2019-2020
Game Manual
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Section 1
The Game

Game Description

Matches are played on a field set up as illustrated in the figures throughout. The Robot Skills Challenge and the Teamwork Challenge use the exact same field and setup.

In the Teamwork Challenge, an Alliance of two (2) Robots, operating under driver control, work together in each Match.

In the Robot Skills Challenge, one (1) Robot attempts 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 limited human interaction.

The object of the game is to attain the highest score by Scoring Balls in or on Cubes, and Scoring Cubes in Corner Goals or on Platforms.

Figure 1: Starting configuration of the field for a VEX IQ Challenge Squared Away Match.
Each VEX IQ Challenge Squared Away Match includes the following:

- Thirty-five (35) Balls
- Seven (7) Cubes
  - Two (2) red Cubes
  - Two (2) blue Cubes
  - Three (3) green Cubes
- Four (4) Corner Goals
  - Two (2) red Corner Goals
  - Two (2) blue Corner Goals
- Three (3) green Platforms

*Figure 2: Overhead view of the Field. The Starting Positions, Cubes, and Balls are all highlighted.*
Game Definitions

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

**Alliance Score** - Points scored in a *Teamwork Match* awarded to both *Teams*.

**Autonomous** - A *Robot* that is operating and reacting only to sensor inputs and to commands pre-programmed by the *Students* into the *Robot* control system. The *Robot* is operating without input from a VEX IQ Controller.

**Ball** – An orange spherical shaped plastic object with diameter of approximately 3” (76.2mm).

![Figure 3: A Squared Away Ball.](image)

**Corner Goal** – One of the four 6” square goals located in the corners of the *Floor* that are used to *Score Cubes*. The inside edges of the black lines surrounding the *Corner Goal* mark the outer edges of the goal. The *Corner Goal* is defined as this portion of the *Floor*, not the 3-dimensional volume above it. The field perimeter and black lines are not considered part of the *Corner Goal*.

![Figure 4: A red Corner Goal.](image)

**Cube** – A red, green, or blue cube-shaped object built out of VEX IQ parts with dimensions of approximately 7” (177.8mm).
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 Drivers will be asked to place their VEX IQ Controller on the ground. A Disablement is not the same as a Disqualification.

Disqualification - A penalty applied to a Team for a rule violation (see <T9> for more details). If a Team is Disqualified in a Match, the Head Referee should notify the Team of their violation at the end of the Match. At the Head Referee’s discretion, repeated violations and Disqualifications for a single Team may lead to its Disqualification for the entire event.

Driver - A Student Team member who stands in the Driver Station and is responsible for operating and controlling that Team’s Robot. Up to two Team members may fulfill this role in a given Match (see <G6>).

Driver Controlled - A Robot operating under the control of a Driver.

Driver Station - The region behind the Field, where the Drivers must remain during the Match unless legally interacting with their Robot.

Field - The entire playing field, including the field perimeter and field tiles.

Field Element - The field perimeter, Floors, Platforms, and any other supporting structures or VEX IQ elements attached to the Field.

Floor – The interior part of the playing field that is within the field perimeter.

Game Object - A Cube or a Ball.
Match - A Driving Skills Match, Programming Skills Match, or Teamwork Match.

Driving Skills Match - A Driver Controlled period that is sixty seconds (1:00) long with only one (1) Robot on the Field.

Programming Skills Match - An Autonomous period that is sixty seconds (1:00) long with only one (1) Robot on the Field.

Skills Match - A Driving Skills Match or Programming Skills Match.

Teamwork Match - A Driver Controlled period that is sixty seconds (1:00) long with one (1) Alliance on the Field.

Platform - One of three (3) green and white structures built out of VEX IQ parts, approximately 5” (127.0mm) or 9.5” (241.3mm) tall, that are used for Scoring Cubes.

Robot - Anything that has passed inspection that a Team places on the Field prior to the start of a Match.

Scored - A Game Object is Scored if it satisfies one of the following conditions, and is not touching a Robot.

a. A Ball is Scored inside of a Cube if it meets the following criteria:
   i. The Ball is at least partially within the three-dimensional volume defined by the outer edges of the Cube’s structure.
   ii. The Ball is not contacting the Floor “outside” of the Cube. The portion of the Floor which is “outside” of the Cube is roughly defined as a vertical projection of the Cube onto the Floor beneath the Cube, regardless of the Cube’s orientation.

Teams may encounter other Ball/Cube states than the examples depicted in the figures below. In these cases, as long as Ball satisfies criteria “a” and does not clearly violate criteria “b”, then the Ball should generally be considered Scored inside of a Cube. Teams will be given the “benefit of the doubt” in these judgment calls, as Head Referees will not be expected or required to define a perfectly rigid imaginary vertical projection or check minute measurements.

Figure 6: A Ball Scored inside of a Cube.

