RECF ACHIEVE
ROBOTICS COMPETITION
PINNACLE

2026-2027

Game Manual Version 1.0

Prefix

Welcome and Thank You

Welcome to the Robotics Education & Competition Foundation (RECF) Achieve Robotics Competition!

RECF Achieve provides a fun environment where creativity, teamwork, and innovation can thrive in the face of a new challenge. Throughout the competition season, students will unlock their potential in the fields of science, technology, engineering, arts, math and computer science.

RECF Achieve will get students excited about STEAM through hands-on learning, documentation, and competition. Students are at the center of everything we do, and they are encouraged to take ownership of their ideas while working collaboratively with teammates and solving real world problems.

One of our goals with RECF Achieve is to allow for broader robotics access for all students. As a part of that goal, we encourage student resourcefulness and outside-the-box thinking with multiple robotics system options as well as allowances for custom plastic and 3D printing.

We are grateful that you have chosen the RECF as your robotics program provider. With so many opportunities available, we are honored that you selected our program to support your students' learning and growth.

Thank you for joining our community. We cannot wait to see what your teams achieve this season!

About the RECF

The Robotics Education & Competition Foundation is a registered US 501(c)(3) non-profit organization that exists to spark interest in science, technology, engineering and math by engaging students in hands-on, sustainable, and affordable curriculum-based robotics programs.

Our global mission is to provide every educator with competition, education, and workforce readiness programs to increase student engagement in science, technology, engineering, math, and computer science. We see a future where every student designs and innovates as part of a team, overcomes failure, perseveres, and emerges confident in their ability to meet global challenges.

As a company, we embrace the core values of passion, integrity, and excellence, which we try to embody in everything we do.

Revision History

Version 1.0 - June 10, 2026

- Initial release

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Section 1: The RECF Achieve Robotics Competition

1.1 About the RECF Achieve Robotics Competition

The RECF Achieve Robotics Competition (RECF Achieve) provides a hands-on educational STEM experience focused on robot design, construction, strategy, programming, and problem-solving. The program emphasizes teamwork, critical thinking, communication, documentation, and real-world application of concepts.

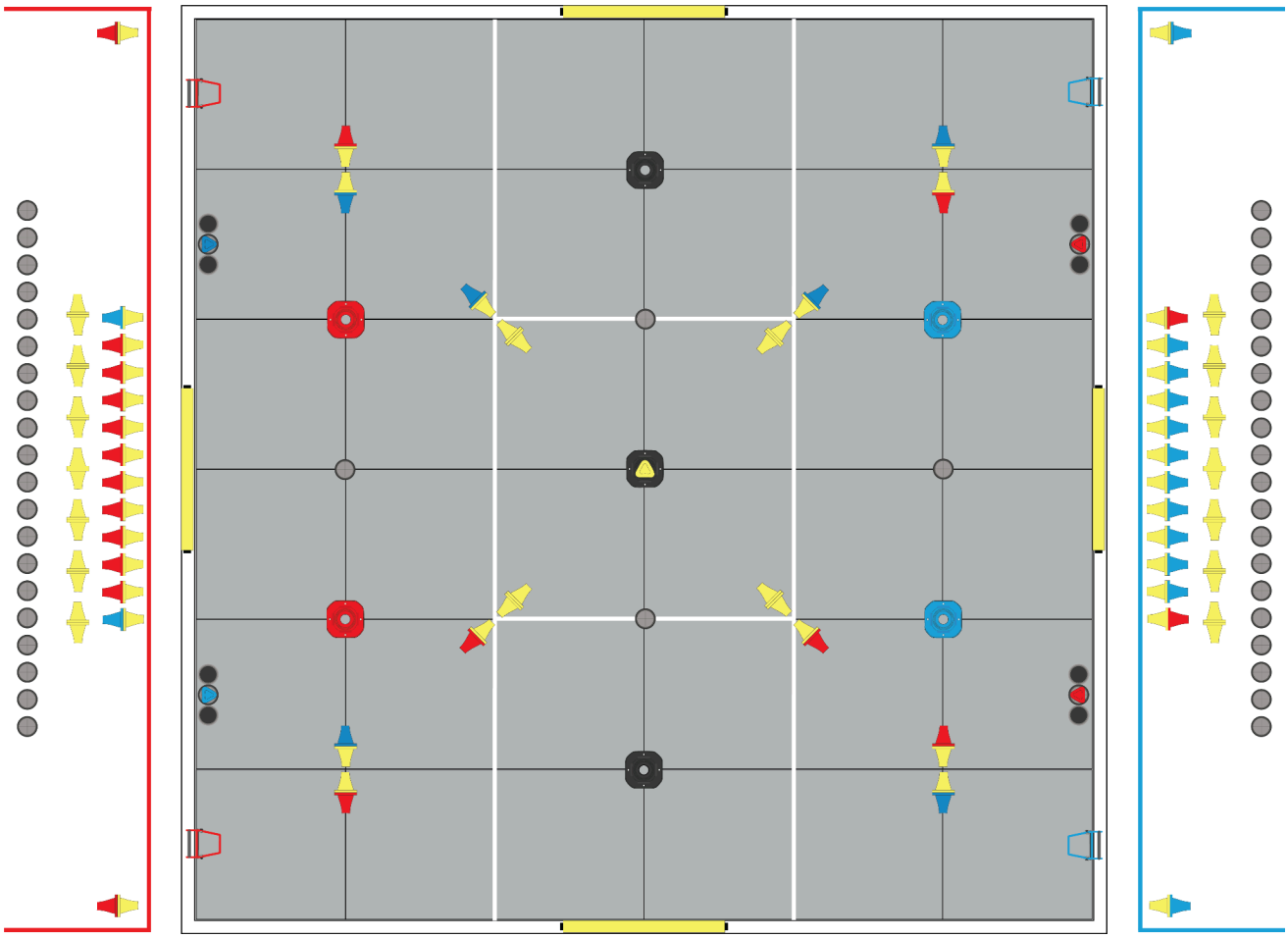
RECF Achieve teams consist of students up to 19 years old, categorized as either middle school or high school teams. Student team members make all of the decisions about their robot's design, construction, and programming—from blank paper all the way to the world championship.

The RECF Achieve season consists of local qualifying events, which qualify teams for assigned event region championships. Event region championships then qualify teams for the RECF STEM World Championship. For more information on the qualification structure, refer to the RECF Qualifying Criteria.

1.2 The 2026-2027 RECF Achieve Game: Pinnacle

In Pinnacle, robots navigate a 12'x12' field to collect and stack pins and cups onto goals, turn rollers, and maximize their score with specific orientations of pins, cups, and rollers. Robots can push, lift, rotate, stack, spin, or plow pins and cups, but must follow the rules of each specific match type.

In some matches, team members drive the robot. In others, the robot drives itself based on pre-programmed code written by the students. Not every robot and team will play the game the same way, and there are some ways to score that are easier than others. Your strategies, and your robot, may change over time. As long as you follow the rules in this game manual and the official RECF Q&A system (details coming soon!), you can play the game however you like!



1.3 Five RECF Achieve Competition Challenges

- Design & Build a Robot (see section 2) - Using the engineering design process, work with your teammates to design, build, and test a robot to score points in matches
- Solo Driving Matches (see section 3) - Up to 3 members of your team work together at the field to score points with a robot responding to input by remote control
- Solo Coding Matches (see section 4) - Up to 3 members of your team work together at the field to score points with a robot operated entirely by segments of code—no controller!
- Alliance Matches (see section 5) - Your team collaborates with another team at the field, using both robots in an attempt to outscore an opposing two-team alliance
- Judging (see section 6) - Document and share your use of the engineering design process in an engineering notebook throughout the season, and describe your work to judges during interviews

1.4 RECF Program Rules

1.4.1 RECF Policies

All participants must follow the guidelines and rules in this game manual, the official RECF Achieve Q&A (details coming soon!), and these additional official RECF policies.

- RECF Organizational Policy
- RECF Student-Centered Policy
- RECF Code of Conduct
- RECF Qualifying Criteria
- RECF Guide to Judging
- RECF Youth Protection Policy
- RECF Commitment to Coach Excellence
- RECF Commitment to Event Excellence

1.4.2 RECF Achieve Teams & Students

Teams must be registered in RECFevents.org for the RECF Achieve program to participate in RECF Achieve qualifying events.

Each RECF Achieve team has one or more students. Students are categorized by their age at the end of the 2027 RECF STEM World Championship. To compete in the U15 / Middle School category, a student must be 15 years of age or younger on May 6, 2027. To compete in the U19 / High School category, a student must be 19 years of age or younger on May 6, 2027 and not yet graduated from secondary school.

Team structure must follow the RECF Organizational Policy. Teams must be student-centered and follow the RECF Student-Centered Policy and the RECF Code of Conduct at all times, including at practices and when attending events.

1.4.3 Supervision & Release Forms

When attending events, students must be accompanied by a responsible adult over the age of 18 for the duration of the event. All participants in RECF events must complete an RECF Participant Release Form each season.

1.5 Definitions

1.5.1 General Definitions

- **Alliance** - Two teams assigned to work cooperatively during a match to score shared points
- **Alliance Match** - A match that includes one or more cooperative alliances
- **Alliance Selection** - The process used to determine which teams will participate in the elimination bracket (see section 7.4.4)
- **Coach / Mentor** - A person who helps students learn concepts used in RECF competitions, and who helps create and organize teams, but who cannot contribute to the students' work used at competitions
- **Drive Team** - 1-3 students who participate in a match as representatives for their team
- **Driver Box** - An area near the field where a drive team must stand during a match (driver boxes are highlighted in blue in figure 1.5.1)
- **Elimination Bracket** - A series of matches that includes the two-team alliances that were formed during the alliance selection process; identifies the tournament winners (see section 7.4.5)
- **Engineering Notebook** - A physical or electronic document that records a team's use of the engineering design process, and their work during a competition season
- **Foul** - The act of breaking a rule during a match or event (see section 1.6 for more details)
- **Foul Card** - A tracking system for repeated rule infractions (see section 1.6 for more details)
- **Grounded** - Description of a robot that has broken a safety rule and is no longer allowed to participate in the match; the robot is not allowed to drive, and the controller should be placed on the floor or another nearby position (not on the field)
- **Robot** - A machine designed and built by students from parts that are legal for use in the RECF Achieve competition
- **Solo Coding Match** - A one-minute match with one robot and one drive team, during which the robot operates only by code created by the students
- **Solo Driving Match** - A one-minute match with one robot and one drive team, during which students operate the robot by remote control
- **Student** - A team member who meets all requirements of the program, is within the age bracket, and who contributes to a team's notebook, robot design, build, code, and/or strategies or serves as a drive team member; a student can only participate on one RECF Achieve team during a season
- **Tournament** - An official RECF Achieve event that meets the requirements of the RECF Qualifying Criteria, and includes Alliance Matches, Solo Driving Matches, Solo Coding Matches, and optional judging

