures 5 & 6).
b)   Fully nested on a *Stacked Cone* (see Figures 7 & 8).

Note 1: *Cones* still count as being *Stacked* even if the *Mobile Goal* that they are *Stacked* on is not *Scored.*
Note 2: By these definitions, if a *Robot* is touching a *Cone* on a *Mobile Goal,* that *Cone* and any above it will not count as being *Stacked.*
Note 3: *Cones* are not considered *Stacked* unless the *Goal* upon which they are fully nested is upright. *Stacked Cones* on tilted *Goals* are fine (e.g. a *Mobile Goal* resting partially on top of a *Zone* pipe or *Cone*), however *Cones* that are fully nested upon a *Goal* that has been knocked over will not count as *Stacked.* (see Figures 9, 10, & 11)
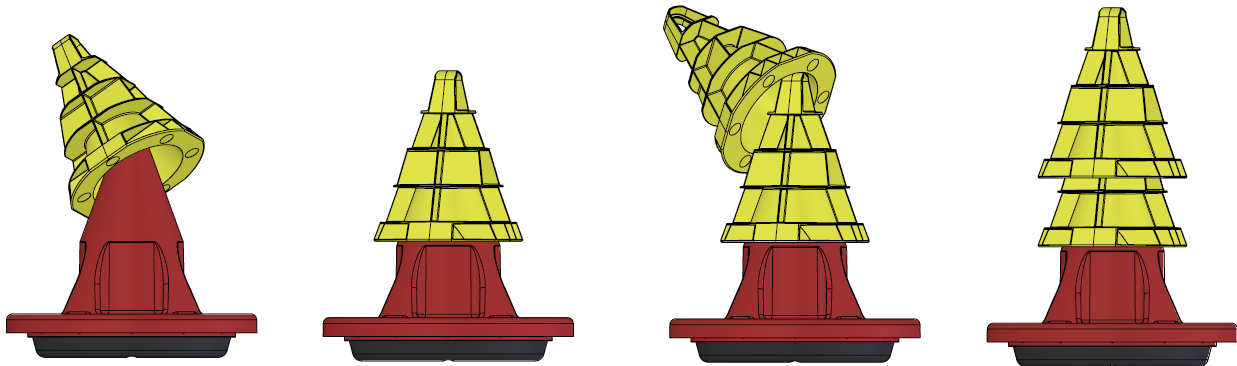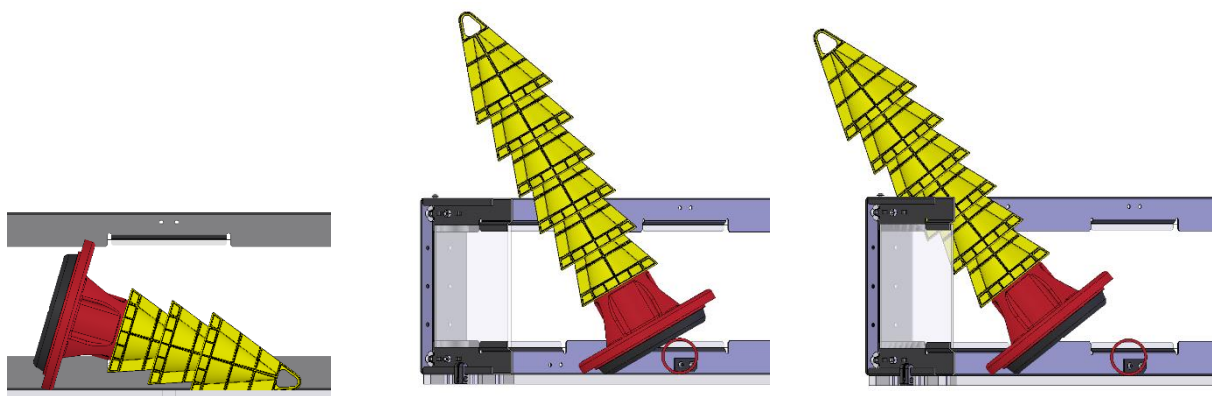

Figure 5: *– A Cone not fully nested on a Goal*
Figure 6: *– A Cone fully nested on a Goal*
Figure 7: *– A Cone not fully nested on a Stacked Cone*
Figure 8: *– A Cone fully nested on a Stacked Cone*

Figure 9: *– A knocked over Mobile Goal; these Cones are not considered Stacked*
Figure 10: *– A Mobile Goal resting on a Field Element (the 20 Point Zone pipe); these Cones are considered Stacked*
Figure 11: *– A Mobile Goal that is tilted due to its Cones resting on the field perimeter; these Cones are considered Stacked*

Starting Bar – The ~1" (25.4 mm) pipe that separates the *5 Point Zone* and the *10 Point Zone* and also designates the location of *Robots* at the start of the *Match* as per <SG1>.

Stationary Goal – One of the two (2) posts with a conical top with an overall height of approximately 25" (635 mm). There is one (1) red and one (1) blue *Stationary Goal*. *Cones* may be *Stacked* on *Stationary Goals* to earn points

Student – Anyone enrolled in a pre-college school or is home-schooled as part of a pre-college educational curriculum and is born after April 28th, 1999. Eligibility may also be granted based on a disability that has delayed education by at least one year.

- *Middle School Student* – A *Student* enrolled in grade 8 or lower, or enrolled in grade 9 in a school which includes grade 8, but not grade 10.
- *High School Student* – Any eligible *Student* that is not a *Middle School Student*.

Supported – A *Scoring Object* is considered to be *Supported* if it would no longer occupy the same position if the "supporting" object were to disappear. Referees will check to see if *Scoring Objects* are *Supported* by gently pulling away the supporting object if possible.

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*. *Teams* may be associated with schools, community/youth organizations, or a group of neighborhood *Students*.

Trapping – A *Robot* is considered to be trapped if an opposing *Robot* has restricted it 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.

Zone – A 5 Point Zone, 10 Point Zone, or 20 Point Zone.