Figure 7: A Ball Scored inside a Cube.
b. A Ball is Scored on top of a Cube if it meets the following criteria:
   i. The Ball is at least partially above the side of the Cube with cross-beams.
      1. The side of the Cube with cross-beams is the side which is furthest away from
         (and roughly parallel to) the Floor.
   ii. The Ball is not contacting the Floor.
   iii. The Ball is at least partially within the three-dimensional area defined by the infinite
        vertical projection of a Cube when it is placed normal to the Floor.

Note: If a Ball meets the criteria for both “inside” and “on top of” a Cube (i.e. criteria a and b), then it counts as being on top of a Cube (i.e. criteria b).
c. **A Cube is Scored in a Corner Goal** if any part of it is contacting a *Corner Goal* of the same color as the *Cube*. See the definition of *Corner Goal* for specific details.

Note: A maximum of one (1) *Cube* may count for points per *Corner Goal*.

![Figure 14](image1.png)

*Figure 14: A red Cube Scored in a Corner Goal.*

![Figure 15](image2.png)

*Figure 15: A Cube Scored in a Corner Goal.*

![Figure 16](image3.png)

*Figure 16: A Cube that is not touching a Corner Goal and is therefore not Scored.*

d. **A Cube is Scored on a Platform** if it meets the following criteria:
   i. The *Cube* is contacting the *Platform* (including its supporting structures).
   ii. The *Cube* is not contacting the *Floor*.
   iii. The *Cube* is not contacting the Field Perimeter.
   iv. The *Cube* matches the color of the *Platform* (i.e. is a green *Cube*).

Note: A maximum of one (1) *Cube* may count for points per *Platform*. 
Starting Position - The two (2) designated 11” x 19” (279mm x 482.6mm) spots on the field where Robots must start the Match. Starting Positions are bounded by the inner edges of the long black lines, outer edge of the short black line, and the inner edge of the field perimeter. See Figure 2 for more details.

Student - Anyone born after May 1, 2004 (i.e. who will be 15 or younger at VEX Worlds 2020). Eligibility may also be granted based on a disability that has delayed education by at least one year. Students are the individuals who design, build, repair, and program the Robot with minimal adult assistance.
  • Elementary School Student - Any Student born after May 1, 2007 (i.e. who will be 12 or younger at VEX Worlds 2020). Elementary School Students may “play up” and compete as a Middle School Student.
  • Middle School Student - Any eligible Student that is not an Elementary School Student.
**Team** - Two or more *Students* make up a *Team*. A *Team* is classified as an *Elementary School Team* if all members are *Elementary School Students*. A *Team* is classified as a *Middle School Team* if any members are *Middle School Students*, or made up of *Elementary School Students* who declare themselves “playing up” as *Middle School Students* by registering their team as a *Middle School Team*. Once declared and playing as a *Middle School Team*, that team may not change back to an *Elementary School Team* for the remainder of the season. *Teams* may be associated with schools, community/youth organizations, or a group of neighborhood *Students*.
Scoring

• A Ball that is Scored in a Cube is worth one (1) point.

• A Ball that is Scored on a Cube is worth two (2) points.

• A Cube that is Scored in a Corner Goal is worth ten (10) points.

• A Cube that is Scored on a Platform is worth twenty (20) points.
Safety Rules

<G1> Treat everyone with respect. All Students and adults associated with a Team are expected to conduct themselves in a respectful and positive manner while participating in the VEX IQ Challenge. If Team members are disrespectful or uncivil to staff, volunteers, or fellow Teams at an event, the Team may be Disqualified from their current or upcoming Match. Judges may also consider team conduct and ethics when determining awards.

In all aspects of the VEX IQ Challenge program, the Students make the decisions and do the work with adult mentorship. The VEX community prides itself on being a positive learning environment where no one is bullied, harassed, or berated. Teams avoid placing unnecessary stress upon Students and/or event volunteers; instead, challenging situations are viewed as teachable moments to model positive behaviors and good sportsmanship.

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 http://link.roboticseducation.org/recf_codeofconduct.

<G2> VEX IQ is a student-centered program. Adults may assist Students in urgent situations, but adults should never work on or program a Robot without Students on that Team being present and actively participating. Students should 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 the VEX IQ Challenge. 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. Violation of this rule could be considered a violation of <G1> and/or the REC Foundation Code of Conduct.

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

<G4> **Pre-match setup.** At the beginning of a **Match**, each **Robot** must meet the following criteria:
   a. Only be contacting the **Floor** and/or **Field Perimeter**.
   b. Fit within an 11” x 19” (279.4mm x 482.6mm) area, bounded by the **Starting Position**.
   c. Be no taller than 15” from the **Floor**.

![Figure 24: Two Robots in a legal Match starting configuration.](image)

An offending **Robot** will be removed from the **Match** at the **Head Referee**’s discretion. They will not receive a **Disqualification**, but they will not be permitted to play in the **Match**.

Note: **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.