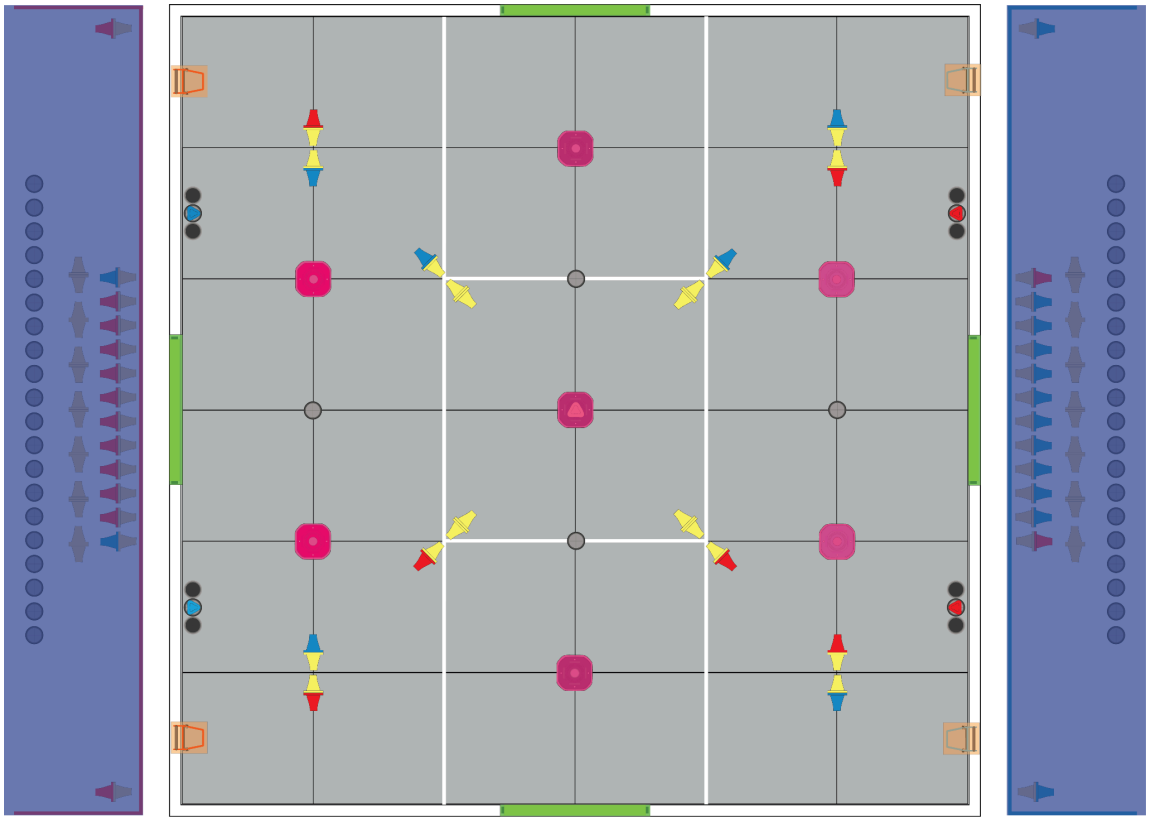


Figure 1.5.1

Figure 1.5.2

1.5.2 Pinnacle Definitions

- **Cup** - A plastic, two-segment object that is roughly 6.48” by 3.16”; each cup has a transparent half and an opaque half
- **Goal** - A structure on the field, mounted to an under-tile plate, where robots can score pins, cups, and stacks (goals are highlighted in pink in figure 1.5.1)
  - **Alliance goal** - A red (tag 2) or blue (tag 3) plastic structure, roughly 3.25” high, in the corresponding red or blue zone.
  - **Center goal** - A black plastic structure (tag 0), roughly 8.77” high, in the center zone
  - **Neutral goal** - A black plastic structure, roughly 5.77” high, in neutral zone 1 (tag 1) or 2 (tag 4).
- **Loader** - One of two structures attached to the field perimeter in a location adjacent to a driver box; used to introduce team-loaded cups and pins into the field (loaders are highlighted in orange in figure 1.5.1)
- **Nested** - A description for a connection between a cup and a pin, or a pin and a goal, in which a convex pinhalf fits securely inside of the opening on a goal or one concave half of a cup. A halfpin can be nested into a cup or a goal. A cup can be nested onto a pinhalf.
- **Pin** - A plastic, two-segment object that is roughly 6.5” by 3.02”; each pin is described by the color(s) of its two segments (yellow/yellow, yellow/red, yellow/blue, or red/blue)
  - **Halfpin** - One segment of a pin, described by its color; when a pin is part of a stack, each of its halfpins will be hidden or visible
  - **Hidden** - Description for a portion of a pin that is not visible when the pin is nested in a cup; can apply to one or both ends of a nested pin, based on the transparency/opacity of the cup its nested into
  - **Visible** - Description for a pin color that is showing when a pin is nested in a cup; can apply to one or both ends of a nested pin, based on the transparency/opacity of the cup its nested into
- **Pinnacle** - A two-object stack that consists of one pin nested to one cup
- **Roller -** A complex structure, mounted to the field perimeter, which includes a 3-sided length of plastic that can be manipulated and set by a robot to display red, blue, or yellow on the side facing into the field
- **Stack -** A group of nested pins and cups
- **Supply** - A set of pins and cups that begin a match in a driver box
- **Zone** - 5 defined areas of the field; neutral zones 1 & 2 and the center zone are also collectively referred to as “the neutral zone”
  - **Red zone** - The 4’ W x 12’ L section of the field closest to the red alliance drivers box, containing both red alliance colored goals.
  - **Blue zone** - The 4’ W x 12’ L section of the field closest to the blue alliance drivers box, containing both blue alliance colored goals.
  - **Neutral zone 1** - The 4’ W x 4’ L section of the field in the center of the head referee side of the field, containing one of the neutral goals.
  - **Neutral zone 2** - The 4’ W x 4’ L section of the field in the center of the audience side of the field, containing one of the neutral goals.
  - **Center zone** - The 4’ W x 4’ L center section of the field, containing the tall center goal.

1.6 Fouls & Penalties

Fouls are decided by a head referee during a match and occur when a rule of gameplay or safety is broken. Fouls may also occur when the RECF Code of Conduct is violated, as determined by the event partner. Teams should not be penalized if they're forced into a foul by an opponent.

Penalty cards serve as a tracking system for fouls. Penalties are announced verbally by a head referee after a match and are recorded in the event management software. All penalties stay with the team for the entire tournament.

For fouls that involve damage or potential damage to the field, people, or other robots, a head referee may also require that the drive team stop operating the robot and put their controller on the ground. This is called grounding.

Head referees should focus on helping teams avoid fouls before they happen, by calling out actions that may lead to a foul. Advance warnings like these do not count as official warnings, and are not recorded by referees.

1.6.1 Official Warning

An official warning is given to an alliance, team, or team member verbally by the head referee the first time they break a specific rule. This official warning helps students learn how to prevent future fouls before they lead to penalties. Future violations of the same rule should result in a yellow card for that rule.

1.6.2 Yellow Card

A yellow card is given to an alliance, team, or team member the second time they break a rule (after they have received an official warning for breaking that specific rule).

1.6.3 Red Card

A red card is given to an alliance, team, or team member the third time they break a rule (after they have received a yellow card for breaking that specific rule).

A team that receives a red card will earn zero points for the current match. In an alliance match, a team that does not receive the red card will receive the actual score of the match. In elimination matches, both teams in the alliance will receive a zero score.

Any foul that affects the outcome of the match will receive a red card for each offense, although in cases where both alliances violate the same rule a head referee may determine that they cancel each other out in terms of their impact on the match. Fouls related to the RECF Code of Conduct, the RECF Student-Centered Policy, or safety rules may also receive a red card for each offense.

1.6.4 Fouls affect eligibility for alliance selection

Any team that receives three or more red cards during an event cannot be part of alliance selection or the elimination bracket. Eligibility for judged awards may also be affected.

Section 2: Design, Build, and Code a Robot

Pinnacle robots are primarily created using VEX V5® electronics and non-electronic parts from any combination of three robot brands: VEX V5®, Robits® by AndyMark, and Pitsco Education TETRIX® MAX. Each robot must pass a brief inspection before it can participate in matches at an official RECF event. Robots may change during the competition, but should be reinspected. Intentionally breaking a robot rule for improved performance may be handled as a violation of the RECF Code of Conduct.

Each robot must use the VEX V5® system of electronics, but can use any combination of legal VEX V5®, Robits® by Andymark, and Pitsco Education TETRIX® MAX structural parts (see rule 2.2.3 for details).

2.1 Robot design

2.1.1 Teams design their own robots

A team's student members get to decide what their robot looks like, and what it does.

2.1.2 Outside references are okay as starting points

Teams can use someone else's design as a starting point, but should modify it to make it their own. They should be able to explain their design process and original ideas when asked. Outside references should be appropriately credited and described in teams' engineering notebooks.

2.2 Robot build

2.2.1 Basic requirements

- Your robot must be safe, and can't damage the field, people, or other robots
- Your robot must pass an inspection before competing at an event and is subject to reinspection at any time during the event
- The power button must be easy to reach during the match
- Your robot can't have parts or mechanisms that intentionally detach during the match
- Your robot can't be larger than 18" wide by 18" long by 18" tall at the start of the match
- Your robot can't ever be larger than 24" wide by 24" long during the match
- There is no limit to how tall your robot can be during the match
- You can only bring one robot to an event
- Your robot can only include legal materials as listed below

2.2.2 Modifying parts

- Electronic components cannot be modified in any way, other than labeling and/or external decorations
- Non-electronic parts may be modified

2.2.3 Required parts

	Required Parts
Robot Brain	VEX V5® Robot Brain
Controller	VEX V5® Controller* **Teams may use up to two controllers for a single robot.*
Radio	VEX V5® Robot Radio
Battery	VEX V5® Robot Battery Li-Ion 1100mAh
License Plates	• Your robot must have exactly two license plates clearly displaying your registered RECF Achieve team number, mounted in two opposing, visible locations on the robot. License plates can't be larger than 7"x3". • You may use VEX V5® Competition License Plates, AndyMark FTC® Alliance Robot Signs, or create custom license plates using 3D printing or other means. License plates do not count towards your custom plastic maximum. • You must have separate red and blue versions of your license plates attached to identify your assigned alliance color during each alliance match. Failure to install the appropriate license plates is a foul.

2.2.4 Optional parts

	Electrical / Pneumatic optional parts
Motors up to a total of 99W	• VEX V5® Smart Motor 11W • VEX V5® Smart Motor 5.5W
Sensors	• VEX V5® AI Vision Sensor • VEX V5® Bumper Switch & Bumper Switch v2 & Bumper Switch 6N • VEX V5® Distance Sensor • VEX V5® GPS Sensor • VEX V5® Inertial Sensor • VEX V5® Line Tracker • VEX V5® Limit Switch • VEX V5® Light Sensor • VEX V5® Optical Sensor • VEX V5® Rotation Sensor • VEX V5® Vision Sensor
Cables	• VEX V5® Smart Cable • VEX V5® Power Cable • VEX V5® 2-Wire, 3-Wire and 4-Wire Extension Cable • VEX V5® 2-Wire and Serial Y-Cable

Pneumatics	Commercially manufactured pneumatic components including cylinders, actuators, valves, gauges, storage tanks, regulators, manifolds, and tubing ● All components must be rated for 100 psi or higher ● Pneumatic devices may only be charged to a maximum of 100 psi ● Compressors or other forms of onboard charging are not permitted ● Pneumatic components may not be modified from their original state, other than cutting tubing or wiring to length; assembling components using pre-existing threads, brackets, or fittings; or applying minor cosmetic labels.

This is not a comprehensive list of legal electronic VEX V5® components. Any robot part within the VEX V5® system is legal for RECF Achieve.

