2025-2026 *FIRST*® Tech Challenge

Competition Manual

DECODE™ Presented by RTX

FIRST TECH CHALLENGE

Contents

1 Introduction

1.1 About *FIRST*®

FIRST® (For Inspiration and Recognition of Science and Technology) was founded by inventor Dean Kamen to inspire young people's interest in science and technology. As a robotics community that prepares young people for the future, *FIRST* is the world's leading youth-serving nonprofit advancing STEM education. For 30 years, *FIRST* has combined the rigor of STEM learning with the fun and excitement of traditional sports and the inspiration that comes from community through programs that have a proven impact on learning, interest, and skill-building inside and outside of the classroom. *FIRST* provides programs that span a variety of age groups:

- *FIRST*® Robotics Competition for grades 9-12, ages 14-18
- *FIRST*® Tech Challenge for grades 7-12, ages 12-18
- *FIRST*® LEGO® League for grades Pre-K-8, ages 4-16
  - *FIRST*® LEGO® League Challenge for grades 4-8 (ages 9-16, ages vary by country)
  - *FIRST*® LEGO® League Explore for grades 2-4 (ages 6-10)
  - *FIRST*® LEGO® League Discover for grades Pre-K-1 (ages 4-6)

Please visit the *FIRST* website for more information about *FIRST* and its programs.

Purpose	Vision	Mission
FIRST exists to prepare the young people of today for the world of tomorrow.	To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology leaders.	The mission of *FIRST* is to provide life-changing robotics programs that give young people the skills, confidence, and resilience to build a better world.

1.2 *FIRST*® Tech Challenge

FIRST Tech Challenge is a student-centered program that focuses on giving young people a unique and stimulating experience. Every September, at an event known as "Kickoff", a new game challenge is introduced. Once the challenge is released, small teams of students with the help of mentors design, build, test, and program robots that must perform a series of game tasks autonomously and under driver control. These teams then put their skills to the test in a series of tournaments which combine the excitement of a competitive sport while encouraging students to help and learn from one another.

Participants and alumni of *FIRST* programs gain access to education and career discovery opportunities, connections to exclusive scholarships and employers, and a place in the *FIRST* community for life. To learn more about *FIRST*® Tech Challenge and other *FIRST*® Programs, visit www.firstinspires.org.

1.3 *FIRST* Ethos and Core Values

1.3.1 Core Values

The *FIRST* Core Values are fundamental to *FIRST* and unique to its programs. They emphasize friendly sportsmanship, respect for the contributions of others, teamwork, learning, and community involvement and are part of our commitment to fostering, cultivating, and preserving a culture of unity.

Our community expresses the *FIRST* philosophies of Gracious Professionalism® and Coopertition® through the *FIRST* Core Values.

Discovery: We explore new skills and ideas.

Innovation: We use creativity and persistence to solve problems.

Impact: We apply what we learn to improve our world.

Inclusion: We respect each other and embrace our differences.

Teamwork: We are stronger when we work together.

Fun: We enjoy and celebrate what we do!

1.3.2 Gracious Professionalism®, a *FIRST* Credo

Gracious Professionalism® is part of the ethos of *FIRST*. It's a way of doing things that encourages high quality work, emphasizes the value of others, and respects individuals and the community. *Gracious Professionalism* is not clearly defined for a reason. It is an aspirational ideal to always strive towards, not a goal to be achieved or a method of measuring someone, and for this reason, you can never say someone "is" or "is not" being Graciously Professional. We should each work to better embody Gracious Professionalism in all our actions. How we pursue this can and should mean different things to everyone.

Some possible meanings of *Gracious Professionalism* include:

- gracious attitudes and behaviors are win-win,
- gracious folks respect others and let that respect show in their actions,
- professionals possess special knowledge and are trusted by society to use that knowledge responsibly, and
- gracious professionals make a valued contribution in a manner pleasing to others and to themselves.