Game Rules

Scoring

- A *Cone Stacked* on a *Goal* is worth two (2) points for the *Alliance* of the color of the *Goal.*
- A *Mobile Goal Scored* in *the 5 Point Zone* is worth five (5) points for the *Alliance* of the color of the *Zone.*
- A *Mobile Goal Scored* in *10 Point Zone* is worth ten (10) points for the *Alliance* of the color of the *Zone.*
- A *Mobile Goal Scored* in *20 Point Zone* is worth twenty (20) points for the *Alliance* of the color of the *Zone.*
- Each type of *Highest Stack* is worth five (5) points for the *Alliance* of the color of the *Goal.*
- A *Robot Parked* at the end of the *Match* is worth two (2) points for the *Alliance* of the color of the *Robot.*
- The winner of the *Autonomous Bonus* with the most points receives a ten (10) point bonus.

Safety Rules

<S1> If at any time the *Robot* operation or *Team* actions are deemed unsafe or have damaged the *Field Elements* or *Scoring* Objects, the offending *Team* may be *Disabled* and/or *Disqualified* by the determination of the referees. The *Robot* will require re-inspection before it may again take the field.

    a.   *Teams* should be extra cautious when interacting with *Scoring Objects*. Damage to *Scoring Objects* can be ruled as a violation of <S1>.

<S2> 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 border during normal game play.

General Game Rules

<G1> 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,* or even the entirety of the event depending on the severity of the situation. It is important to remember that we are all judged based on how we deal with adversity. 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.

<G2> When reading and applying the various rules in this document, please remember that common sense always applies in the VEX Robotics Competition.

<G3> 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. An offending *Robot* will be removed from the match at the Head Referee's discretion.

<G4> Each *Team* shall include up to three *Drive Team Members*. No *Drive Team Member* may fulfill this role for more than one *Team* at any given event.

<G5> *Drive Team Members* may only touch the *Team's* controls, *Robot,* and *Scoring Objects* at specified times during a *Match* as per <G5a> and <SG3>. *Drive Team Members* are prohibited from making intentional contact with any *Scoring Object*, *Field Element* or *Robot* during a *Match,* with the exception of the contact specified in <G5a> and <SG3>.

   a. During the *Driver Controlled Period*, *Drive Team Members* may handle their own *Robot* if no part of the robot has moved at all during the *Match*. The type of fixes that are allowed are limited to the following:
      a. Turning the Robot on or off
      b. Plugging in a battery and/or power expander
      c. Plugging in a VEXnet Key
      d. Turning the power expander on or off
   b. *Drive Team Members* are not permitted to break the plane of field perimeter at any time during the match, with the exception of the actions described in <G5a> and <SG3>.

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.

<G6> During a *Match*, the *Drive Team Members* must remain in their *Alliance Station*. *Drive Team Members* are not allowed to use any sort of communication devices during their *Match*. Devices with communication features turned off (e.g. a phone in airplane mode) are allowed.

<G7> During the qualification rounds, the red *Alliance* has the right to place its *Robots* on the field last. During the elimination rounds, the higher 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*. A *Team* that violates this rule will have its robots randomly repositioned by the referees.

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

<G8> During a *Match*, *Robots* may be operated only by the *Drive Team Members* and/or by software running on the *Robot's* control system. During the *Autonomous Period Drive Team Members* are not permitted to interact with the *Robot,* the controls on their VEXnet Joysticks, or to unplug from the field in any way, directly or indirectly. (e.g. Triggering sensors without touching the *Robot* is still illegal.) 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.

<G9> Scores will be calculated for all *Matches* immediately after the *Match* once all objects and *Robots* on the field come to rest. The determination of the *Autonomous Bonus* will occur for all *Matches* immediately after the *Autonomous Period* after all objects and *Robots* on the field come to rest.

<G10> 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.*

<G11> *Robots* may not intentionally detach parts during any *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.

<G12> Strategies aimed solely at the destruction, damage, tipping over, or *Entanglement* of *Robots* are not part of the ethos of the VEX Robotics Competition and are not allowed. However, *VEX Robotics Competition In the Zone* is an interactive game. Some incidental tipping, *Entanglement*, and damage may occur as a part of normal game play. 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 a *Team* being *Disqualified* from the remainder of the competition.

VEX Robotics Competition In the Zone is intended to be an offensive game. *Teams* that partake in solely defensive strategies will undergo extra scrutiny in regard to <G12>. In the case where referees are forced to make a judgment call on interaction between a defensive and offensive *Robot*, the referees will err on the side of the offensive *Robot*.

A *Team* is responsible for the actions of its *Robot* at all times, including the *Autonomous Period*. This goes for *Teams* that are driving recklessly and potentially causing damage, but also goes for *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.

🌐 vexrobotics.com

<G13> Intentional strategies causing 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.

<G14> *Robots* must be designed to permit easy removal of *Scoring Objects* from any mechanism without requiring the *Robot* to have power after a *Match*.

<G15> Field tolerances may vary by as much as ±1", except where otherwise noted, so *Teams* must design *Robots* accordingly. Please make sure to check Appendix A for more specific tolerances. Note: The field perimeter should always be resting upon the Field Perimeter Rubber Feet, regardless of whether or not the tabs have been cut off the foam field tiles.

<G16> Replays are at the discretion of the Event Partner and Head Referee, and will only be issued in the most extreme circumstances.

<G17> All *Teams* must adhere to all VEX Robotics Competition Rules as they are written and must abide by the stated intent of the rules. Every *Team* has the opportunity to ask for official rules interpretations in the VEX Robotics Competition Question & Answer Forum. All responses in this Q&A forum should be treated as official rulings from the VEX Robotics Competition Game Design Committee, and they represent the correct and official interpretation of the VEX Robotics Competition Rules.

There may also be periodic "Team Updates" posted on the *VEX Robotics Competition In the Zone* webpage in the competition section of www.vexrobotics.com and www.roboticseducation.org. These updates are also "official" parts of the *VEX Robotics Competition In the Zone* rules.

The VEX Robotics Competition Question & Answer Forum can be found at www.vexforum.com, or directly at http://www.vexrobotics.com/In_the_Zone.

<G18> All rules in this manual are subject to changes, and not considered official until August 17th, 2017. We do not expect any major changes to take place, however we do reserve the right to make game changes until August 17th, 2017. There will also be scheduled manual updates on June 15th, 2017 and April 5th, 2018.

    a. The Game Design Committee reserves the right to make changes to this manual in the April 5th, 2018 release specifically for the VEX Robotics World Championship. Specific items which will be considered for changes are the number of *Cones* and *Mobile Goals*.