	Mechanical / Structural optional components
VEX V5® / VEX IQ®	All VEX V5® structural and mechanical parts are considered legal, including: ● VEX V5® metal C-channel, U-channel, plates, angles, rails, tracks, gussets, brackets, and shafts ● VEX V5® wheels and tires ● VEX V5® hardware and fasteners, such as screws, nuts, bolts, washers, bearings, shaft couplers, standoffs, shaft inserts, VersaHex adapters and spacers ● VEX V5® plastic and metal gears, sprockets, pinions, gear inserts, rack gears, bevel gears, worm gears, worm wheels, mounting brackets, lead screw nuts and segments, cam followers, and joints ● VEX V5 chain and treads, tank tread links, conveyer belt inserts, and conveyer belt base links ● VEX V5® plastic shaft bearings, shaft collars, bearing flats, hex nut retainers, shaft bushings, and standoff retainers ● VEX V5 ® Flywheel weight and Intake Roller ● VEX V5® Claw kits ● VEX IQ® Chain *This is not a comprehensive list of legal VEX V5® components. Any robot part within the VEX V5® system is legal for RECF Achieve.*
Robits® by Andymark	All Robits® by AndyMark structural and mechanical parts are considered legal, including: ● Robits® tubes, beams, gussets, carriers, channel, plates, aluminum slides, bushings, brackets, and standoffs ● Robits® wheels and tires ● Robits® hardware, fasteners, spacers, screws, nuts, bearings, and springs ● Robits® gears, hex shafts, shaft adaptors, and belts ● Robits® chain sections, links, breakers, and tensioners ● Robits® pulleys, pulley mounts, pulley bearings, pulley extensions, and slide pulley holders ● Robits® turntable gears and assemblies *This is not a comprehensive list of legal Robits® by AndyMark components. Any non-electronic structure, motion, or hardware part from the Robits® by AndyMark system is legal for RECF Achieve. Please consider compatibility with VEX V5®*

	system electronic components (such as motors) if utilizing Robits® by AndyMark components.
Pitsco TETRIX® MAX	All Pitsco Education TETRIX® MAX structure and mechanical parts are considered legal, including: ● TETRIX® MAX channels, bars, angles, plates, brackets, flats, and rails ● TETRIX® MAX tubes, tube reinforcers, tubing couplers, tube clamps, tubing corner blocks, and tubing anchor blocks ● TETRIX® MAX wheels and tires ● TETRIX® MAX hardware, fasteners, screws, and nuts ● TETRIX® MAX gears and sprockets ● TETRIX® MAX axles, hubs, spacers, stand-offs, bushings, shafts, shaft couplers and axle set collars ● TETRIX® MAX tank tread chain links, tank tread rubber inserts, tank tread conveyor paddles, and chain breakers ● TETRIX® MAX gripper kit *This is not a comprehensive list of legal Pitsco Education TETRIX® MAX components. Any non-electronic structure, motion, or hardware part from the Pitsco Education TETRIX® MAX system is legal for RECF Achieve. Please consider compatibility with VEX V5® system electronic components (such as motors) if utilizing TETRIX® MAX components.*
Any source	Commercially-available fastening hardware (when used for fastening), including screws, nuts, spacers, washers, and standoffs

Important notes

1. Some product kits from Robits® by AndyMark and Pitsco Education TETRIX® MAX include prohibited electronic parts, including motors, servos, controllers, cables, batteries, sensors, etc. Please take this into account when making purchasing decisions for your robot build. If you are unsure whether a part is prohibited, please submit a question to the official RECF Achieve Q&A system.
2. If you are utilizing a pre-designed robot system kit, such as a chassis, lift kit, launcher expansion kit, claw kit, etc. you must appropriately document and credit that part of your robot AND modify it to make it your own in some capacity.
3. Please note that not every part will be compatible with other parts when combining robotics systems.

	Custom plastic and decorations
Custom Plastic	● Up to twelve individual custom plastic pieces, which can be a combination of two styles: ○ **Flat cut -** Piece up to 4”x12” in size, cut from certain types of non-shattering plastic up to 0.070” thick ○ **3D printed -** Piece up to 3”x5”x2” in size, printed from certain types of plastic filament ● Flat-cut plastic requirements:

	○ You may modify your custom flat cut plastic by making holes, cutting sizes and shapes as desired, bending, or otherwise changing the form or appearance of the plastic. You may not chemically weld, melt, or treat flat-cut plastic. ○ You may use any of the following flat-cut plastic types: polycarbonate (Lexan), acetal monopolymer (Delrin), acetal copolymer (Acetron GP), POM (acetal), ABS, PEEK, PET, HDPE, LDPE, nylon (all grades), polypropylene, PTFE, and FEP. ○ Flat-cut plastic that may shatter (ex. plexiglass or acrylic) is not allowed ● 3D printed plastic requirements: ○ You may use any of the following filament types: PLA, ABS, TPU, PETG, nylon, and carbon fiber-filled filaments ● Custom plastic parts must be designed or customized by student team members, but can be manufactured by an outside entity (e.g., SendCutSend) ● Please document your use of custom plastic in your engineering notebook
Decorations	Decorations, including 3D printed decorations, are permitted as long as they have no function and do not affect other robots. 3D printed decorations, except license plates, count towards your custom plastic total.
Misc.	● Any rubber bands up to 8” long and .25” wide ● Hot glue to secure cable connections ● Plastic zip ties up to 12” long and 0.25” wide ● Non-aerosol-based lubricants or grease, when used sparingly; lubricants or grease may not be used on any components that will come into contact with any part of the field, game objects, or other robots ● Anti-static compound, when used sparingly in a way that will not leave residue on any part of the field, game objects, or other robots ● An unlimited amount of rope or string that is non-elastic and no thicker than ¼” (6.35mm) ● Commercially-available products designed for bundling or wrapping cables and/or pneumatic tubing, used only for the purpose of cable/tubing protection, organization, or management (e.g., electrical tape, cable carrier, or cable track) ● Commercially-available anti-slip drawer liner, in pieces no larger than 12”x15” ● One micro-SD card installed in the VEX V5® Robot Brain

2.2.5 Disallowed items

- Any electronic components from a system other than VEX V5®, including motors, servos, controllers, cables, sensors, batteries, and radios.
    - Electronic components from Robits® by AndyMark and Pitsco Education TETRIX® MAX are prohibited.
- Any structural / mechanical parts from a system other than Robits® by Andymark, Pitsco Education TETRIX®, or VEX V5® unless listed in rule 2.2.4.
- Anything that compromises the safety of people, other robots, the field, or game pieces

2.3 Robot Code

2.3.1 Students create their own code

A team's student members get to decide what their robot's code looks like, and what it does. Adults may teach coding concepts, but may not tell students what should or should not be included in their code.

2.3.2 Coding libraries are okay as starting points

Teams can use coding libraries as a starting point, but should modify the resulting code to make it their own. They should be able to explain how their code works and how it has been modified from the original ideas when asked. Outside references should be appropriately credited and described in teams' engineering notebooks.

Section 3: Pinnacle Solo Driving Matches

In Pinnacle solo driving matches, student drive teams have 60 seconds to score as many points as possible while operating their robot with a remote controller. Solo matches aren't pre-scheduled. The field setup is shown in figures 3.0.1 and 3.0.2 below. The rules for solo driving matches represent the basic rule set for Pinnacle. Once students master solo driving matches, they only need to learn a few more rules to understand how other match types work.