<G5> **Expansion is limited during a Match.** During the **Match**, **Robots** may not expand beyond the following restrictions:
   a. Horizontally, beyond an 11” x 19” (279.4mm x 482.6mm) area.
   b. Vertically, beyond the 15” (381mm) high starting requirement.

This expansion limit does not require that the **Robot** stay in the same configuration as it was when it began the **Match**. It simply means that, at any given moment during the **Match**, it should be able to fit within an 11” x 19” x 15” (279.4mm x 482.6mm x 381mm) rectangle. See <R5> for more details.
Violations of this rule will result in a warning for minor offenses that do not affect the Match. Major and/or score affecting offenses will result in a Disqualification. Teams who receive multiple warnings, or who are unable to easily remedy the violation, may also receive a Disqualification at the Head Referee’s discretion. <R2e> would then apply, and Robots may need to be re-inspected for compliance with <R5>.

**<G6> Two Drivers per Team.** Each Team shall include two Drivers. No Driver may fulfill this role for more than one Team at any given event, or in a given season. Teams with only one Student in attendance at an event are granted an allowance to use another qualified Driver from the event. That Driver may now only drive for the team the Driver is subsuming in for, for the duration of the event.

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 Students on the Team that were awarded the spot. Students can be added as support to the team but should not be added as drive-team members or programmers for the team.

An exception is allowed if one (1) Student on the drive team or a programmer on the Team cannot attend the event. The team can make a single substitution of a drive team member 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 reviewed by the REC Foundation and may result in one or both teams being disqualified for the event or the remainder of the season with all trophies and awards won that season being nullified.

**<G7> Drivers switch Controllers midway through the Match.** In a given Match, no Driver shall operate a Robot for more than thirty-five (0:35) seconds. The two Drivers must switch their controller between twenty-five (0:25) seconds and thirty-five (0:35) seconds remaining in the Match. The second Driver may not touch his/her Team’s controls until the controller is passed to him/her. Once the controller is passed, the first Driver may no longer touch his/her Team’s controls.

Note: If only one Driver is present (i.e. the Team has not exercised the allowance in <G6>), this rule still applies, and they must cease Robot operation after thirty-five (0:35) seconds.

Violations of this rule will result in a warning for minor offenses that do not affect the Match. Score affecting offenses will result in a Disqualification. Teams who receive multiple warnings may also receive a Disqualification at the Head Referee’s discretion.

**<G8> Drivers drive your Robot, and stay in the Driver Station.** During a Match, Robots may only be operated by that Team’s Drivers. Drivers must remain in their Driver Station, except when legally interacting with their Robot as per <G17>. Drivers are not allowed to use any communication devices during their Match. Devices with communication features turned off (e.g. a phone in airplane mode) are allowed.

**<G9> Hands out of the Field.** Drivers are prohibited from making intentional contact with any Field Element, Game Object, or Robot during a Match, except for the allowances in <G17>.
Violations of this rule will result in a warning for minor offenses that do not affect the Match. Score affecting offenses will result in a Disqualification. Teams who receive multiple warnings may also receive a Disqualification at the Head Referee’s discretion.

Note: Accidental contact may result in a warning, Disqualification, or Disablement at the Head Referee’s discretion.

<G10> Keep Game Objects in the Field. Game Objects that leave the Field during a Match will not be returned. “Leaving the Field” means that a Game Object is outside of the vertical projection of the Field Perimeter and no longer in contact with the Field, Field Elements, other Game Objects, or Robots.

If a Game Object is on its way out of the Field (as determined by the Head Referee), but is deflected back into the field by a Driver, field monitor, ceiling/wall, or other external factor, <G9> would apply. This Game Object should be considered “out of the field” and removed by the Head Referee.

If the redirection occurred due to contact with a Driver, it will be at the Head Referee’s discretion whether <G9> or <G10> should apply.

<G11> When it’s over, it’s over. Scores will be calculated for all Matches immediately after the Match is complete, and once all Robots and Game Objects on the Field come to rest.

a. Head Referees or other event staff are not allowed to review any videos or pictures from the Match, per <T1>.

b. If there is a concern regarding the score of a Match, only the Drivers from that Match, not an adult, may share their questions with the Head Referee.

c. This rule’s intent is for Driver inputs and Robot motion to cease at the end of the Match. A pre-programmed routine which causes Robot motion to continue after the end of the Match would violate the spirit of this rule. Any scoring which takes place after the Match due to Robots continuing to move will not count.

<G12> Keep your Robot together. Robots may not intentionally detach parts or leave mechanisms on the Field during any Match. If an intentionally detached component or mechanism affects gameplay, the Team may be Disqualified at the Head Referee’s discretion.

Note: Parts that become unintentionally detached from the Robot are no longer considered to be part of the Robot and can be either left on the Field, or collected by a Driver (utilizing <G17>).