🌐 vexrobotics.com

VEX In the Zone Specific Game Rules

\<SG1\> At the beginning of each *Match*, each *Robot* must be placed such that it is touching the *Alliance's Starting Bar*, not touching any *Scoring Object* other than those permitted by \<SG2\> and not touching another Robot.
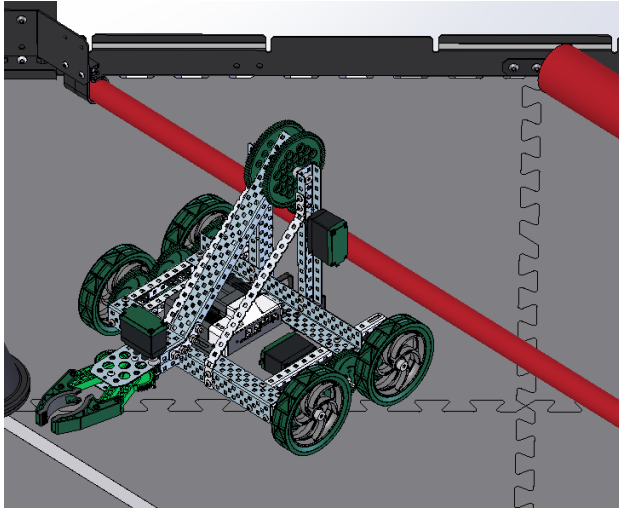
Figure 12 (left): An illegal starting position
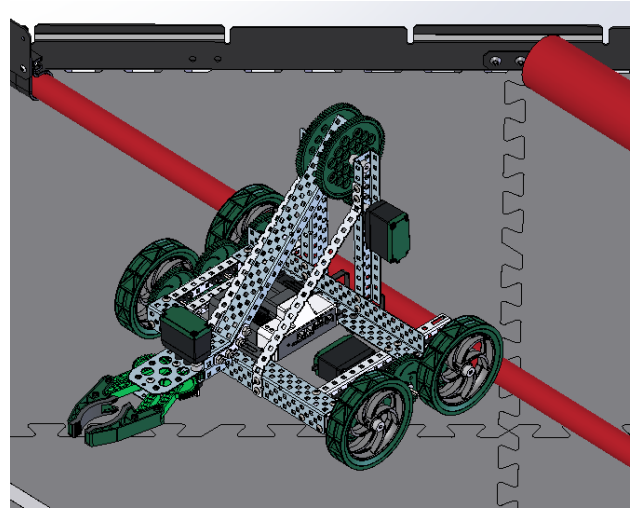
Figure 13 (right): A legal starting position

\<SG2\> Prior to the start of each *Match*, each *Robot* must use its one (1) *Cone* available as a *Preload*. A *Cone* is considered to be legally preloaded if it is touching the *Robot,* not touching another *Robot,* and is fully within the field perimeter. If a Robot is not present for their *Match*, their *Cone* will be placed randomly such that it is touching the *Alliance Starting Bar*.
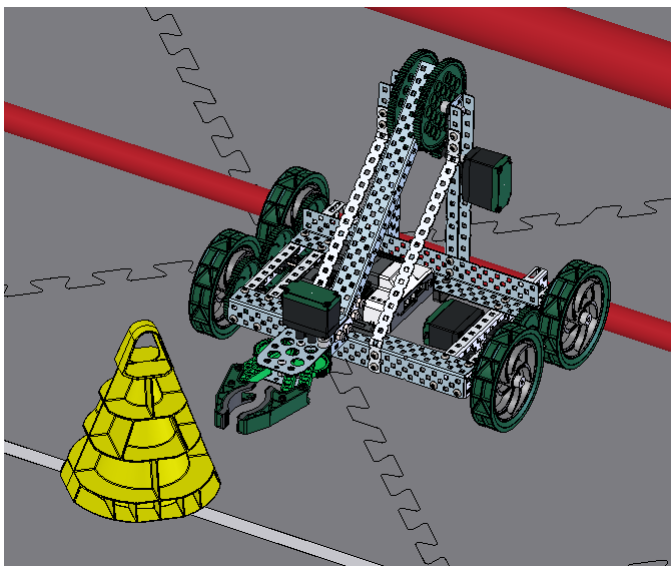
Figure 14 (left): An Illegal Preload
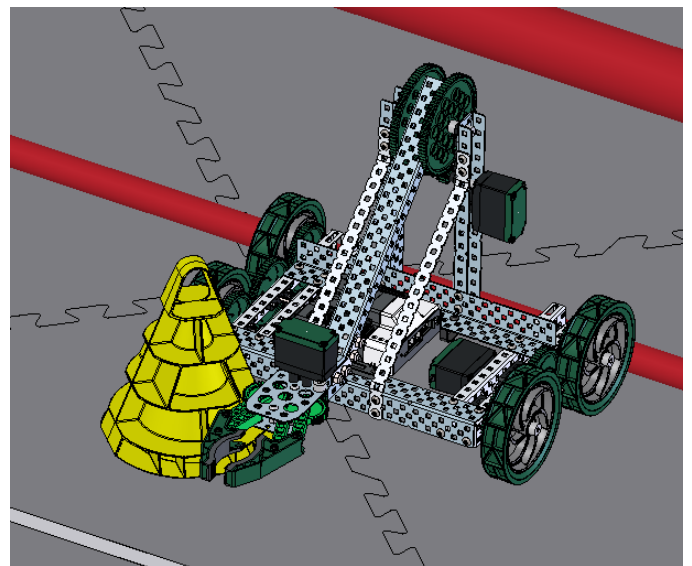
Figure 15 (right): A Legal Preload

🌐 vexrobotics.com

<SG3> There can never be more than one (1) *Cone* on a *Loader* at any given time. There will be one (1) *Cone* on the *Loader* to start the *Match*. Additional *Cones* may be loaded by a *Drive Team Member* onto the *Loader* at any point during the *Match*. *Cones* must be placed upright and upon the *Loader*. *Robots* may not contact a *Cone* if it is being touched by a human.

Note: *Cones* are considered to be "in play" once they are placed on the *Loader* and may no longer be contacted by *Drive Team Members*.