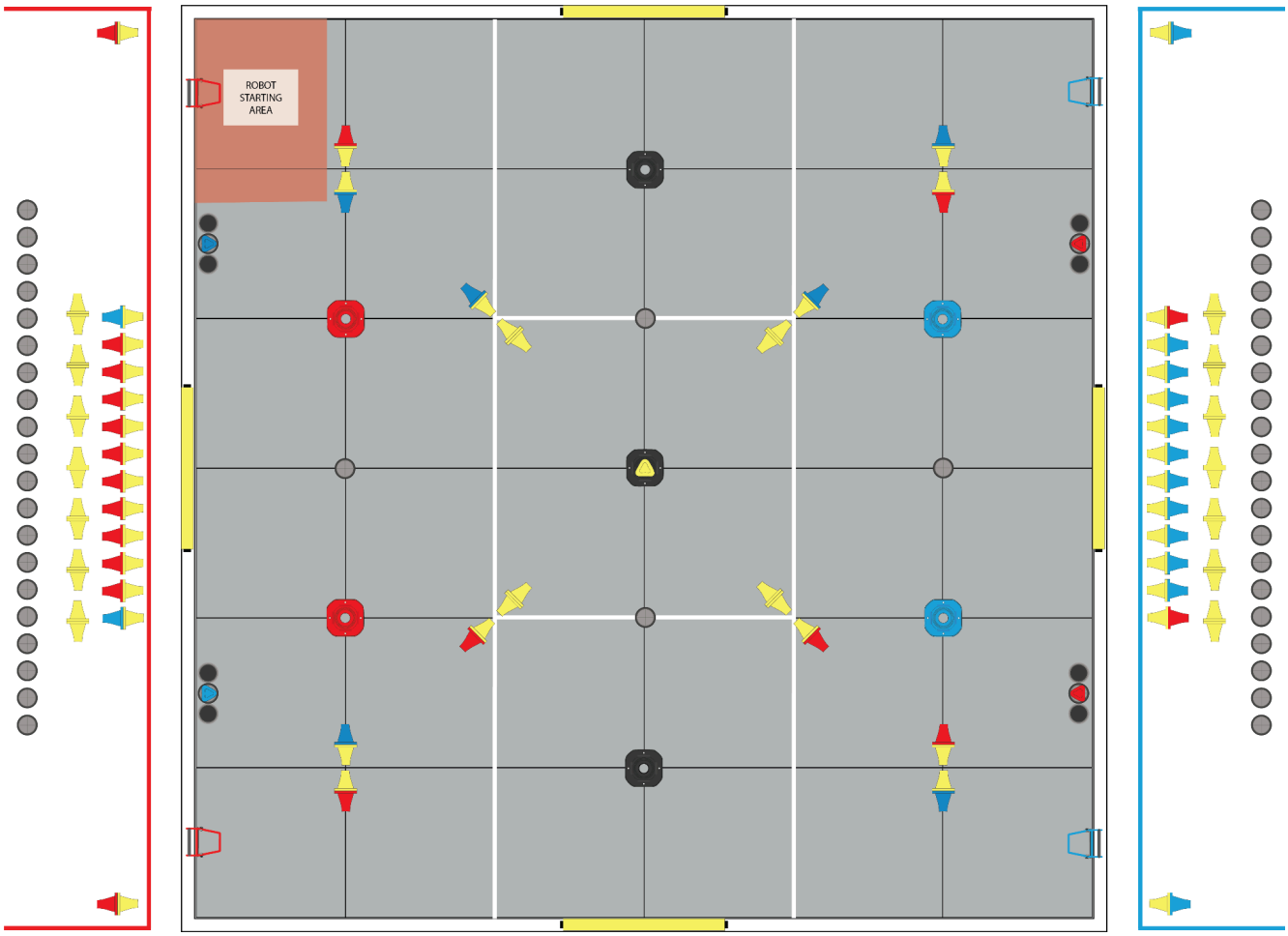


Figure 3.0.1

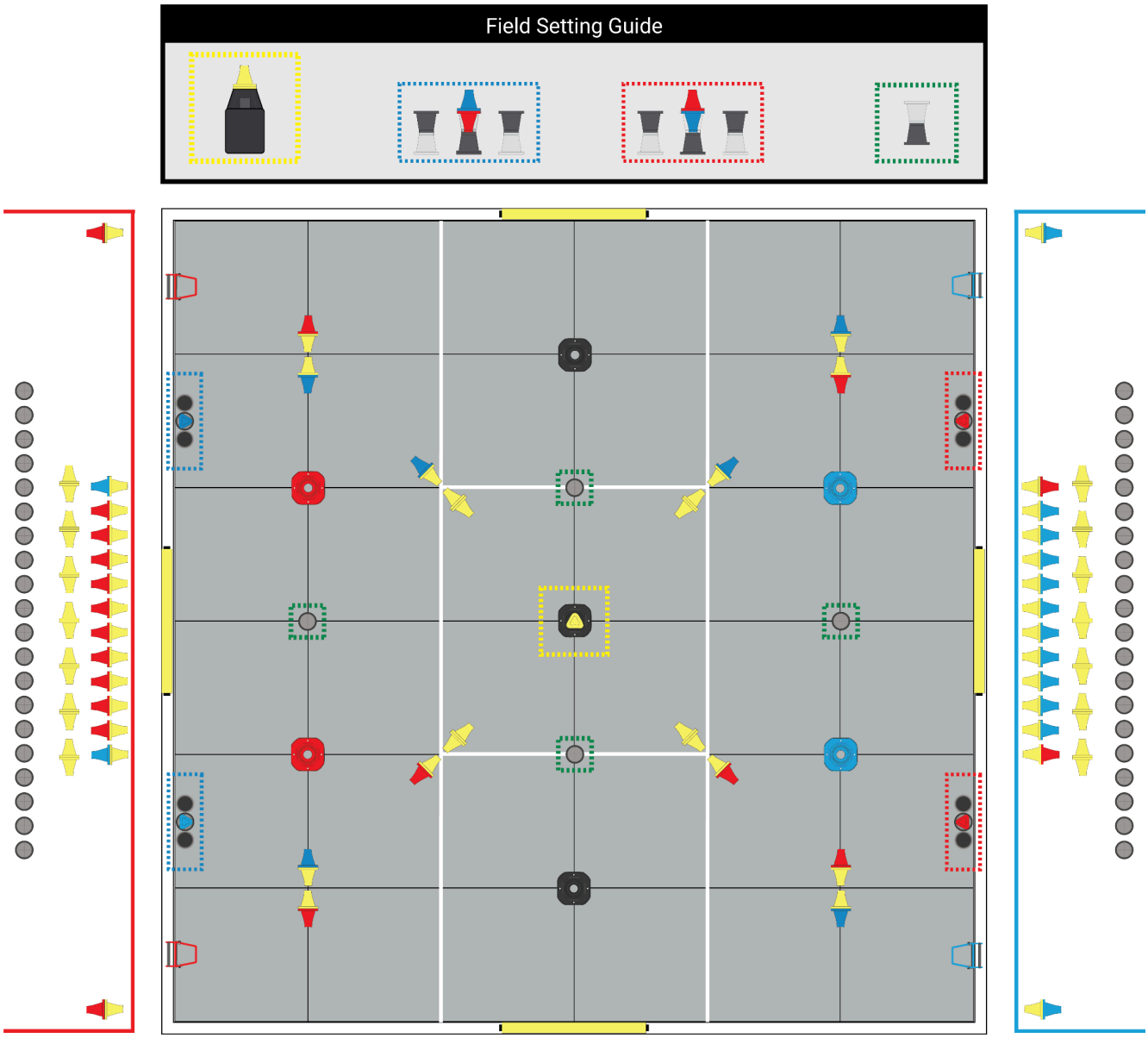


Figure 3.0.2

3.1 Solo Match Scoring

3.1.1 Cups and pins must be nested to count as scored

To count as scored, a pin must be nested into either a goal or a scored cup.

To count as scored, a cup must be nested onto a scored pin.

3.1.2 Scored cup on any goal

Each cup scored on a goal earns one point.

3.1.3 Scored red halfpin on a red or neutral goal

Each visible red halfpin that is scored on a red or neutral goal earns 5 points.

3.1.4 Scored blue halfpin on a blue or neutral goal

Each visible blue halfpin that is scored on a blue or neutral goal earns 5 points.

3.1.5 Scored yellow halfpin on a red or neutral goal

Each visible yellow halfpin that is scored on a red or neutral goal earns 5 points only if the roller in that goal's zone is set to red.

3.1.6 Scored yellow halfpin on a blue goal

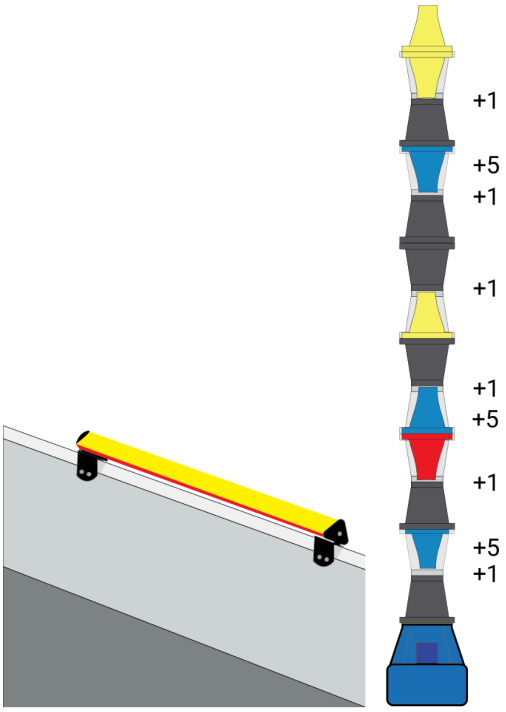
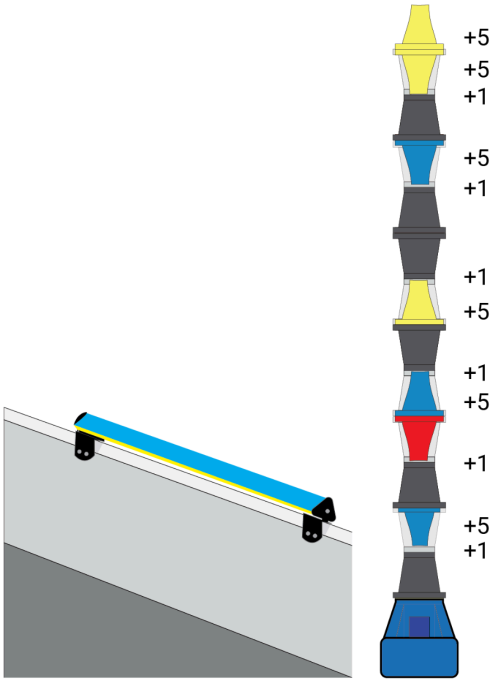
Each visible yellow halfpin that is scored on a blue goal earns 5 points only if the roller in that goal's zone is set to blue.

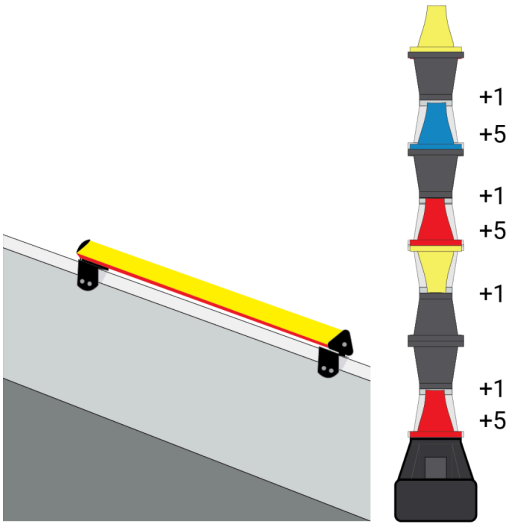
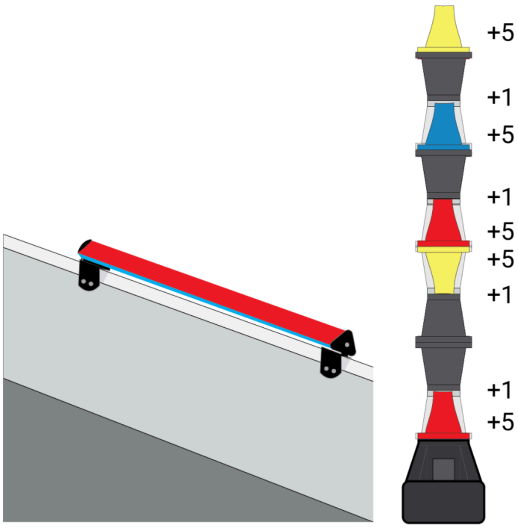
3.1.7 Scored halfpin of any color on the center goal

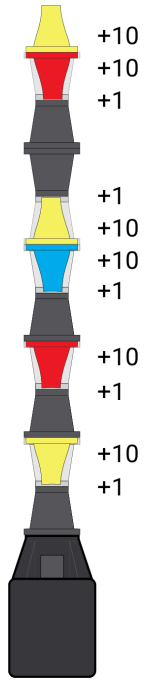
Each visible halfpin that is scored on the center goal earns 10 points.

Solo Match Scoring Category	Points
Scored cup	1 point per cup
Scored red or blue halfpin in a color-matching or neutral goal	5 points per visible halfpin
Scored yellow halfpin on a red or neutral goal, with a roller set to red	5 points per visible halfpin
Scored yellow halfpin on a blue goal, with a roller set to blue	5 points per visible halfpin
Any scored halfpin on the center goal	10 points per visible halfpin

3.1.8 Solo Match Scoring Examples

Blue goal with the roller set to yellow or red • Six cups at 1 point each = 6 • Three blue halfpins at 5 points each = 15 • Total score for this goal = 21 • Red halfpins can't score on blue goals • Because the roller in this zone isn't set to blue, yellow halfpins are worth 0	
Blue goal with the roller set to blue • Six cups at 1 point each = 6 • Three blue halfpins at 5 points each = 15 • Three yellow halfpins at 5 points each = 15 • Total score for this goal = 36 • Red halfpins can't score on blue goals	

Neutral or red goal with the roller set to yellow or blue • Four cups at 1 point each = 4 • Two red halfpins at 5 points each = 10 • One blue halfpin at 5 points = 5 • Total score for this goal = 19 • Because the roller in this zone isn't set to red, yellow halfpins are worth 0	
Neutral or red goal with the roller set to red • Four cups at 1 point each = 4 • Two red halfpins at 5 points each = 10 • One blue halfpin at 5 points = 5 • Two yellow halfpins at 5 points each = 10 • Total score for this goal = 29	

Center goal (has no corresponding roller) ● Five cups at 1 point each = 5 ● Six visible halfpins at 10 points each = 60 ● Total score for this goal = 65	

3.2 Starting Positions

3.2.1 Driver boxes for solo matches

Up to three student team members (the drive team) can come to the field for each solo match. One drive team member can use the blue driver box and the blue loaders, but must remain in the blue driver box for the entire match. All other drive team members must remain inside of the red team driver box during the match unless they are interacting with their robot as allowed in 3.4.1. Only the drive team members can operate the robot during the match.

Drive team members can't wear headphones or communicate with anyone beyond the field during the match, and spectators or non-drive team students can't coach the drive team. Sitting or standing on chairs/stools for support or elevation is only allowed if approved by the RECF through an accommodation request.

3.2.2 Robot starting position

The robot must begin the match within the 18" x 18" x 18" starting size limit, in contact with one of the two red loaders (as shown in the first image in section 3), and not in contact with any pins or cups other than their preload pin (3.2.3).

3.2.3 Preload pin

A robot must start the match in contact with one yellow/red pin.

3.2.4 Eye protection

Every drive team member has to wear some form of eye protection. Eyeglasses meet the requirement, but we recommend safety glasses with non-shattering lenses and side shields.

3.3 Match Play

3.3.1 The robot can only operate while the match timer is counting down

Robots can't be in motion before the match timer begins counting down from 60 seconds, and have to stop when the timer hits 0. Points scored after the timer reaches 0 will be deducted before the score is submitted, and the team will receive a foul.

3.3.2 The robot can carry one pin, one cup, and one stack at a time

A robot can carry up to one unstacked pin, one unstacked cup, and one stack of any height at any time.

A team can avoid a foul for this rule by stopping all other match play until they've removed the extra cup(s)/pin(s)/stack(s). If they can't remove the extra objects, they should consider grounding their own robot for the rest of the match. Playing the game while carrying extra objects after being asked to stop driving by a head referee will result in a foul.

3.3.3 Cups and pins stay in the game

Removing a cup or pin from the field is a foul. Intentional or egregious fouls will receive red cards.

A cup or pin that leaves the field will be returned by the nearest field volunteer when and if they're able to safely and reasonably do so, in a position against the field wall close to where it left the field. Cups or pins that are leaving the field cannot be deflected back into the field by humans, or by anything outside of the field.

3.3.4 Team-loaded objects

Any drive team member can move cups, pins, and pinnacles from the supply in their driver box into one of the two adjacent loaders during the match (not before!). Only the objects that begin the match in a driver box can be added, and they can only be added to the adjacent loaders. Any unused preloads (3.2.3) can be added to the supply and used as team-loaded objects.