<G13> Don’t damage the Field or Game Objects. Robots may not grasp, grapple, or attach to any Field Elements, including the Platforms. 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.

While Robots are permitted to grasp, grapple, or attach to Game Objects, Robots which cause damage to Game Objects would be considered in violation of this rule and/or <S1>. 
The intent of this rule is to prevent Robots from unintentionally damaging the Field or Game Objects. Minor violations of this rule that do not affect the Match will result in a warning. Score affecting offenses will result in a Disqualification. Teams that receive multiple warnings may also receive a Disqualification at the Head Referee’s discretion.

The key words in this rule are “clamping” or “anchoring”. Bumping into a Platform while Scoring, or using Field Elements for alignment, are both fine.

<G14> Let go of Game Objects after the Match is over. Robots must be designed to permit easy removal of Cubes and Balls from their Robot without requiring that the Robot have power or remote control after the Match is over.

<G15> Be prepared for minor field variance. Field tolerances may vary by as much as ±1” unless otherwise specified. Teams must design Robots accordingly.

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

<G17> Handling the Robot mid-match is allowed under certain circumstances. If a Robot goes completely outside the playing Field, gets stuck, tips over, or otherwise requires assistance, the Team’s Drivers may retrieve & reset the Robot. To do so, they must:

a. Signal the Head Referee by placing their VEX IQ Controller on the ground.
b. Move the Robot to any legal Starting Position.
c. Any Game Object being controlled by the Robot while being handled must be removed from the Robot and gently placed in a non-Scored position by the Team.
d. Any Game Objects in the Starting Position may be moved out of the Starting Position and gently placed into a non-Scored position by the Team.

This rule is intended so Teams can fix damaged Robots or help get their Robots “out of trouble.” It is not intended for Teams to use as part of a strategy to gain an advantage during a Match, including via moving Game Objects per parts c and d above. If a Head Referee sees Teams strategically exploiting this rule, they may be Disqualified from said Match.

<G18> This manual will have three scheduled updates. All rules in this manual are subject to changes, and not considered official until August 16th, 2019. There will also be scheduled manual updates on June 14th, 2019 and April 10th, 2020. While we do not expect there to be major changes outside of these scheduled updates, Teams are strongly encouraged to review the Q&A system for rule updates and clarifications.

The Game Design Committee reserves the right to make changes to this manual in the April 10th, 2020 release specifically for the VEX Robotics World Championship. One specific item that will be considered for changes is the number of Game Objects on the Field.
The Q&A system is an extension of this Game Manual. All Teams must adhere to all VEX IQ Challenge 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 IQ Challenge Question & Answer System.

All responses in this Q&A system should be treated as official rulings from the VEX IQ Challenge Game Design Committee, and they represent the correct and official interpretation of the VEX IQ Challenge Rules. The Q&A system is the only source for official rulings and clarifications.

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 VEX IQ Challenge Question & Answer System can be found at https://www.roboevents.com/VIQC/2019-2020/QA.
Section 2
The Robot

Description

Every Robot will be required to pass a full inspection before being cleared to participate in the VEX IQ Challenge. This inspection will ensure that all Robot rules and regulations are met. Initial inspections will typically take place during team registration/practice time. Every Team should use the rules below as a guide to pre-inspect their Robot and ensure that it meets all requirements.

Robot Rules

<R1> **Robots must pass inspection.** The Team’s Robot must pass inspection before being allowed to participate in any Matches. Noncompliance with any Robot design or construction rule may result in Disqualification of the Robot at an event.
   a. If significant changes are made to a Robot, it must be re-inspected before it will be allowed to participate in a Match.
   b. If a Robot has multiple functional configurations, all possible configurations must be inspected before being used in competition.
   c. Teams may be requested to submit to random inspections by event personnel during the event. Refusal to submit will result in Disqualification.
   d. Referees or inspectors may decide that a Robot is in violation of the rules. In this case, the Team in violation will be Disqualified and the Robot will be barred from the Field until it passes re-inspection.

<R2> **One Robot per Team.** Only one (1) Robot will be allowed to participate per Team in the VEX IQ Challenge. Though it is expected that Teams will make changes to their Robot at the event, a Team is limited to only one (1) Robot, and a given Robot may only be used by (1) Team. The VEX IQ system is intended to be a mobile robotics design platform. As such, a VEX IQ Challenge Robot, for the purposes of the VEX IQ Challenge, has the following subsystems:

**Subsystem 1:** Mobile robotic base including wheels, tracks, 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 IQ legal battery, a VEX IQ control system, and associated Smart Motors for the mobile robotic base.

**Subsystem 3:** Additional mechanisms (and associated Smart Motors) that allow manipulation of Game Objects or navigation of Field obstacles.