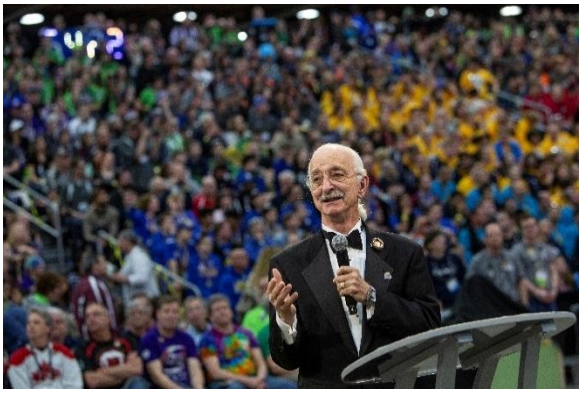
In the context of *FIRST*, this means that all teams and participants should:

- learn to be strong competitors, but also treat one another with respect and kindness in the process and
- avoid leaving anyone feeling as if they are excluded or unappreciated.

Knowledge, pride, and empathy should be comfortably and genuinely blended.

In the end, *Gracious Professionalism* is part of pursuing a meaningful life. When professionals use knowledge in a gracious manner and individuals act with integrity and sensitivity, everyone wins and society benefits.

Figure 1-1: Dr. Woodie Flowers, Gracious Professionalism advocate and exemplar



"The FIRST spirit encourages doing high-quality, well-informed work in a manner that leaves everyone feeling valued. Gracious Professionalism seems to be a good descriptor for part of the ethos of FIRST. It is part of what makes FIRST different and wonderful."

- Dr. Woodie Flowers, (1943 – 2019)
Distinguished Advisor to FIRST

It is a good idea to spend time going over this concept with your team and reinforcing it regularly. We recommend providing your team with real-life examples of *Gracious Professionalism* in practice, such as when a team loans valuable materials or expertise to another team that they will later face as an opponent in competition. Routinely highlight opportunities to display *Gracious Professionalism* at events and encourage team members to suggest ways in which they can demonstrate this quality themselves and through outreach activities.

1.3.3 Coopertition®

At *FIRST*, *Coopertition*® is displaying unqualified kindness and respect in the face of fierce competition. *Coopertition* is founded on the concept and philosophy that teams can and should help and cooperate with one another even as they compete. *Coopertition* involves learning from teammates and mentors. *Coopertition* means competing always but assisting and enabling others when you can.

1.4 Spirit of Volunteering

FIRST can only hope to achieve our mission of providing life-changing robotics programs that give young people the skills, confidence, and resilience to build a better world with your help.

There are two phrases which drive and motivate the individuals that volunteer their time for *FIRST*: "Giving Back" and "Pay It Forward." Each year, you have the extraordinary opportunity to help create the best-ever experience for our fellow volunteers, mentors, and students by becoming a *FIRST* volunteer.

To our team members and mentors: remember that the volunteers you interact with are dedicating their most precious asset - their time - to ensure that all teams have a fulfilling, fun, and memorable competition. Volunteers are the lifeblood of *FIRST*, and without them, *FIRST* would not be where it is today. We urge you to remember that *Gracious Professionalism* is part of the ethos of *FIRST*. It's a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community. We strive to train each volunteer to always exhibit Gracious Professionalism - we hope we can work together to create an environment where all feel safe and welcome.

Please consider volunteering at local events near you but know that not all applicants can be placed in all roles at any given event. Please work with your volunteer coordinator and local Program Delivery Partner (PDP) to help identify the most meaningful way you can help in your region. A complete set of all role-specific volunteer materials can be found on our Volunteer Resources Page.

1.5 Accessibility and Inclusion

FIRST is committed to *STEM for Everyone*™ and as such, *FIRST* makes reasonable accommodations for persons with disabilities who need and request accommodations. If a participant needs accommodation for an event, please contact your local leadership before the event so they can help ensure the accommodation is provided. Local leadership may make exceptions to rules to allow for reasonable accommodation given the exceptions do not create an undue hardship or cause safety concerns.

1.6 This Document & Its Conventions

The 2025-2026 Competition Manual is a resource for all *FIRST* Tech Challenge teams for information specific to the 2025-2026 season and the DECODE™ presented by RTX game. Its audience will find the following details:

- a general overview of the DECODE game,
- detail about the DECODE playing FIELD,
- a description of how to play the DECODE game,
- rules (related to safety, conduct, gameplay, inspection, event, etc.),
- ROBOT construction rules, and
- a description of how teams advance at 2025-2026 tournaments and throughout the season.

The intent of this manual is that the text means exactly, and only, what it says. Please avoid interpreting the text based on assumptions about intent, implementation of past rules, or how a situation might be in "real life." There are no hidden requirements or restrictions. If you've read the entire manual, you already know everything needed for your journey.