A loader can only contain one cup, one pin, or one pinnacle at any time. The drive team member must let go of the object before a robot is allowed to touch it.

3.3.5 Don't reach into the field

Before a match, students can only reach into the field to place their robot. Referees can adjust objects if they're more than 1" out of position or in an incorrect orientation.

During a match, students can only reach into the field to troubleshoot their robot if it hasn't moved during the match (3.4.1).

3.3.6 How to stop a match early

If a drive team wants to end a match early, they should stop driving, put their controller(s) on the ground, and give a clear signal such as “Stop Time!” For improved accuracy, drive team members may notify the referee before the match or provide a countdown before the stop signal. The time remaining on the match timer will be recorded as the stop time.

3.3.7 Field control

Drive team members must attach their primary controller to the provided field control system. The controller must remain connected for the entire match unless the head referee asks them to disconnect it for troubleshooting, and until they are cleared to retrieve their robot at the end of the match.

All code for the robot and controller must be designed to follow directions from the field control system.

3.4 What Happens When Things Go Wrong

3.4.1 Robot hasn’t moved during the match

If a team’s robot hasn’t moved during the match, drive team members are allowed to troubleshoot it during the driver-controlled period of the match. They can’t make mechanical/structural repairs or changes, and can only interact with the robot brain, battery, and/or radio. They should pay attention to other robots on the field to avoid safety hazards.

3.4.2 Match replay

The head referee and event partner may decide to replay a match due to technical issues outside of the team’s control that affect the outcome of the match.

3.4.3 Field damage

If a robot damages a field, it may be grounded by the head referee for the rest of the match. If the head referee decides that damage caused by a student or robot is intentional, the team may earn a red card and a zero score for the match.

3.4.4 Appealing a decision

If the drive team members disagree with a decision made or score recorded by a referee, they should remain at the field and notify the referee immediately. Drive team members and referees should be prepared to show specific rules and/or Q&A answers that back up their opinions, and should remember that referees can only make rulings based on the game manual and their own observations and perspectives of the match. Referees and drive team members may never view video or photos from the match while at the field or during discussions that affect match outcomes or scoring, and team members who were not at the field for the match are not allowed to approach the field. The head referee will determine when the discussion is over, and will announce their final and binding decision.

Section 4: Pinnacle Solo Coding Matches

In Pinnacle solo coding matches, teams have 60 seconds to score as many points as possible using only pre-written code to operate the robot. Solo matches aren't pre-scheduled.

Rules from Section 3: Solo Driving Matches apply unless they're specifically changed by a rule in this section.

4.1 Changes From Solo Driving Matches

4.1.1 No driving the robot

Drive team members must still attach their controller to the field controller if required by the event, but can't use the controller to operate the robot during the match.

Section 5: Pinnacle Alliance Matches

In Pinnacle alliance matches, teams have 120 seconds to score as many points as possible. Each match includes two teams paired as a red alliance and two teams paired as a blue alliance. The two teams in an alliance work together to share scored points, and in an effort to outscore the other alliance. Skipping an alliance match will be considered a violation of the RECF Code of Conduct.

All rules from Section 3: Solo Driving Matches apply to alliance matches unless they're specifically changed by a rule in this section.

5.1 Alliance Match Scoring

5.1.1 Cups and pins must be nested to count as scored

To count as scored, a pin must be nested into either a goal or a scored cup.

To count as scored, a cup must be nested onto a scored pin.

5.1.2 Scoring on alliance goals

5.1.2.1 Alliance-color halfpin scored on a matching alliance goal

An alliance earns 5 points for each visible halfpin of their alliance color scored on either of their alliance goals.

5.1.2.2 Cup scored on an alliance goal

An alliance earns 1 point for each cup scored on either of their alliance goals.

5.1.2.3 Yellow halfpin scored on an alliance goal

An alliance earns 5 points for each visible yellow halfpin scored on an alliance goal only if the roller in that zone matches their alliance color.

5.1.3 Scoring on neutral goals

5.1.3.1 Alliance-color halfpin scored on a neutral goal

An alliance earns 5 points for each visible halfpin of their alliance color that is scored on a neutral goal.

5.1.3.2 Cup scored on a neutral goal

An alliance earns 1 point for each cup scored on the neutral goal when the roller in that zone is turned to their alliance color. Neither alliance earns points for cups when the roller in that zone is turned to yellow.

5.1.3.3 Yellow halfpin scored on a neutral goal

An alliance earns 5 points for each visible yellow halfpin scored on the neutral goal when the roller in that zone is turned to their alliance color. Neither alliance earns points for yellow halfpins when the roller in that zone is turned to yellow.

5.1.4 Scoring on the center goal

5.1.4.1 Alliance-color halfpin scored on the center goal

An alliance earns 10 points for each visible halfpin of their alliance color that is scored on the center goal.

5.1.4.2 Cup scored on the center goal

The alliance who has scored the highest number of visible alliance-colored halfpins on the center goal earns 1 point for each cup scored on the center goal. In the case of a tie, neither alliance earns points for cups scored on the center goal.

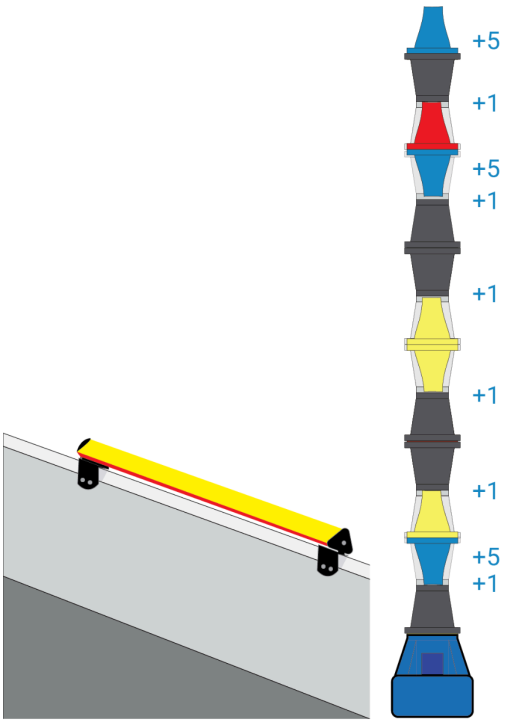
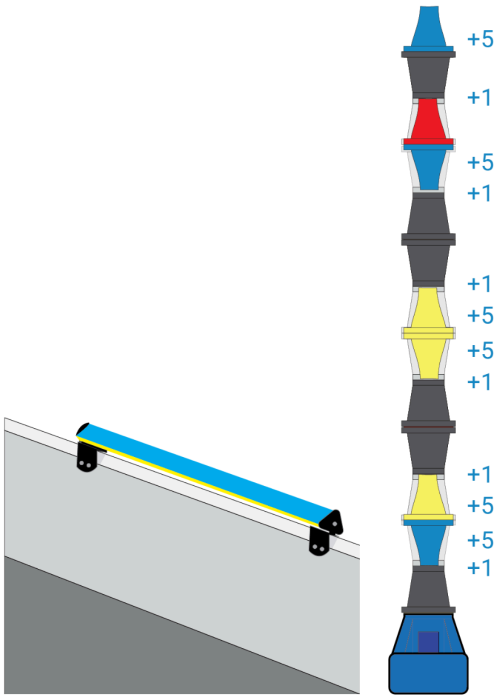
5.1.4.3 Yellow halfpin scored on the center goal

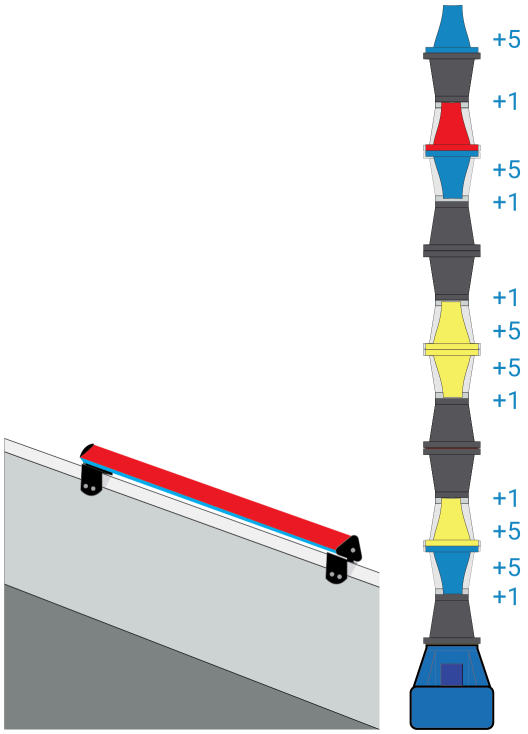
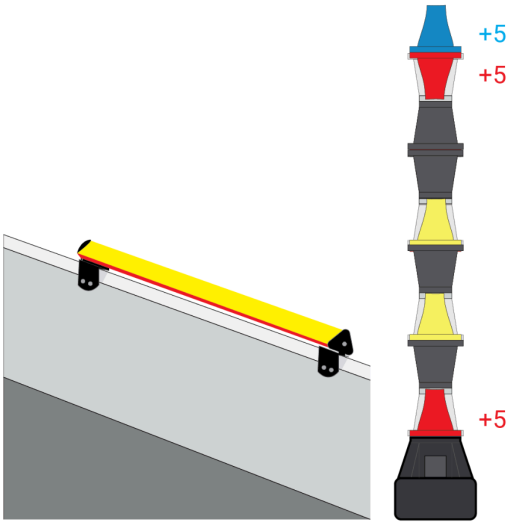
The alliance who has scored the highest number of visible alliance-colored halfpins on the center goal scores 10 points for each visible yellow halfpin on the center goal. In the case of a tie, neither alliance earns points for halfpins scored on the center goal.

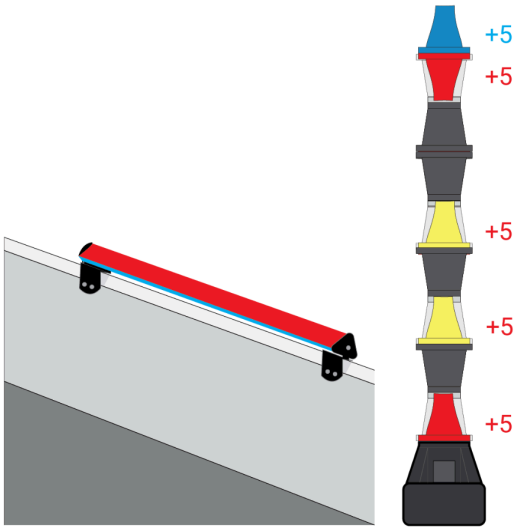
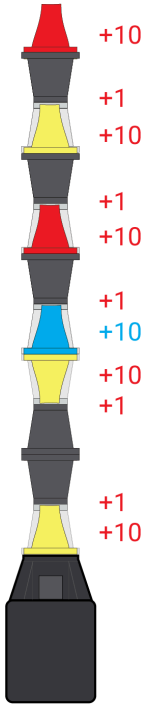
5.1.5 Parked robot

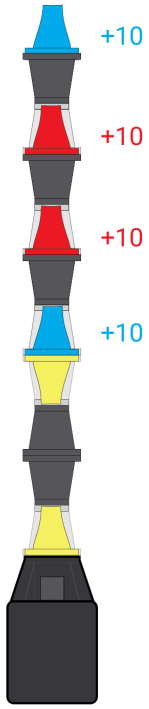
Each Robot in contact with one their alliance’s loaders at the end of the match earns 21 points, with a maximum of one robot per loader.