Given the above definitions, a minimum Robot for use in any VEX IQ Challenge event (including Robot Skills Challenges) must consist of subsystem 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 participate with one Robot while a second is being modified or assembled.
   b. Teams may not switch between multiple Robots. This includes using different Robots for Robot Skills Challenge Matches, Qualifying Matches, and/or Finals Matches.
   c. Multiple Teams may not use the same Robot during a competition or season. 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.
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. <T8> 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 <R2a>, <R2b>, and <R2c> 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 <R2>. Above that, use common sense as referenced in <G2>. If you can place two complete and legal *Robots* on a table next to each other, then they are two separate *Robots*. Trying to decide if changing a pin, a wheel, or a motor constitutes a separate *Robot* is missing the intent and spirit of this rule.

**<R3> Only registered Teams may compete in the VEX IQ Challenge.** To participate in an official VEX IQ Challenge Event, a *Team* must first register on robotevents.com. Upon registering they will receive their VEX IQ Challenge *Team* Number and two (2) VEX IQ Challenge License Plates. Every *Robot* should have their VEX IQ Challenge License Plates displayed on two opposing sides with their VEX IQ Challenge Team Number clearly written or printed upon it.

a. License Plates must fulfill all *Robot* rules.

b. License Plates must be clearly visible at all times. For example, License Plates must not be in a position that would be easily obstructed by a *Robot* mechanism during standard *Match* play.

![Figure 25: A VEX IQ Challenge License Plate with a VEX IQ Challenge Team Number written upon it.](image)

**<R4> Robots must fit in the sizing box.** At the start of each *Match*, the *Robot* must be able to satisfy the following constraints:

a. Only be contacting the *Floor* and/or the *Field* Perimeter.

b. Fit within an 11” x 19” (279.4mm x 482.6mm) area, bounded by the *Starting Position*.

c. Be no taller than 15” from the *Floor*.

This rule works in conjunction with <G4>. <R4> is an “inspection rule”, meaning that a *Robot* may not
pass inspection if it cannot satisfy these constraints. However, <G4> is a “game rule”, meaning that even if a Robot passed <R4> in inspection (i.e. it is theoretically capable of satisfying the constraints), Head Referees will still be watching for it before each Match.

<R5> Max Robot size is 11” x 19”. Robots must be demonstrably able to comply with the expansion rules set forth by <G5>.

a. A Robot may not expand beyond an 11” x 19” horizontal area any at any point during the Match. This limit includes the full range of motion by any appendages. For example, an arm that extends out of these constraints while operating during the Match would make the Robot illegal.

Figure 26: A Robot which starts the Match with the legal size constraints.

Figure 27: The Robot from Figure 26 which has expanded outside of the legal size constraints.

Note: The 11” x 19” horizontal limit is not restricted to the same configuration or relative position to the Robot as it was at the beginning of the Match, in its 11” x 19” Starting Position. For example, a Robot with mechanisms that can extend out of opposite sides of the Robot would be legal, so long as the Robot never exceeds 11” x 19” at any point during the Match. Teams who have the potential to violate this rule should be prepared to demonstrate how they will limit this motion during a Match.

Figure 28: A Robot with a mechanism that can extend in multiple directions.

Figure 29: The Robot from Figure 28 which never exceeds the maximum size constraint as the mechanism moves.
b. A Robot may not expand beyond a 15” (381mm) vertical limit at any point during the Match.

Teams are advised to bear these constraints in mind and develop solutions which eliminate any mechanical risk of a violation. However, using sensors and/or programming to keep a Robot within these constraints would also be within the spirit of this rule.

<R6> Robot starting configuration is the same as inspection configuration. The starting configuration of a Robot at the beginning of a Match must be the same as the Robot configuration that was inspected for compliance, and within the maximum allowed size.

a. Teams using more than one Robot configuration at the beginning of Matches must tell the inspector(s) and have the Robot inspected in its largest configuration(s).

b. A Team may NOT have its Robot inspected in one configuration and then place it in an uninspected configuration at the start of a Match.

<R7> VEX IQ parts only. Robots may be built ONLY from official robotic components from the VEX IQ product line, unless otherwise specifically noted within these rules.

a. Official VEX IQ products are ONLY available from VEX Robotics & official VEX Resellers. To determine whether a product is “official” or not, consult www.vexiq.com.

b. If an inspector or other event official questions whether something is an official VEX IQ component, the Team will be required to provide documentation to an Inspector that proves the component’s source. Such types of documentation could include receipts, part numbers, or other printed documentation.

c. Only the VEX IQ components specifically designed for use in 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 IQ apparel, team or event support materials, packaging, Field Elements, that are not listed in the Legal Parts Appendix or other non-robot products on a VEX IQ Challenge Robot).

d. Products from the VEX EDR or VEXpro product line cannot be used for Robot construction. Products from the VEX EDR product line that are also cross-listed as part of the VEX IQ product line are legal. A “cross-listed” product is one which can be found in both the VEX IQ and VEX EDR sections of the VEX Robotics website.

e. Mechanical/structural components from the VEX Robotics by HEXBUG product line are legal for Robot construction. However, electrical components from the VEX Robotics by HEXBUG product line are illegal for Robot construction.

f. Official components from the VEX IQ product line that have been discontinued are still legal for Robot use. If using a discontinued part, Teams must be cognizant of <R7a>.

g. 3D printed components, such as replicas of legal VEX IQ parts or custom designs, are not legal for Robot use.