> **a.** *Robots* may not contact *Cones* on the opposing *Alliance Loader*.

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.

<SG4> A *Robot* may not *Pin* or *Trap* an opposing *Robot* for more than five seconds during the *Driver Controlled Period*. A *Pin* or *Trap* is officially over once the *Pinning Robot* has moved away and the *Robots* are separated by at least 2 feet (approximately one (1) foam tile). After ending a *Pin* or *Trap*, a *Robot* may not *Pin* or *Trap* the same *Robot* again for a duration of 5 seconds; if a *Team* does pin the same *Robot* again, the pinning count will resume from where it left off when the pinning *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. There is no penalty for *Pinning* during the *Autonomous Period*.

<SG5> *Robots* may not intentionally or accidentally, indirectly or directly, remove *Cones* from an opponent's *Stack* (i.e. *Cones* that are fully nested on an opponent's upright *Goal*).

> **a.** A *Robot* that accidentally knocks over an opponent's *Goal,* causing *Cones* to be removed, would be in violation of this rule. *Teams* should exercise extreme caution when interacting with or around opponent *Goals*.

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.

<SG6> *Robots* may not intentionally grasp, grapple or attach to any *Field Elements* or the opposing *Mobile Goals*. Strategies with mechanisms that react against multiple sides of a *Field Element* in an effort to latch 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

🌐 vexrobotics.com

will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the Head Referee's discretion.

<SG7> Two *Robots* on the same *Alliance* may not work in tandem to block access to portions of the field. Examples include, but are not limited to, two *Robots* blocking access to:

- *Scoring Zones*
- Corners of the field (especially in an effort remove access to *Cones* or *Mobile Goals*)
- The *Loader*

Note: Robots incidentally blocking access to portions of the field while attempting to Stack Cones on Goals, Score *Mobile Goals* in Goal Zones or while Parking is an expected part of game play.

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.

<SG8> It is expected that *Scoring Objects* may unintentionally leave the field during *Match* play. *Scoring Objects* that leave the playing field will not be returned. *Teams* may not intentionally remove *Scoring Objects* from the field while not in the process of *Scoring/Stacking*. We do expect *Scoring Objects* to leave the field accidently during intentional *Scoring/Stacking*, however doing so intentionally or repeatedly would be a violation of this rule.

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.

<SG9> *Robots* may not *Possess* more than one (1) *Cone* at a time.

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.

Note: The intent of this rule is not to punish *Robots* for pushing *Cones* that are in their way; that is, *Robots* are free to incidentally drive through *Cones* on the field while *Possessing* a *Cone*. However, **Teams are not allowed to employ *Cone* hoarding strategies.** *Cone* "hoarding" refers to the act of intentionally plowing multiple *Cones* to a specific location of the field, even with a flat/convex portion of a *Robot,* such that they are kept away from the opposing *Alliance*.

Note 2: *Stacked Cones* do not count towards the *Possession* limit. (i.e. A *Robot* is allowed to control the movement of a *Mobile Goal* with *Stacked Cones*). *Robots* can interact with *Cones* that are fully

🌐 vexrobotics.com

nested on upright *Goals* without those *Cones* counting towards the possession limit, provided that those *Cones* would otherwise be considered *Stacked* if they were not being contacted by a *Robot*.

<SG10> *Robots* may not contact the opposing *Alliance's 10 Point Zone* or *20 Point Zone*.

   a. *Robots* may not contact an opposing *Robot* that is contacting opposing *Robot's 10 Point Zone, 20 Point Zone*, or *Starting Bar*.

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.

<SG11> *Robots* may not put a *Mobile Goal* in an opposite *Goal Zone*. (i.e. A *Robot*, regardless of *Alliance*, cannot put a red *Mobile Goal* in a blue *Goal Zone* or a blue *Mobile Goal* in a red *Goal Zone*.)

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.

<SG12> *Robots* may not intentionally drop or place *Scoring 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.

<SG13> At the start of the *Match* all *Scoring Objects* on the field will be placed upright in their designated locations, however the rotation is not specified.

<SG14> As per <G3>, 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. Once the *Match* begins, *Robots* may expand, but no horizontal dimension can exceed 36" (914.4 mm) at any point during the *Match*.

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.

   a. There is no height limit on *Robot* expansion.

<SG15> *Scoring Objects* cannot be used to accomplish actions that would be otherwise illegal if they were attempted by *Robot* mechanisms.

Section 3 – The Tournament

Overview

The main challenge of the VEX Robotics Competition will be played in a tournament format. Each tournament will include *Practice*, *Qualifying*, and *Elimination Matches*. After the *Qualifying Matches*, teams will be ranked based on their performance. The top teams will then participate in the *Elimination Matches* to determine the tournament champions.

Tournament Definitions

Alliance Captain – The *Team Representative* of the highest ranked team that is asked to invite an available team to join his or her alliance.

Alliance Selection – The process of choosing the permanent alliances for the *Elimination Matches.*

Autonomous Points (AP) – The second basis of ranking teams. *Autonomous Points* are awarded in the amount of *Autonomous Bonus* points earned by an *Alliance* in a *Qualifying Match*.

Disqualification – A penalty applied to a team for a rules violation. When a team is disqualified in a *Qualifying Match* they receive zero (0) *WP, AP,* and *SP*. When a team is disqualified in an *Elimination Match* the entire alliance is disqualified and they receive a loss for the match.

Elimination Match – A match used to determine the championship alliance. Alliances of three (3) face off in a best two (2) of three (3) series, with two teams playing in each match. The first alliance to win two (2) matches will proceed to the next round.

Practice Match – An un-scored match used to provide time for teams to get acquainted to the official playing field.

Qualifying 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 awarded in the amount of the score of the losing alliance in a *Qualifying Match.*

Team Representative – A student chosen to represent their team during *Alliance Selection* for the final *Elimination Matches*.

Win Points (WP) – The first basis of ranking teams. *Win Points* are awarded for winning (two points) and tying (one point) a *Qualifying Match*.

Practice Matches

At the event, *Practice Matches* may be played in the morning during the team registration time until the drivers meeting begins. Every effort will be made to equalize practice time for all teams, but they may be conducted on a first-come, first-served basis. These matches are not scored, and will not affect team ranking.