5.1.6 Alliance match scoring examples

Blue goal with the roller set to yellow • Six cups at 1 point each = 6 to blue • Three blue halfpins at 5 points each = 15 to blue • Red halfpins can't score on blue goals • Because the roller is set to yellow, yellow halfpins are worth 0 Total score for this goal is 0 points to the red alliance, and 21 points to the blue alliance.	
Blue goal with the roller set to blue • Six cups at 1 point each = 6 to blue • Three blue halfpins at 5 points each = 15 to blue • Three yellow halfpins at 5 points each = 15 to blue • Red halfpins can't score on blue goals Total score for this goal is 0 points to the red alliance, and 36 points to the blue alliance.	

Blue goal with the roller set to red • Six cups at 1 point each = 6 to blue • Three blue halfpins at 5 points each = 15 to blue • Three yellow halfpins at 5 points each = 15 to red • Red halfpins can't score on blue goals Total score for this goal is 15 points to the red alliance, and 21 points to the blue alliance.	
Neutral goal with the roller set to yellow • Two red halfpins at 5 points each = 10 to red • One blue halfpin at 5 points = 5 to blue Because the roller in this zone is set to yellow, neither alliance earns points for scored cups or yellow halfpins. Total score for this goal is 10 points to the red alliance, and 5 points to the blue alliance.	

Neutral goal with the roller set to red • Two red halfpins at 5 points each = 10 to red • One blue halfpin at 5 points = 5 to blue Because the roller in this zone is set to red, the red alliance also earns points for scored cups and yellow halfpins in this goal. • Four scored cups = 4 to red • Two scored yellow halfpins = 10 to red Total score for this goal is 24 points to the red alliance, and 5 points to the blue alliance.	
Central goal (no corresponding roller) • Two red halfpins at 10 points each = 20 to red • One blue halfpin at 10 points = 10 to blue Because red has more visible scored halfpins than blue, the red alliance also earns points for scored cups and yellow halfpins in this goal. • Five scored cups = 5 to red • Three scored yellow halfpins = 30 to red Total score for this goal is 55 points to the red alliance, and 10 points to the blue alliance.	

Central goal (no corresponding roller) • Two red halfpins at 10 points each = 20 to red • Two blue halfpins at 10 points each = 20 to blue Because the two alliances have an equal number of visible, scored, alliance-colored halfpins in this goal, neither alliance earns points for the scored cups or yellow halfpins.	

5.2 Changes From Solo Driving Matches

5.2.1 Driver boxes for alliance matches

Because an alliance match includes two opposing alliances, two teams in each alliance match are designated on the match schedule as the red alliance and will share the red driver box. The other two teams in each match are designated as the blue alliance on the match schedule and will share the blue driver box. See figure 5.3.1 for more details.

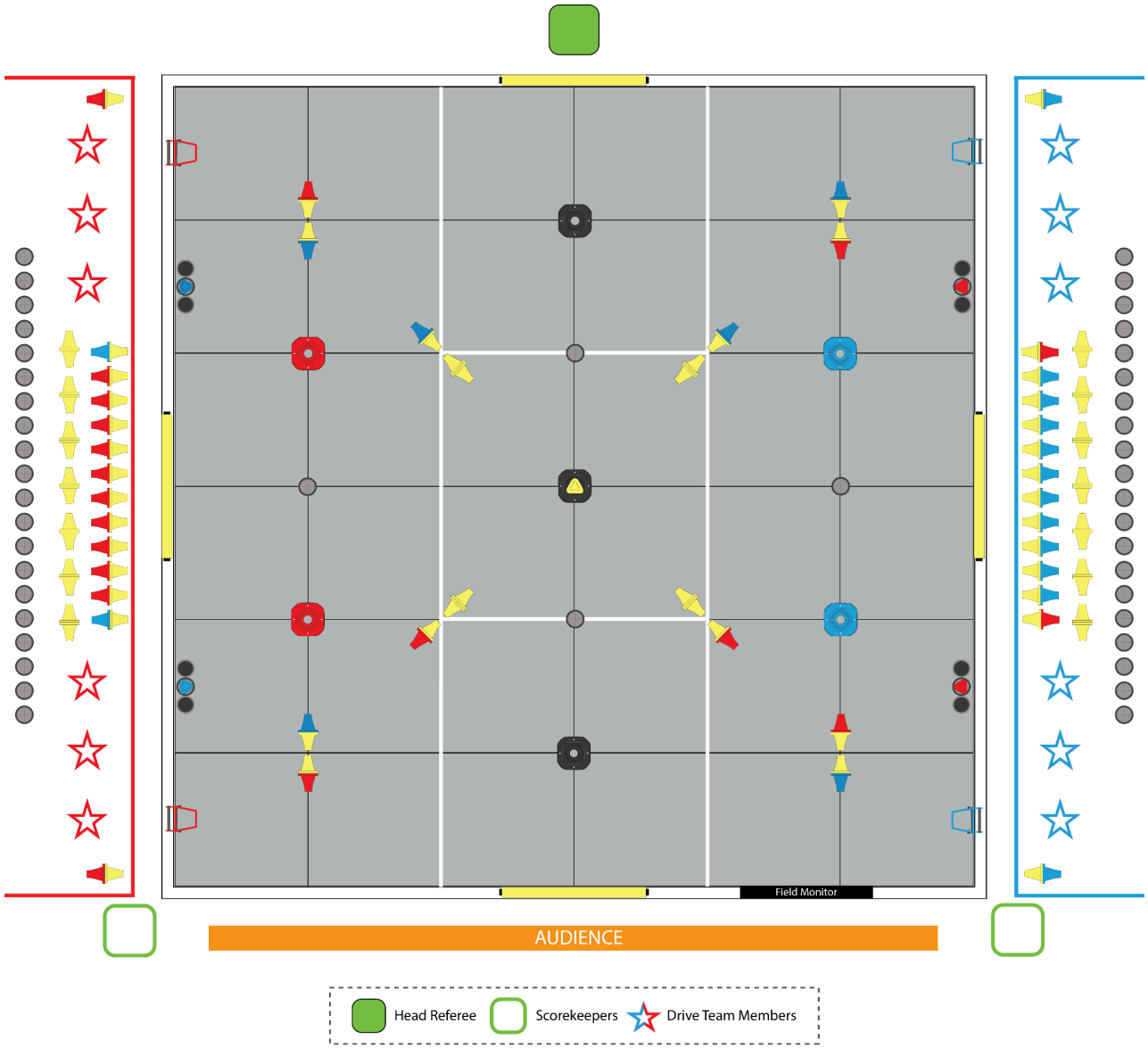


Figure 5.3.1

5.2.2 Robot starting positions

Each robot must begin the match within the 18” x 18” x 18” starting size limit, in contact with one of their alliance-colored loaders that is not in contact with another robot, and not in contact with any pins or cups other than their preload pin (3.2.3), as shown in figure 5.3.2.

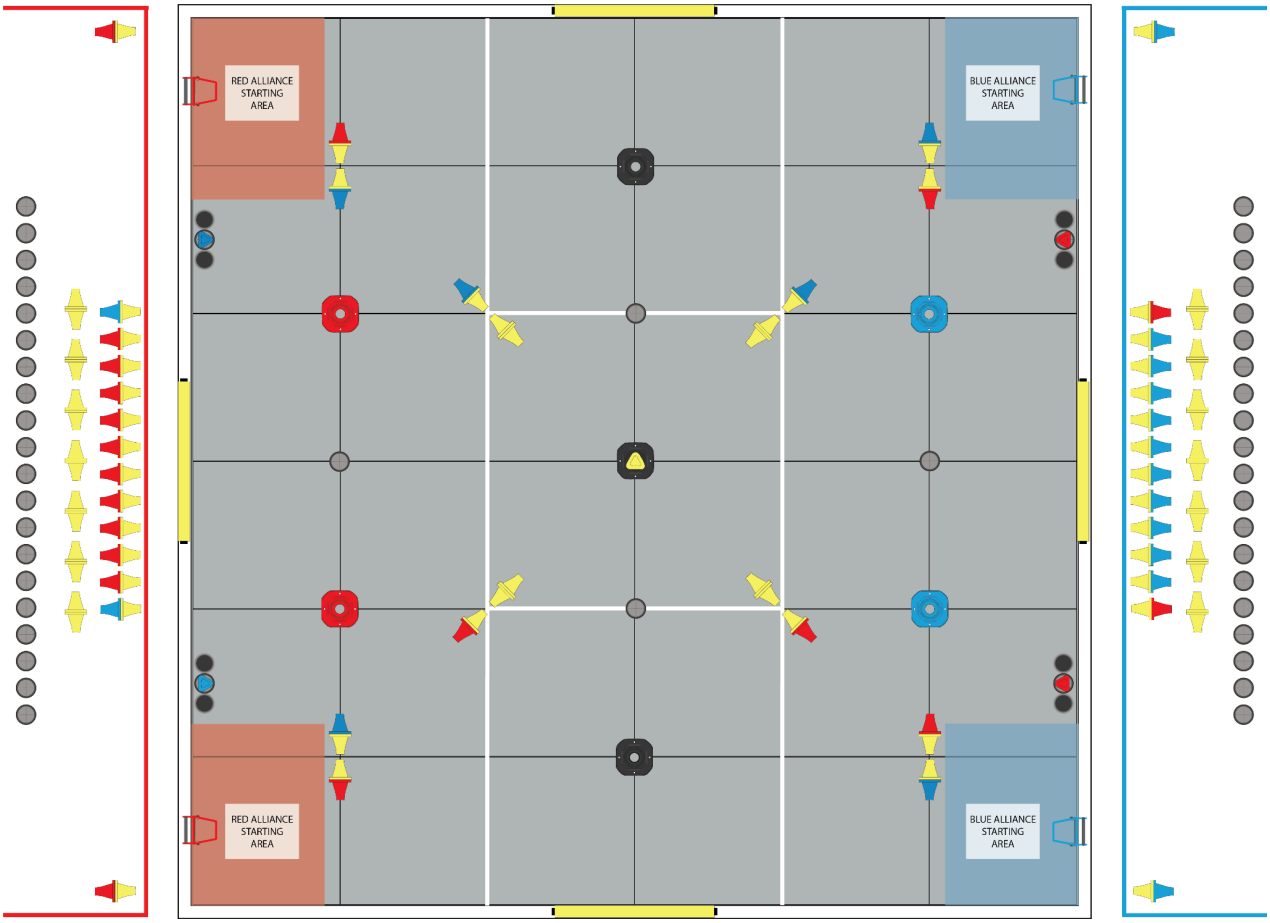


Figure 5.3.2

5.2.3 Team-loaded objects

Drive team members can add objects from the supply in their driver box into their alliance-colored loaders during both periods of the match, but not before the autonomous period begins and not while the timer is stopped between the match periods.

5.2.4 Stopping a match early

An alliance match can end early if everyone agrees, but no match stop time will be recorded.

5.3 Additional Rules for Alliance Matches

5.3.1 Alliance matches begin with a 15-second autonomous period

Robots aren't allowed to contact anything on the opponent's side of the neutral zone. They can contact anything in their own alliance-colored zone, and anything in the neutral zone including all tape lines.

5.3.2 Robots in the neutral zone give up some protection during the autonomous period

Robots in the neutral zone are likely to encounter other robots in the neutral zone, and unless the head referee decides that an entanglement, tipping, or trapping interaction (see 5.3.6) was intentional or strategic, most interactions won't result in fouls .

5.3.3 Fouls are handled differently during the autonomous period

If a team breaks any rule during the autonomous period of a match, they can't receive an autonomous ranking point. Fouls that occur during the autonomous period are only recorded and tracked if they're related to the RECF Code of Conduct or result in a red card; other fouls should not result in foul cards or affect the overall match score.

5.3.4 Goals in the neutral zone are not protected

Both alliances can add and remove pins, cups, pinnacles, or stacks on all three goals in the neutral zone, with no limitation.

5.3.5 Alliance-colored goals are protected

Alliances can't interact with the goals in their opponent's alliance-colored zone, including adding or removing nested pins or cups. Breaking this rule will result in a red card, unless the robot was forced into the penalty by a robot from the other alliance.