Note: A comprehensive list of legal parts can be found in the VEX IQ Challenge Legal Parts Appendix, which will be released alongside the June 14th Game Manual Update (as noted in <G18>).
Some non-VEX items are permitted. Robots are allowed to use the following additional “non-VEX IQ” components:

- Appropriate 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 event. Inspectors will have the final say in what is considered “non-functional”.
  - Any decorations must be backed by legal materials that provide the same functionality (i.e. if your Robot has a giant decal that prevents Game Objects from falling out of the Robot, the decal must be backed by VEX IQ material that also prevents the Game Objects from falling out).
  - The use of non-toxic paint is considered a legal non-functional decoration. However, any paint being used as an adhesive or to impact how tightly parts fit together would be classified as functional.
- Rubber bands that are identical in length and thickness to those included in the VEX IQ product line (#32 & #64).
- ⅛” metal shafts from the VEX EDR product line.

Additional VEX IQ products that are released during the season are legal for use. Some “new” components may have certain restrictions placed on them upon their release. These restrictions will be documented on their VEX IQ product webpage, or in the VEX IQ Legal Parts appendices.

One Brain per Robot. Robots are limited to one (1) VEX IQ Robot Brain.

- Robot Brains, microcontrollers, or other electronic components that are part of the VEX Robotics by HEXBUG, VEX EDR, or VEXpro product lines are not allowed.
  - The Robot AA Battery Holder (228-3493) is the only exception to this rule, per <R12>.
- Robots must use one (1) VEX IQ 900 MHz radio, VEX IQ 2.4 GHz radio, or VEX IQ Smart Radio in conjunction with their VEX IQ Robot Brain.
- The only legal method of driving the Robot during Teamwork Matches and Driving Skills Matches is the VEX IQ Controller.

Six motors per Robot. Robots may use up to six (6) VEX IQ Smart Motors.

- Additional motors cannot be used on the Robot (even ones that aren’t connected).

One battery pack per Robot. The only allowable sources of electrical power for a VEX IQ Challenge Robot is one (1) VEX IQ Robot Battery or six (6) AA batteries via the Robot AA Battery Holder (228-3493).

- Additional batteries cannot be used on the Robot (even ones that aren’t connected).
- Teams are permitted to have an external power source (such as a rechargeable battery pack) plugged into their VEX IQ Controller during a Match, provided that this power source is connected safely and does not violate any other rules (such as <G7>).

Parts may NOT be modified.

- Examples of modifications include, but are not limited to, bending, cutting, sanding, gluing, or melting.
- Cutting metal VEX IQ or VEX EDR shafts to custom lengths is permitted. This is the only legal exception to this rule.
Teams should remember to prioritize student safety at all times if attempting to cut metal shafts. Adult assistance in the spirit of <G2> is a must-have, and sharp edges should be sanded or otherwise rounded off. Similarly, any use of power tools in a pit space while at an event must be discussed with the Event Partner in advance. Even if used in a safe capacity, there is still a possibility of violating venue / event rules, or causing alarm for nearby Teams. If used without significant regard for safety, it could be considered a violation of the REC Foundation Code of Conduct.

<R14> Robots may not be dangerous. The following types of mechanisms and components are NOT allowed:
  a. Those that could potentially damage Field Elements or Game Objects.
  b. Those that could potentially damage other Robots.
  c. Those that pose an unnecessary risk of entanglement.

<R15> Inspection concludes when the form is signed. A Robot is deemed successfully inspected when it has been recorded as “passed” by an inspector and the inspection form has been signed by both the inspector and a Student Team member.

<R16> Robots are ready to play at the Field. Teams must be prepared to play when they bring their Robots to the Field. For example, Teams should ensure that their batteries are charged and their VEX IQ Controller is paired with their Robot before placing the Robot on the Field.

<R17> Keep the Robot up to date. Teams should make sure that their VEX IQ firmware (VEXos) is up to date. Teams can download the latest version of VEXos at https://link.vex.com/vexos.
Section 3
The Tournament

Description

The VEX IQ Challenge encompasses both the Teamwork Challenge and the Robot Skills Challenge. This section determines how the Teamwork Challenge and Robot Skills Challenge are to be played at a given event.

Awards may be given to top Teams in each format, as applicable. Awards may also be given for overall performance in the judged criteria. Please review the Awards Appendix for more details, available in the VEX IQ Challenge Squared Away section of www.vexrobotics.com or www.roboticseducation.org.

Tournament Definitions

Event Partner - The VEX IQ Challenge 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.