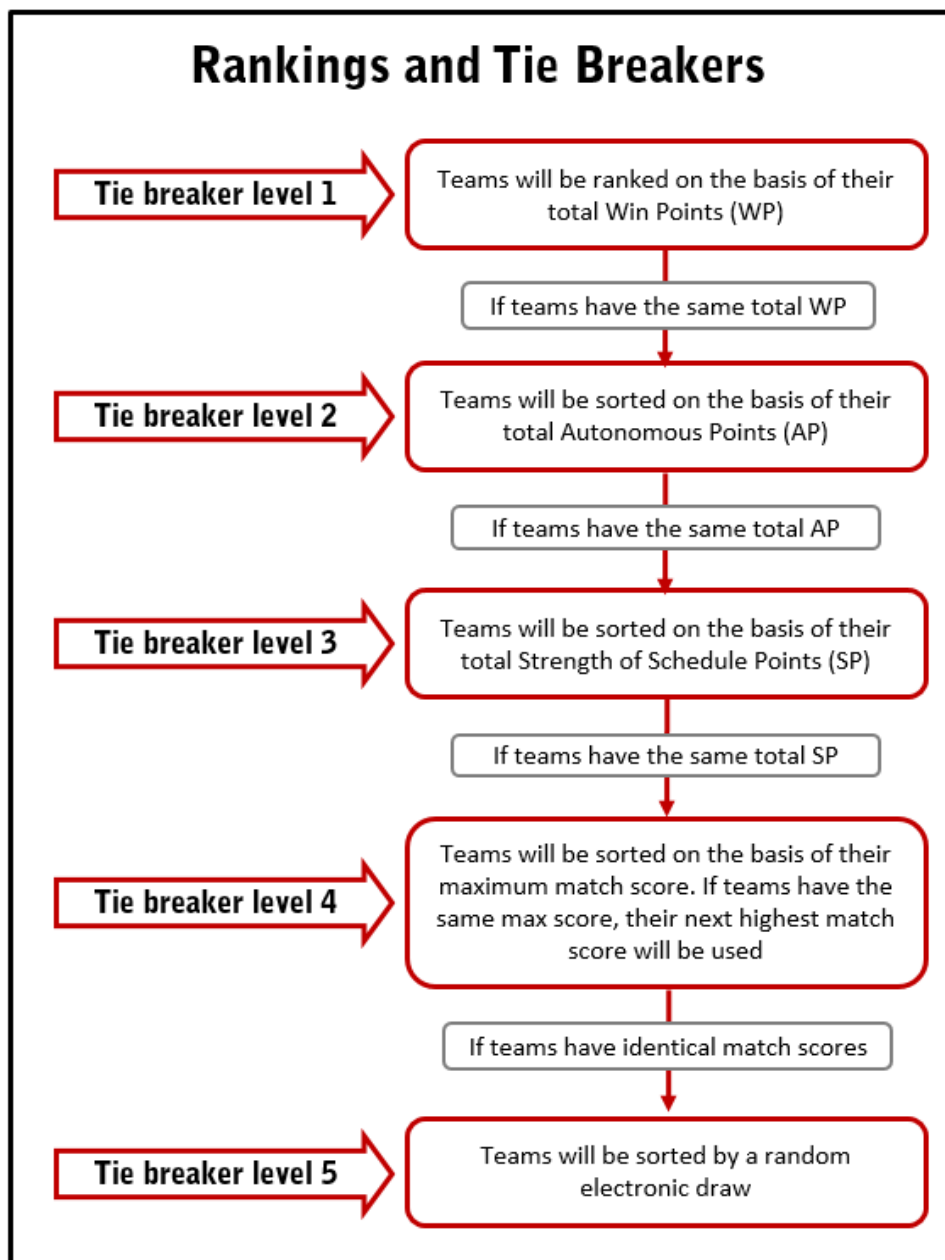## Qualifying Matches

Schedule

- The *Qualifying Match* schedule will be available prior to opening ceremonies on the day of competition. This schedule will indicate alliance partners and match pairings. It will also indicate the alliance's color – red or blue. For tournaments with multiple fields, the schedule will also indicate which field the match will take place on.
- The *Qualifying Matches* will start immediately after opening ceremonies in accordance with the qualifying match schedule.
- Teams will be randomly assigned an alliance partner to compete against two randomly assigned opponents in each *Qualifying Match*.
- All teams will be scored on the same number of *Qualifying Matches*.
- In some cases, a team will be asked to play in an additional *Qualifying Match*, but will not receive credit for playing this extra match.

Rankings

- At the conclusion of each match, *Win Points (WP)* will be issued:
  - Winning teams of a *Qualifying Match* receive two (2) *WP*.
  - Losing teams of a *Qualifying Match* receive zero (0) *WP*.
  - If a *Qualifying Match* ends in a tie, all four teams receive one (1) *WP*.
  - If a team is *Disqualified* they receive zero (0) *WP*.
- All teams in each *Qualifying Match* will also receive *Autonomous Points (AP)*.
  - Teams who earn the autonomous bonus in a Qualifying Match receive ten (10) AP.
  - Teams who do not earn the autonomous bonus in a Qualifying Match receive zero (0) AP.
  - If a team is disqualified they receive zero (0) *AP*.
- All teams in each *Qualifying Match* will also receive *Strength of Schedule Points (SP)*.
  - The number of *SP* assigned for each match, is that of the losing alliance's score.
  - In the event of a tie, both alliances will receive the same *SP* (equal to the tie score).
  - If a team is disqualified they receive zero (0) *SP*.

- o If both teams on an alliance are *Disqualified*, the teams on the winning Alliance will be awarded their own score as their *SP* for that match.
- For a *Qualifying Match*, if **no** member of a team is present in the driver station at the start of a match, that team is declared a "no show" and will receive zero (0) *WP,* zero (0) *AP*, and zero (0) *SP*. A "no show" is treated exactly the same as a *Disqualification*.