5.3.6 Interactions with opponent robots are limited

Teams may not use their robots in ways that prevent other robots from playing the game for extended periods of time. Teams can use limited defensive driving maneuvers, but can only limit the actions of an opponent robot (i.e., trap, hold, or lift) for a 4-count (approximately four seconds). The count will pause when the trapped robot has an avenue of escape, or the two robots have separated for at least another 4-count. If the interaction resumes before the 2nd 4-count ends, the original count should resume. A trap/hold/lift that lasts longer than a 4-count is a foul, and can result in a red card at the head referee's discretion.

Unintentional entanglement, grabbing, grappling of other robots may result in the offending robot being grounded for the rest of the match.

Intentional use of strategies such as entanglement, grabbing, grappling, or disabling another robot may result in a red card and the offending robot being grounded for the rest of the match.

5.3.7 Robots can't use game objects to break rules

Teams can't use cups, pins, stacks, or any part of the field to indirectly break a game or robot rule. Game objects are effectively extensions of a robot while a robot is interacting with them, although they don't count toward robot size limits. For example: a team can't use a stack to knock down the opposing alliance's stacks or pins.

5.3.8 Each alliance in the elimination bracket gets one time out

Time outs are available between matches in the elimination bracket, but can only be used immediately before a match that includes the alliance who calls it. Each time out can be up to three minutes, but can end early if that alliance's teams and head referee agree.

5.4 What Happens When Things Go Wrong

5.4.1 Missed match or late to a match

If a team's robot isn't at the field for an alliance match before its scheduled start time (or, for elimination and finals matches and/or when the event is running behind schedule, when the match is otherwise ready to begin), the team will be marked as absent from that match. They will not earn points for that alliance match; the score for the other team in their alliance is not affected.

If a team's robot is not ready to play at the scheduled match time (or, for elimination and finals matches and/or when the event is running behind schedule, when the match is otherwise ready to begin), the head referee may ask the team to remove the robot from the field. Robots cannot be added to a match after the pre-match time countdown.

If the robot is at the field for the entire match, whether it is on the field or not, the team is eligible to receive a score for that match.

5.5 Ranking Points

Alliances earn ranking points for achieving tasks throughout the course of scheduled alliance matches. These ranking points are added together to determine the overall rank of individual teams for alliance selection.

5.5.1 Autonomous Ranking Point

Each alliance can earn 1 ranking point for ending the autonomous period of an alliance match with all of the following tasks completed:

- At least 3 cups and 4 halfpins scored across at least 2 goals
- Alliance zone roller showing the matching alliance color

5.5.2 Endgame Ranking Point

Each alliance earn 1 ranking point for ending an alliance match with all of the following tasks completed:

- Scoring a stack that has at least 5 scored, visible halfpins of their alliance color
- At least one roller showing their alliance color
- At least one robot in contact with an alliance loader

5.5.3 Win Points

- Alliances earn 2 win points for ending an alliance match with the highest score
- Alliances earn 1 win point for ending an alliance match with a tied score

Section 6: Judging and Awards

At events that offer judging, teams will participate in an interview with judges to answer questions about their team, robot design/construction, code, and strategies; each team must be offered an equal opportunity to be interviewed. Teams also submit their engineering notebooks for review by judges.

Each team interview lasts about 10 minutes and in-person interviews generally take place between matches. Judges use the Team Interview Rubric and Engineering Notebook Rubric to evaluate and rank teams. Teams are encouraged to review these rubrics in advance.

See the RECF Guide to Judging for more information about judging and awards.

6.1 Engineering Notebooks

An engineering notebook is a record-keeping tool that provides students with an opportunity to develop essential skills such as project and time management, brainstorming, and both written and interpersonal communication. Teams are encouraged to document their use of the engineering design process, including details of successes and challenges. All documentation and work related to the engineering notebook must be completed by the students, and they can't use AI-generated content. To learn more about engineering notebooks and the engineering design process visit the RECF Library.

Teams can maintain their notebook using either a traditional physical notebook or a range of digital tools, such as software applications or cloud-based platforms. Some events may only accept physical notebooks, while others may require digital submissions. In these cases, physical notebooks can be scanned and submitted electronically, and physical logbooks may be printed for submission. Be sure to check the event details on RECFevents.org to confirm which format is accepted.

6.2 Team Interviews

Team interviews are face-to-face (or virtual) conversations between a team of students and two or more volunteer judges. Interviews are opportunities for teams to share their design process, match strategies, learning experiences, and overall approach to the RECF Achieve Robotics Competition.

6.3 Award Deliberation

Award deliberation is the last step in the judging process. In this step, judges work with the judge advisor and one another to select candidates for each award.

The Engineering Notebook Rubric and Team Interview Rubric are tools to assist with deliberations. A team's score, whether a specific line item on a rubric or the overall score, is a data point that the judges can use as a part of the process. It is not a replacement for qualitative judgments in the deliberation process.

Judges will choose winners of each award based on the specific award criteria in the RECF Guide to Judging. No team may receive more than one judged award at an event.

Section 7: Event Personnel, Processes, & Guidelines

7.1 Event Personnel

7.1.1 Event Partner

An event partner is a certified volunteer who runs an event using the guidelines in RECF's policies and game manuals. RECF event partners must be at least 18 years old, and can't serve as a head referee or judge advisor at their event. Event partners oversee the activities in this section of the game manual, and can add specific rules based on their site and event. Event partners cannot make decisions about match scores or rulings, cannot determine penalties for fouls, and cannot influence who receives judged awards. Event partners have the final decision on non-match and non-robot decisions at an event.

7.1.2 Head Referee

A head referee is a certified volunteer who oversees matches using the guidelines in the game manual. RECF Achieve head referees must be at least 20 years old. Head referees work with team members to prevent and avoid fouls, and communicate fouls and penalties to teams when they occur. Head referees have the final decision on all match and robot rules, and should train robot inspectors and scorekeeper referees at events as appropriate.

Every alliance and elimination match must be watched by at least one head referee, and a head referee must be available to assist at robot inspection and solo matches as needed. See this article and related content in the RECF Library for more information.

7.1.3 Scorekeeper Referee

Scorekeeper referees score all varieties of match, and can oversee solo matches independently. RECF Achieve scorekeeper referees must be at least 15 years old. Every solo match must be watched by at least one referee. If there's a question about scoring or match play that doesn't have a clear answer in the game manual, scorekeeper referees should consult a head referee before answering. See this article and related content in the RECF Library for more information.

7.1.4 Judge Advisor

A judge advisor is a certified volunteer who trains and oversees volunteer judges at an event using the guidelines in the RECF Guide to Judging. RECF Achieve judge advisors must be at least 21 years old. See this article and related content in the RECF Library for more information.

7.1.5 Judge

A judge is a volunteer who reviews teams' engineering notebooks and/or interviews teams about their processes, then deliberates with other judging volunteers to identify award candidates and select award winners. RECF Achieve judges must be at least 20 years old and

cannot be current RECF Achieve team members. See this article and related content in the RECF Library for more information.

7.1.6 Robot Inspector

A robot inspector is a volunteer who confirms that teams' robots meet the requirements in the game manual. If there's a question that doesn't have a clear answer in the game manual, robot inspectors should consult a head referee. See this article and related content in the RECF Library for more information.

7.1.7 Field Resetter

A field resetter is a volunteer who ensures that all objects on the field are in the correct positions at the beginning of each match. Field resetters should not begin to reset a field after a match until a referee directs them to do so. See this article and related content in the RECF Library for more information.

7.1.8 Queuer

A queuer is a volunteer who ensures that the correct teams are at the correct alliance matches. If time allows, they can attempt to locate teams who haven't checked in for upcoming matches, but they are not required to do so. See this article and related content in the RECF Library for more information.

7.1.9 Emcee

An emcee is a volunteer who provides play-by-play information for the audience during alliance matches. Emcees should avoid suggesting strategies, and cannot simultaneously serve as referees. See this article and related content in the RECF Library for more information.

7.2 Event Processes

7.2.1 Team Check In

Each team must check in when they arrive at the event, and confirm that at least one adult will remain onsite to supervise team members for the entire event. Some events use team check-in as a way to distribute event hand-outs like nametags, site maps, general schedules, and lunch order forms. Team check-in often occurs at a visible location just inside the main doors of the venue.

7.2.2 Robot Inspection

Each robot must pass an inspection before it can be used in any type of match at an event. Volunteer inspectors will confirm that robots meet the requirements in the game manual, and will mark passed inspections in the event management software. Robot inspection often occurs at a set of tables near the competition fields or in the team pit area.

7.2.3 Creating the Alliance Match Schedule

If any teams have not checked in, or any robots haven't passed inspection, the event partner should resolve them before creating the alliance match schedule in the tournament software. The alliance match schedule should only include teams who will participate in alliance matches. See rule 7.4.2 for more information.

7.2.4 Queueing

Teams should check in at the queuing table(s) before their scheduled alliance match time, and will be routed to the correct field by volunteer queuers. Queueing generally occurs at a set of tables near the alliance match fields, with two tables (one for each alliance) for each named competition field. Providing tables gives teams a safe place to put their robots while they wait for upcoming matches. Tables are also recommended at the line for solo matches.

7.2.5 Running Matches

To display a match timer on a connected display, a referee or emcee can select an alliance match by match number in the tournament software, or a solo match by team number and match type. The referee or emcee should confirm that the drivers are ready, then activate the match timer from their mobile device.

After the match completes, referees should score the match and confirm object counts for each scoring category with the drive team members before submitting the match score and moving to the next match.

7.2.6 Alliance Selection / Elimination Bracket

At the end of alliance matches, the event partner should identify any teams that are unavailable or ineligible to participate in alliance selection and mark them in the tournament software. Once teams are removed from the list, the event partner can determine the number of alliances that will participate in alliance selection and initiate the alliance selection process. Once alliance selection is complete, the event partner will create the elimination bracket in the tournament software. See rule 7.4.4 for more information.

7.2.7 Entering Award Winners

After the judging volunteers have selected the winners of all judged awards listed for the event, the judge advisor and event partner should work together to enter winners in the tournament software. They should confirm the base number and team letter for each winner, and ensure that no team is marked to receive more than one judged award. Winners of performance awards are automatically marked by the software.

7.2.8 Finalizing an Event

After matches and awards conclude, the event partner should finalize and upload the tournament information to RECFevents.org. Some events (e.g., multiple divisions) may need to work with RECF staff to finalize their results.

7.3 Field Parameters

7.3.1 Equipment

All of the fields used for alliance matches at an event should have the same setup and modifications, and all of the fields used for solo matches at an event should have the same setup and modifications. For example, an event could put all of the alliance match fields on identical risers and all of the solo match fields on the ground.

7.3.1.1. Field perimeter types

Pinnacle is played on a 12x12 field consisting of field tiles and a field perimeter. Approved field perimeters are the AndyMark FIRST Tech Challenge Perimeter Kit (am0481), the VEX® Portable Competition Field Perimeter (276-8242), and the VEX® Metal Competition Field Perimeter (278-1501).

7.3.1.2 Field control options

Robots must be connected to the field via field control.

Solo matches: Approved field control methods are the VEXnet® Field Controller Kit (275-1401), VEX® Smart Field Controller (276-7577), a VEXnet® Competition Switch (276-2335), or utilizing the timed run option on a VEX V5® Controller (476-4820).

Alliance matches: Approved field control methods are the VEXnet® Field Controller Kit (275-1401), VEX® Smart Field Controller (276-7577), or a VEXnet® Competition Switch (276-2335).

7.3.2 Variances

Although fields and setups should be as identical as possible, teams have to be prepared for some amount of variance. Goals, walls, rollers, loaders, and other field-mounted parts may vary slightly, up to ±1” (25.4mm) in any direction. Starting locations for cups and pins may also vary up to ±1” (25.4mm) in any direction.