Finals Match – A Teamwork Match used to determine the Teamwork Challenge champions.

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.

Match Stop Time – The time remaining (i.e. displayed on the timer or audience display) in a tiebreaker Finals Match when an Alliance ends the Match early by placing their controllers on the ground. The Match Stop Time is rounded down to the nearest even number. For example, if controllers are set down when the displayed time is 13 seconds, the Match Stop Time is recorded as 12 seconds. If an Alliance does not finish the Match early, they receive a default Match Stop Time of 0 seconds.

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

Qualifying Match – A Teamwork Match used to determine the event rankings.


Teamwork Challenge – A portion of the VEX IQ Challenge. The Teamwork Challenge consists of Teamwork Matches. The Teamwork Challenge includes Qualifying Matches and Finals Matches, and may include Practice Matches.
Tournament Rules

<T1> Head Referees have ultimate authority during the event, including all three types of Matches. The Head Referees’ rulings are final.
   a. Referees and event staff are not allowed to review any photo or video Match recordings to settle disputes.
   b. Referees will review the Field at the end of each Match and accurately record the game Scored. If there is a disagreement with the scoring, only the Drivers, not an adult, may share their questions or concerns with the Head Referee. Once the Field is cleared for the next Match, Drivers can no longer dispute the Match score.

<T2> During Teamwork Matches, two (2) Teams form an Alliance that will play on the Field.
   a. Qualifying Match Alliances are randomly selected.
   b. Finals Match Alliances are assigned as follows:
      i. The first and second ranked Teams form an Alliance
      ii. The third and fourth ranked Teams form an Alliance
      iii. And so on, until all Teams participating in Finals Matches have formed Alliances.

<T3> There are no time outs in Qualifying Matches, Finals Matches or Robot Skills Matches.

<T4> If an Alliance wants to end a Qualifying Matches or a Finals Match early, both Teams should signal the referee by ceasing all Robot motion and placing their controllers on the ground. The referee will then signal to the Teams that the Match is over and will begin to tally the score. If the Match is a tiebreaker Finals Match, then the Match Stop Time will also be recorded.

<T5> Practice Matches may be played at some events, but are not required. If Practice Matches are run, every effort will be made to equalize practice time for all Teams.

<T6> Qualifying Matches will occur according to the official Match schedule. This schedule will indicate Match partners, Qualifying Match time, and, if the event has multiple Fields, which Field the Qualifying Match will be played on.
Note: The official Match schedule is subject to changes at the Event Partner’s discretion.

<T7> Teams are ranked by their average Qualifying Match scores. Every Team will be ranked based on the same number of Qualifying Matches.
   a. A certain number of a Team’s lowest Qualifying Match scores will be excluded from the rankings based on the quantity of Qualifying Matches each Team plays.

<table>
<thead>
<tr>
<th>Number of Qualifying Matches per Team</th>
<th>Number of excluded Match scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between four (4) and seven (7)</td>
<td>1</td>
</tr>
<tr>
<td>Between eight (8) and eleven (11)</td>
<td>2</td>
</tr>
<tr>
<td>Between twelve (12) and fifteen (15)</td>
<td>3</td>
</tr>
<tr>
<td>Sixteen (16) or more</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 1: Matches that will be “dropped” from a Team’s final average Qualifying Match scores.
b. In some cases, a Team will be asked to play an additional Qualifying Match. The extra Match will not impact the Team’s ranking. Teams are reminded that <G1> is always in effect and Teams are expected to behave as if the additional Qualifying Match counted.

c. Ties in Team ranking are broken by:
   i. Removing the Team’s lowest score and comparing the new average score.
   ii. Removing the Team’s next lowest score and comparing the new average score (on through all scores).
   iii. If the Teams are still tied, the Teams will be sorted by random electronic draw.

<T8> If no member of a Team is present in the Driver Station at the start of a Qualifying Match, that Team is considered a “no show” and will receive zero (0) points. The other Team in the Alliance will still play and receive points for the Match.

<T9> A Team that is Disqualified in a Qualifying Match receives zero (0) points for the Match. The other Team on their Alliance will still receive points for the Match.
   a. In Finals Matches, Disqualifications apply to the whole Alliance, not just one Team. An Alliance that is Disqualified in a Finals Match will receive zero (0) points.

<T10> The number of Finals Matches, and therefore the number of Teams who will participate in Finals Matches, is determined by the event organizer.
   Note: Each year, the REC Foundation releases an event Qualifying Criteria document which will provide further case-by-case tournament structure guidelines. The 2019-2020 Qualifying Criteria can be found here.