Rankings and Tie Breakers

Tie breaker level 1 → Teams will be ranked on the basis of their total Win Points (WP)

If teams have the same total WP

Tie breaker level 2 → Teams will be sorted on the basis of their total Autonomous Points (AP)

If teams have the same total AP

Tie breaker level 3 → Teams will be sorted on the basis of their total Strength of Schedule Points (SP)

If teams have the same total SP

Tie breaker level 4 → Teams will be sorted on the basis of their maximum match score. If teams have the same max score, their next highest match score will be used

If teams have identical match scores

Tie breaker level 5 → Teams will be sorted by a random electronic draw

vexrobotics.com

Elimination Matches

- The *Alliance Selection* process will consist of two rounds of selection, such that eight alliance captains will form elimination alliances consisting of three teams.
- These eight alliances will participate in a tournament to determine the event champions.
- If a team is *Disqualified* during an *Elimination Match*, then their entire alliance is *Disqualified*, and the match will be recorded as a loss.

Alliance Selection Process

- Every team will choose a student to act as a *Team Representative*.
    o These student representatives will proceed to the playing field at the designated time to represent their teams in the *Alliance Selection*.
- There will be eight alliances formed in the *Alliance Selection*.
- In order of tournament ranking, the *Team Representative* of the highest ranked team not already in an alliance will be asked to step forward as an *Alliance Captain* to invite another available team to join their alliance.
- A team is available if they are not already part of an alliance, or have not already declined an alliance invitation.
    o If the team accepts, it is moved into that alliance.
    o If a team declines an invitation, they CANNOT be invited into another alliance, but are still available to select their own alliance if the opportunity arises.
    o If a team declines, the *Alliance Captain* from the inviting team must then extend another invitation.
- This process will continue until all eight *Alliance Captains* have been designated and chosen one alliance partner.
- **The same method is used for each *Alliance Captain*'s second choice. Teams will select in the same order they did in the first round.** Any teams remaining after alliance eight makes their second choice will not compete in the *Elimination Matches*.
- Some smaller events may choose to use a different alliance format to better suit the number of teams, please see the event modification section of this document for more details.

Match Ladder

The *Elimination Matches* will play in a ladder format as shown below.
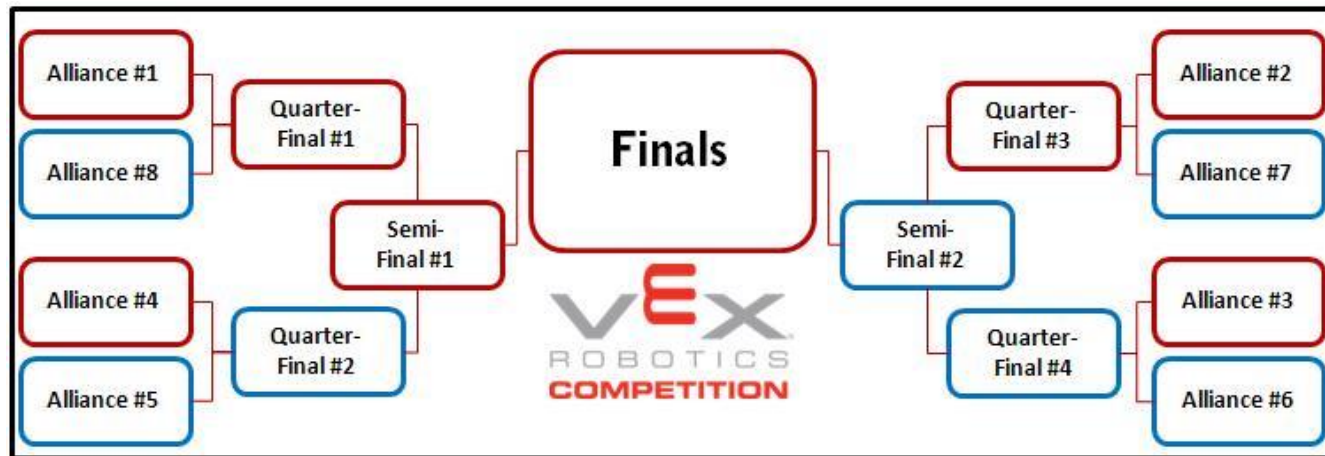
Elimination Scoring

In the elimination rounds, teams do not get *Win Points*; they get a win, loss or tie. Within each bracket of the Elimination Match Ladder, matches will be played to determine which alliance advances, as follows:

- The first alliance to win two matches advances.
- Any tied matches will be replayed until one alliance has two wins, and advances.

Tournament Rules

<T01> Referees have ultimate authority during the competition. **Their rulings are final.**

a. The referees will not review any recorded replays*.*
b. Any questions for the referees must be brought forward by a student drive team member within the time period of two (2) qualifying matches or immediately after the score is announced of an elimination match.

<T02> The only people from a team permitted by the playing field are the three drive team members who are identified by the drive team badges. These badges are interchangeable but not during a match.

<T03> During matches, two teams from an alliance will play on the field. **Any team which sits out the first match in an elimination series, must play in the second match, with no exceptions.** In the third and any subsequent matches, any two of the three teams may play. Prior to each *Elimination Match*, the *Alliance Captain* must let the referee know which two teams will be playing in the upcoming match.

<T04> There are no time outs in the qualifying rounds; in the elimination rounds, each alliance will be allotted ONE time out of no more than three minutes, as permitted by the head referee. The matches must progress according to schedule.

a. If a robot cannot report for a match, at least one member of the team should report to the field for the match.

<T05> 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.

Event Modification

Small Tournaments (Level 1 Tournaments): In the case that an event has fewer than 24 teams (the requisite amount to have eight full alliances), tournaments may be played as follows:

- If there are between 18 and 23 teams at a tournament
  - Alliances will still consist of three teams
  - The number of alliances will be equal to the amount of teams divided by three, less any remainder. (e.g. If there are 19 teams, 19/3 = 6.33 → 6 picking teams)
- If there are 17 or fewer teams
  - Alliances will consist of two teams
  - The number of alliances will be equal to the amount of teams divided by two, less any remainder. (e.g. If there are 13 teams, 13/2 = 6.5 → 6 picking teams)
  - Some tournaments of this size may choose to use unbalanced alliances; having one alliance of 3 teams to allow all teams to participate in the elimination rounds. (e.g. If there are 17 teams, 7 alliances of 2 and 1 alliance of 3). Three team alliances must still adhere to <T03> despite competing against other 2 team alliances.
    - If a tournament is using this format, alliances should be selected as per usual until each alliance has two teams. The remaining team would then be added to the top ranked alliance. (i.e. Seeds 2-8 have 2 teams, while Seed 1 gets 3 teams)
- The match ladder follows the same format as a full tournament, with byes being awarded when there is no applicable alliance. (e.g. If there are seven alliances, there would be no 8th alliance, thereby awarding a bye to the 1st alliance in the quarter-finals.)