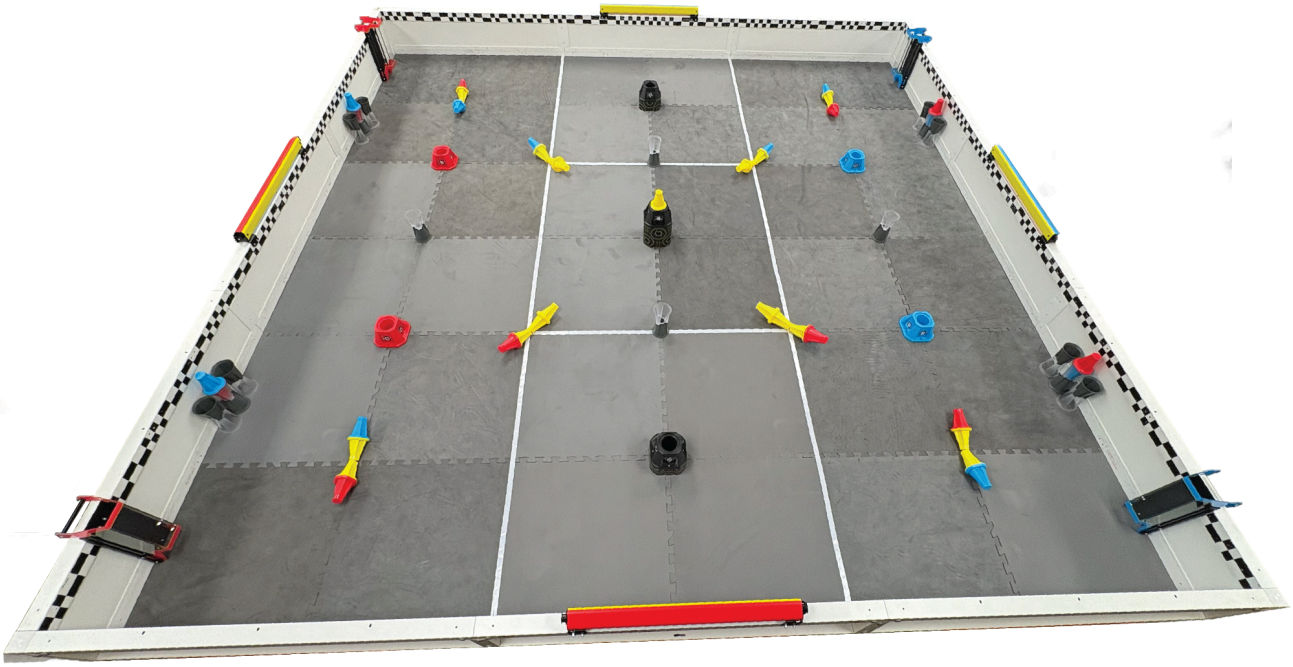


Figure 7.3.2

7.4 Match Parameters

7.4.1 Solo Matches

Each team can attempt up to three solo matches of each type at an event (three solo driving matches and three solo coding matches). These matches aren't scheduled, and teams can make these attempts whenever their event schedule permits. Solo match fields should open early in the event, and remain open long enough to give each team an opportunity to complete their maximum number of solo matches. As a general rule, solo match fields should remain open until alliance matches have ended.

7.4.2 Alliance Matches

Each team will have at least six alliance matches at a qualifying event or at least eight matches at a championship event, which will appear on the match schedule generated by the tournament software. The software will assign alliance partners, match times, fields, and team colors as needed. Matches can only run early if the head referee and all teams are checked in for the match and ready to play.

If a team is marked with an asterisk (*) for one of the last matches on the schedule, any points and/or ranking points earned will not affect their ranking at the event. This occurs when extra matches are necessary to provide each team with the same minimum number of matches. Teams should remember that the RECF Code of Conduct includes supporting alliance partners, and do their best even though it won't affect their ranking.

7.4.3 Practice Matches

Some events choose to include scheduled practice matches that occur before official alliance matches begin. Practice matches aren't required, and the scores don't affect teams' rankings.

7.4.4 Alliance Selection

Ranking points earned in alliance matches are used to rank teams for alliance selection. Event partners can decide how many alliances will participate in the elimination bracket, but (if possible) should avoid choosing a number that will result in only one team being excluded from alliance selection. Recommendations for the number of alliances to include are below:

Number of teams at the event	**Recommended number of alliances to form during alliance selection**
Less than 18	● If an even number of teams are at the event, the number of teams divided by 2 ● If an odd number of teams are at the event, the number of teams minus 3 then divided by 2
18-25	8
26-32	12
32 or more	16

Each team at the event must send one student to represent the team for alliance selection. No communication devices are allowed during alliance selection. Any electronics such as phones or tablets must be in airplane mode and disconnected from wi-fi during alliance selection. Decisions related to alliance selection must be made by the students on the team.

Alliance selection will begin with the representative from the highest ranked team inviting any eligible team of their choice to become alliance partners. The invited team's representative then has the opportunity to either accept or decline the offer. If the offer is declined, the invited team cannot be invited to another alliance, and will only be able to be the inviting team if they are ranked highly enough to have that opportunity. Team representatives should be mindful of the number of teams being included in elimination rounds before declining an invitation.

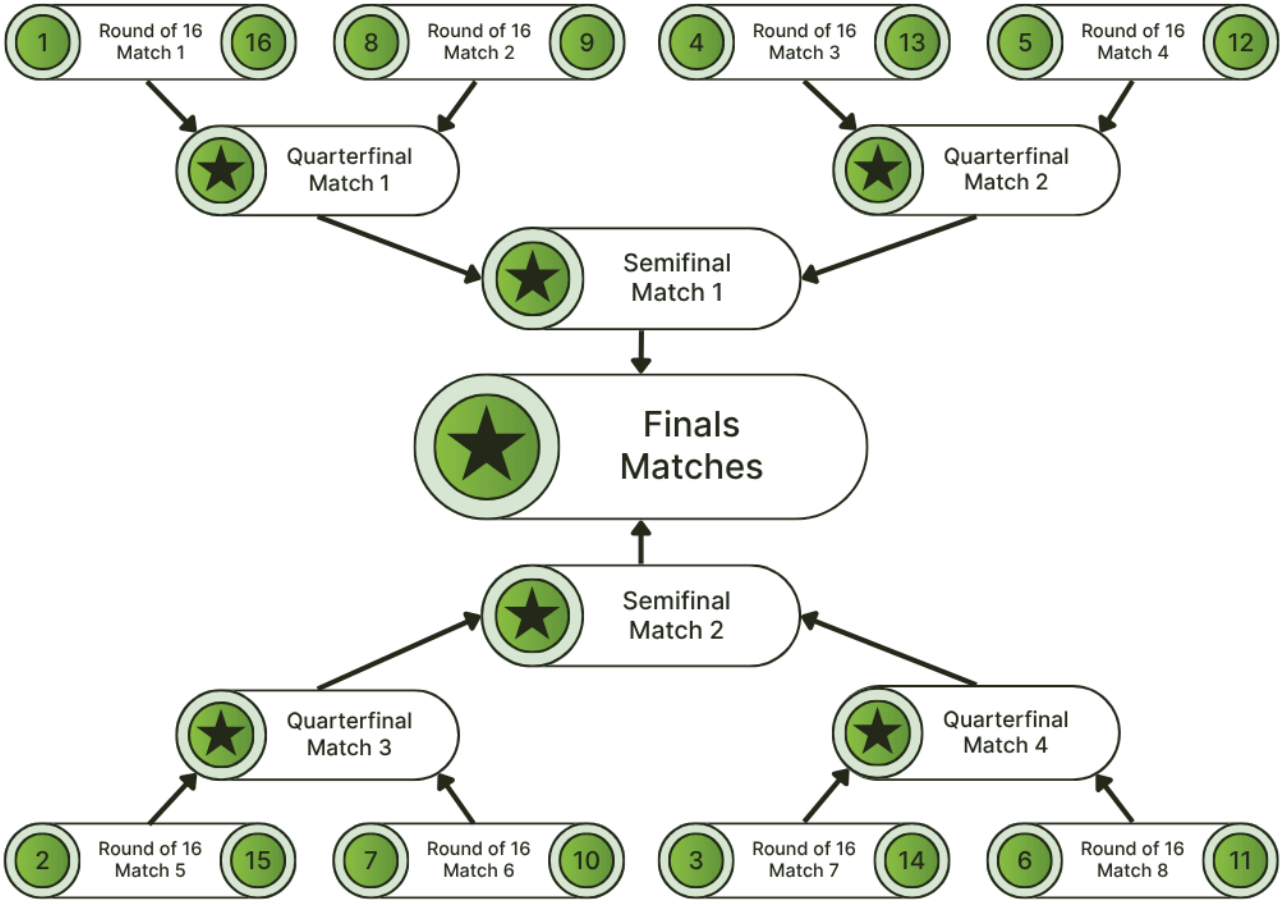
Once the first alliance is formed, the next highest ranked team's representative will be given the opportunity to invite a team to become alliance partners. This process will continue until the number of alliances set by the event partner have been established.

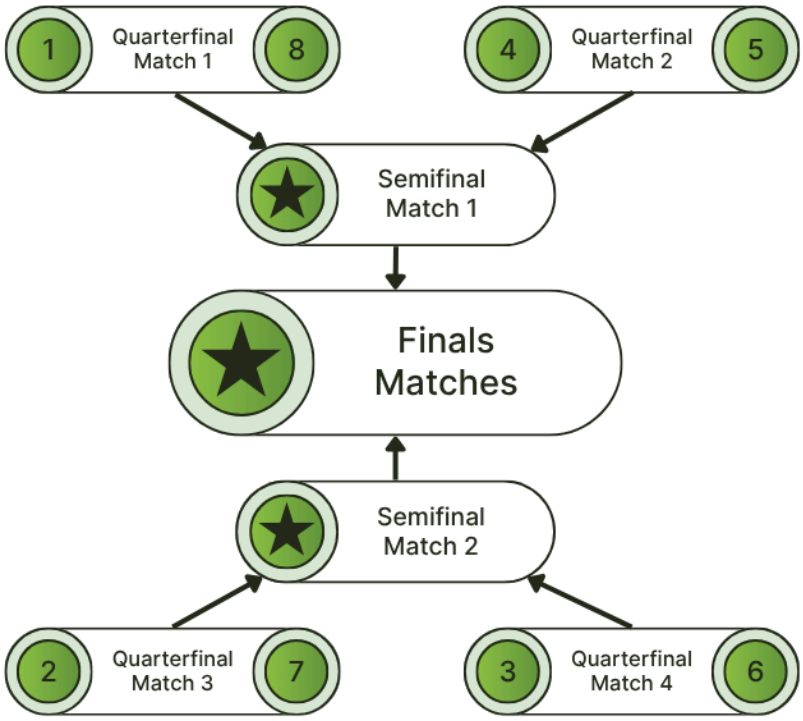
7.4.5 Elimination Bracket

Alliances created during alliance selection compete in a traditional single elimination bracket to determine the tournament winners. Alliances are seeded based on the highest-ranked team in the alliance. There are several rounds of elimination matches; the number of rounds will be based on the number of alliances participating. Higher-ranked alliances may receive byes if

there is an unbalanced bracket. The winning alliance from each match will advance to the next round of matches until only two alliances remain. If an elimination match results in a tie, the two teams will play up to two tie-breaker matches; if the 3rd match is also a tie, the higher-seeded alliance will be recorded as the winner.

The figures below show how alliances flow through 16-alliance and 8-alliance brackets, with the winner of each match progressing to the next level.





7.4.6 Finals Matches

When only two alliances remain, they will advance into the finals match(es). For events that do not qualify to the RECF STEM World Championship, a single finals match will determine the tournament champions. For events that qualify to the RECF STEM World Championship, there will be up to three finals matches; an alliance has to win two matches to be crowned the tournament champions.