<T11> Finals Matches are played sequentially, starting with the lowest ranked Alliance. Each Alliance will participate in one (1) Finals Match. The Alliance with the highest Finals Match score is the Teamwork Challenge champion.
   a. Alliances are ranked by their Finals Match score. The highest scoring Alliance is in first place, the second highest scoring Alliance is in second place, etc.
   b. Ties for first place in Finals Matches will result in a series tiebreaker Finals Matches, starting with the lower ranked Alliance. The Alliance with the highest tiebreaker Finals Match score will be declared the Teamwork Challenge champion.
      i. If the tiebreaker Finals Match scores are tied, the Alliance with the higher Match Stop Time will be declared the winner.
      ii. If the Match Stop Time is also tied, a second series of tiebreaker Finals Matches will be played. If this second series of tiebreaker Finals Matches is also tied, then the higher ranked Alliance will be declared the winner.
   c. If there is a tie for a place other than first, the higher ranked Alliance will receive the higher rank.

Example 1: Alliance 6 and Alliance 3 are tied for first place. During the tiebreaker Finals Matches, Alliance 6 scores 13 points and has a Match Stop Time of 12 seconds. Alliance 3 scores 13 points and has a Match Stop Time of 10 seconds. Alliance 6 is the Teamwork Challenge winner.

Example 2: Alliance 4 and Alliance 5 are tied for third place. Alliance 4 is the third place winner and Alliance 5 is the fourth place winner.

The lower ranked Alliance must “overcome” the higher ranked Alliance in order to become the Teamwork Challenge champion.
At many events, the playing Field will be placed on the ground. Some events may choose to elevate their Fields. At the 2020 VEX Robotics World Championship, the Fields will be 18” high.

### Robot Skills Challenge Rules

**<RSC1>** All rules, scoring, and field layouts from previous sections apply to the Skills Matches, unless otherwise specified.

**<RSC2>** For each Skills Match, teams are awarded a score based on the standard game and scoring rules. Teams will be ranked based on the sum of their highest Programming Skills Match score and highest Driving Skills Match score.

- a. If two Teams are tied for the highest score, the tie will be broken by looking at both Teams’ next highest Programming Skills Match score. If the Teams remain tied, the tie will be broken by looking at both teams’ next highest Driving Skills Match score. This process will repeat until the tie is broken.
- b. If the tie cannot be broken (i.e. both Teams have the exact same scores for each Programming Skills Match and Driving Skills Match), then the following ordered criteria will be used to determine which team had the “best” Programming Skills Match:
  - i. Points for Balls Scored inside of Cubes.
  - ii. Points for Balls Scored on top of Cubes.
  - iii. Points for Cubes that are Scored in Corner Goals.
  - iv. Points for Cubes that are Scored on Platforms.
- c. If the tie still cannot be broken, the same process in the step above will be applied to the Teams’ highest Driving Skills Match.
- d. If the tie still isn’t broken, Event Partners may choose to allow Teams to have one more deciding Match, or both Teams may be declared the winner.

**<RSC3>** During Skills Matches, Robots may be placed in either of the two (2) Starting Positions on the Field.

**<RSC4>** Teams play Matches on a first-come, first-served basis. The Event Partner will determine how many Skills Matches every Team is allowed to play.

**<RSC5>** A Team may handle their Robot as many times as desired during a Programming Skills Match.

- a. Upon handling the Robot, it must be immediately brought back to any legal Starting Position.
  - i. Driver may reset or adjust the Robot as desired from this position, including pressing buttons on the Robot Brain or activating sensors.
- b. Any Game Objects being controlled by the Robot while being handled must be removed from the Robot and gently placed in a non-Scored position by the Team.
- c. Any Game Object in the Starting Position may be moved out of the Starting Position and gently placed into a non-Scored position by the Team.
d. During a Programming Skills Match, Drivers may move freely around the Field, and are not restricted to the Driver Station when not handling their Robot.
i. An intent of this exception is to permit Drivers who wish to “stage” Robot handling during a Programming Skills Match to do so without excessive running back and forth to the Driver Station.

Note: This rule only applies to Programming Skills Matches. Driving Skills Matches are still governed by <G17>, especially for strategic violations.

e. The rest of <G8>, which states that Drivers are not allowed to use any communication devices during their Match, still applies.

<RSC6> Drivers must start a Robot’s Programming Skills Match routine by pressing a button on the Robot Brain or manually activating a sensor. Because there is no VEX IQ Controller handoff, only one (1) Driver is required for Programming Skills Matches (although Teams may still have two (2) if desired). <G6> still applies to any Drivers participating in the Match.

a. Pre-Match sensor calibration is considered part of the standard pre-Match setup time, i.e. the time when Teams would typically be turning on the Robot, moving any mechanisms to their desired legal start position, etc.

In accordance with <G4>, Teams should be mindful of event schedules and set their Robots up as promptly as possible. The definition of “prompt” is at the discretion of the Event Partner and Head Referee, and could depend on things like how much time is left for the Robot Skills Challenge field(s) to be open, how many Teams are waiting in line, etc. As a general guideline, three seconds to calibrate a Gyro Sensor would be acceptable, but three minutes to debug a program would not.