Medium Tournaments (Level 2 Tournaments and above): For all tournaments with at least 24 teams, tournaments may be played as follows:

- The standard format of 8 Alliances of 3 teams
- 12 Alliances of 2 teams

VEX Robotics Competition In the Zone – Game Manual

- o This setup is recommended for tournaments that do not have enough qualifying spots to qualify an entire three team alliance for the World Championship
- o The elimination bracket for a 12 alliance tournament would play out as follows

Field Height: At many tournaments the playing field will be placed on the floor. Some tournament organizers may choose to elevate the playing fields by 24" to 36". At the 2018 VEX Robotics World Championship the platforms will be 24" high. For safety reasons, no drive team members will be allowed to stand on any sort of object during a match, despite the presence of raised fields.
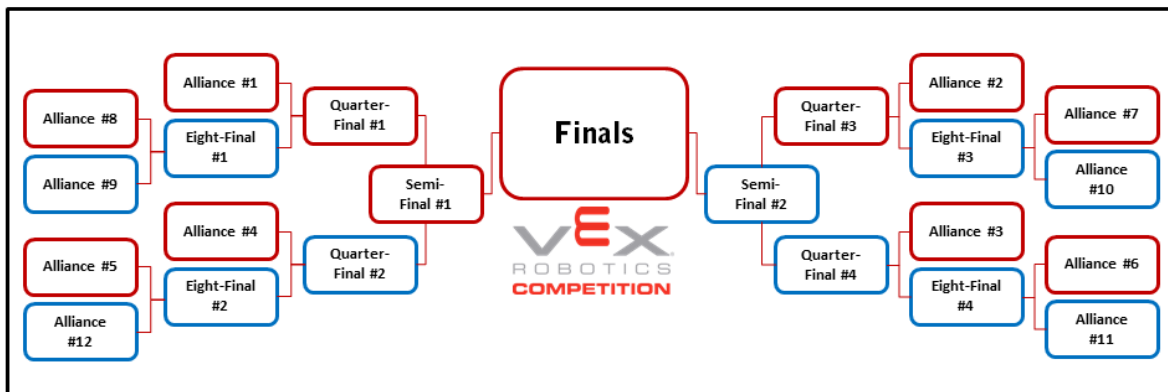
Section 4 – The Robot

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 In the Zone*. Prior to competing at each event, all robots will have to pass an inspection.

Robot Rules

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

<R1> 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 VEX legal battery, a 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 switch back and forth between multiple robots during a competition.

<R2> 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. If significant changes are made to a robot, it must be re-inspected before it will be allowed to compete.
b. All 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. Referees or inspectors may decide that a robot is in violation of the rules. In this event, the team in violation will be disqualified and the robot will be barred from the playing field until it passes re-inspection.

<R3> The following types of mechanisms and components are NOT allowed:

a. Those that could potentially damage playing field components.
b. Those that could potentially damage other competing robots.
c. Those that pose an unnecessary risk of entanglement.

<R4> At the beginning of any match, robots must be smaller than 18" x 18" x 18".

a. During inspections, robots will be measured in one of two ways
    i. Robots will be placed into a "sizing box" which has interior dimensions matching the above size constraints. To pass inspection, a robot must fit within the box without touching the box walls or ceiling.
    ii. Robots will be sized using a VEX Robotics Competition Robot Sizing Tool. Robots will be placed on a flat surface and must not touch the measurement slide as it is passed over the surface. Please see http://www.vexrobotics.com/vex/products/competition-products/vrc-products/276-2086.html for a visual reference.
b. Robots may expand beyond their starting size constraints after the start of a match.
c. 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.

<R5> Robots may be built ONLY from Official **Robot** Components from the VEX Robotics Design System unless otherwise specifically noted within these rules.

a. During inspections if there is a question about whether something is an official VEX component, a team will be required to provide documentation to an inspector, which proves the component's source. Such types of documentation include receipts, part numbers, or other printed documentation.

🌐 vexrobotics.com

b. Only the VEX Robotics Design System Components specifically designed to be used for Robot construction are allowed. Using additional components outside their typical purpose is against the intent of the rule (i.e. please don't try using VEX apparel, competition support materials, packaging or other non-robot products on a VEX Robotics Competition Robot).

c. 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>. Products from the VEXpro or VEX IQ, or VEX Robotics by HEXBUG product line which are also cross listed as part of the VEX product line are legal.

d. Official Robotics Components from the VEX Robotics Design System which have been discontinued are still legal for competition use. However teams must be cognizant of <R5a>.

<R6> Official VEX products are ONLY available from VEX & Official VEX Resellers. To determine whether a product is "official" or not, consult www.vexrobotics.com.

<R7> 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 parts which are **identical** to legal VEX parts. For the purposes of this rule, products which are identical in all ways except for color are permissible. Note: It is up to inspectors to determine whether a component is "identical" to an official VEX component.

c. Any commercially available #4, #6, #8, M2, M2.5, M3 or M4 screw up to 2" long, and any commercially available nut and/or washer to fit these screws.

d. Teams may add non-functional decorations provided that these do not affect the 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 "nonfunctional".

    i. Anodizing and painting of parts would be considered a legal nonfunctional decoration

    ii. Any guards or decals must be backed by legal materials that provide the same functionality. i.e. If your robot has a giant decal that prevents *Scoring Objects* from falling out of the robot, the decal must be backed by VEX material that also prevents the *Scoring Objects* from falling out.

    iii. If using the VEX speaker (Part #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.

    iv. 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.

⊕ vexrobotics.com

e. Any non-aerosol based grease or lubricating compound, when used in **extreme** moderation on surfaces and locations that do NOT come into contact with the playing field walls, foam field surface, game objects, or other robots.

f. Non shattering plastic from the following list; polycarbonate, acetel 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.

  i. Plastic can be mechanically altered by cutting, drilling or bending etc., but **it cannot be chemically treated, melted or cast.** Teams may heat the polycarbonate to aid in bending.

g. A small amount of tape may be used for the following purposes:

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

  ii. For labeling wires and motors.

  iii. Teflon tape solely for the purposes of preventing leaks may be used on the threaded portions of pneumatic fittings.

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

h. Hot glue for securing cable connections

j. A USB extension cable may be used for the sole purpose of remote mounting of a VEXnet key. The key must be mounted in the following manner.

  i. The VEXnet key must be mounted such that no metal is touching the key above the VEXnet logo.

  ii. We highly recommend that no metal may be within 2” of the top of the VEXnet key.

k. An unlimited amount of 1/8”, braided, nylon rope

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

m. VEX IQ pins used solely for the purpose of attaching VEX Team Identification Number Plates.

<R8> Additional VEX Robotics Design System Components that are released during the competition season are considered legal for use.

Some “new” components may have certain restrictions placed on them upon their release. These restrictions will be documented in a Team Update. Team Updates will be posted to the *VRC In the Zone* home page in the Competition section of www.vexobotics.com

⊕ vexrobotics.com

<R9> Robots must use ONLY one (1) VEX EDR Microcontroller.

    a. Examples of VEX EDR Microcontrollers are the VEX v.5 PIC Microcontroller and the VEX ARM® Cortex®-based Microcontroller.

    b. Microcontrollers that are part of other VEX product lines such as VEXpro, VEX RCR, VEX IQ, or VEX Robotics by HEXBUG are not allowed.

<R10> 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, VEX IQ, or VEX Robotics by HEXBUG product line are prohibited including all VEXplorer electronics.

    c. A 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. Mixing and matching VEXnet transmitters and receivers is prohibited.

<R11> Robots may use either:

Option 1: Up to ten (10) VEX EDR motors or VEX Servos (Any combination, up to ten) and a legal VRC pneumatic system. (See <R18>)

Option 2: Up to twelve (12) VEX EDR motors or VEX Servos (Any combination, up to twelve) 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 (P/N 276-2194), or on a "VEX Motor Controller 29" module.

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

<R12> A maximum of one (1) VEX Y-cable can be used per Motor Port of the Microcontroller or Power Expander. (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 can 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 a Motor Controller 29

<R13> The only allowable sources of electrical power for a VEX Robotics Competition Robot is any single (1) VEX 7.2V Robot Battery Pack of any type, unless the robot is utilizing the VEX Power

⊕ vexrobotics.com

Expander, and a single (1) 9V backup battery. Robots utilizing the VEX Power Expander can use a second (2) VEX 7.2V Robot Battery of any type.

a. Additional batteries cannot be used on the robot (even ones that aren't connected).
b. Robots are permitted to use a maximum of one (1) VEX Power Expander.
c. To ensure reliable wireless communication, it is required that all teams connect a charged 9V Backup battery to their VEXnet system using the VEXnet Backup Battery Holder (276-2243).
d. Any VEX 7.2V Battery Pack is legal, in the quantities described above.
e. 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.
f. VEXnet Joysticks must only be powered by AAA batteries.
   i. 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.

<R14> No more than two VEX hand-held transmitters may control a single robot during the tournament. No modification of these transmitters is allowed of ANY kind.

a. No other methods of controlling the robot (light, sound, etc) are permissible.

<R15> Parts may NOT be modified as follows:

a. Motors (including the internal PTC), extension cords, sensors, controllers, battery packs, reservoirs, solenoids, pistons and any other electrical component or pneumatics component of the VEX Robotics Design System may NOT be altered from their original state in ANY way.
   i. Internal or external mechanical repairs of VEX Limit and Bumper switches are permitted; using components from these devices in other applications is prohibited
   ii. 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.**
   iii. Teams may change or replace the gears in the "2-Wire 393" or "2-Wire 269" motors, with the corresponding official VEX Replacement Gears
   iv. Teams may cut pneumatic tubing to a desired length
b. Welding, soldering, brazing, gluing, or attaching in any way that is not provided within the VEX Robotics Design System will NOT be allowed.
   i. Mechanical fasteners may be secured using Loctite or a similar thread-locking product; this may be used for securing hardware ONLY.
   ii. Teams are permitted to fuse/melt the end of the 1/8" nylon rope to prevent fraying

> **iii.** The gluing permitted by <R7h> is an exception to this rule.

<R16> The Robot on/off switch must be accessible without moving or lifting the robot. The Robot Microcontroller lights should also be visible by competition personnel to assist in diagnosing robot problems.

<R17> 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.

<R18> 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 teams 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 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.

<R19> To participate in an official VEX Robotics Competition Tournament a team must first register on robotevents.com. Upon registering they will receive their VEX Team Identification Number (VEX Team ID#) and a welcome kit containing VEX Team Identification Number Plates. Every robot should have their VEX Team ID# Plates displayed on a minimum of 2-opposing sides.

a. The VEX Team Identification Number Plates are considered a non-functional decoration, and cannot be used as a functional part of the robot.
b. These number plates must fulfill all robot rules (i.e. they must fit within the 18" cube per <R4>, they cannot cause entanglement, etc.)
c. Robots must use the colored plates that match their alliance color for each match. (i.e. Robots on the red alliance must have their red plates on for the match) It must be abundantly clear which color alliance the robot belongs to.

⊕ vexrobotics.com

<R20> During the Autonomous Period, human operators 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 Autonomous mode.

For more information on this, teams should consult the help guides produced by the developers of their chosen programming software.

<R21> Any violation of robot rules will result in a team being unable to play until they pass inspection (per <R2d>). In addition, teams who intentionally circumvent or violate rules to gain an advantage over their fellow competitors are in violation of the spirit and ethos of the competition. As such, anyone caught violating a rule in this manner may be disqualified from upcoming matches, the event, or even future events at the discretion of the VEX Robotics Competition Game Design Committee.

Special Event Rule Modifications

The rules listed in this section represent the way the game will be played at ALL VEX Robotics Competition "Championship" Events. We know that some events will choose to modify the rules slightly to suit unique circumstances. In particular, we expect some events will make the following rule exceptions:

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

If an event makes the changes they need to inform all attending teams. It is especially important that any 75 Mhz events make sure their teams are using the correct communication type.