Specific methods are used throughout this manual to highlight warnings, cautions, key words, and phrases. These conventions are used to alert the reader to important information and are intended to help teams in constructing a ROBOT that complies with the rules in a safe manner.

Links to other section headings and rule references within this manual appear in blue underlined text with a grey background. Links to external resources appear blue underlined text.

For linked references not included in a preview release of this document, the links will appear with the section letter and ### for the rules number within square brackets. For example, a cross link to a game rule before a game rule is released will appear as [G###] and will be replaced with the current linked rule when that section of the manual is released.

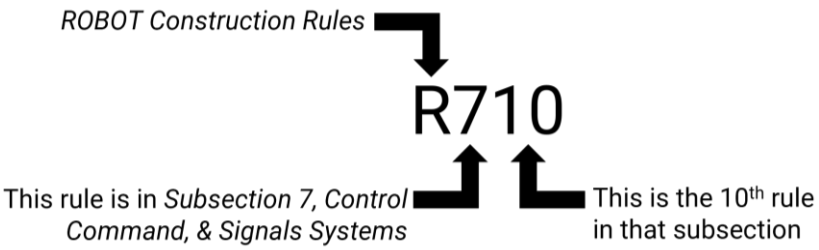
Key words that have a particular meaning within the context of *FIRST* Tech Challenge and DECODE are defined in section 16 Glossary and indicated in ALL CAPS throughout this document.

The rule numbering method indicates the section, subsection, and position of the rule within that subsection. The letter indicates the section in which the rule is published.

- I for Section 3 Competition Eligibility and Inspection (I)
- E for Section 5 Event Rules (E)
- A for Section 6 Awards (A)
- G for Section 11 Game Rules (G)
- R for Section 12 ROBOT Construction Rules (R)
- T for Section 13 Tournament (T)
- L for Section 14 League Play Tournaments (L)
- C for Section 15 FIRST Championship (C)

The following digit(s) represents the subsection in which the rule can be found. The final digits indicate the rule's position within that subsection.

Figure 1-2 Rule numbering method



> Warnings, cautions, and notes appear in orange boxes. Pay close attention to their contents as they're intended to provide insight into the reasoning behind a rule, helpful information on understanding or interpreting a rule, and/or possible "best practices" for use when implementing systems affected by a rule.
>
> While orange boxes are part of the manual, they do not carry the weight of the actual rule (if there is an inadvertent conflict between a rule and its orange box, the rule supersedes the language in the orange box).

Imperial dimensions are followed by comparable metric dimensions in parentheses to provide metric users with the approximate size, mass, etc. Metric conversions (e.g., dimensions) round to the nearest 0.05 cm. , e.g., "17.5 in. (~44.45 cm)." The metric conversions are offered for convenient reference only and do not overrule or take the place of the imperial dimensions presented in this manual and the official drawings (i.e., dimensions and rules will always defer to measurements using imperial units).

Rules include colloquial language, also called headlines, in an effort to convey an abbreviated version of the rule or rule set. There are two versions of headline formatting. Evergreen rules, rules which are expected to go relatively unchanged from season to season, are indicated with their headline presented in ***bold green text** with a leading asterisk. "Relatively unchanged" means that the overall intent and presence of the rule from season to season is constant, but game specific terms may be updated as needed (e.g., changing Pixels to Samples in a rule about what DRIVE COACHES may not contact during a MATCH). These rules also start their respective section, so their rule number is less likely to change from season to season. All other rule headlines use **bold orange text**. Any disagreement between the specific language used in the rules and the colloquial language is an error, and the specific rule language is the ultimate authority. If you discover a disparity, please let us know at customerservice@firstinspires.org.

Team resources that are not generally season specific (for example, what to expect at an event, communication resources, team organization recommendations, and award descriptions) can be found on the *FIRST* Tech Challenge website.

1.7 Translations & Other Versions

The *FIRST* Tech Challenge Competition Manual is originally and officially written in English and is occasionally translated into other languages for the benefit of *FIRST* Tech Challenge teams whose native language may not be English. These assets are posted on the Translated Manuals page.

A text-based English version can be provided only for use with assistive devices and not for redistribution. For more information, please contact *FIRST* Tech Challenge at customerservice@firstinspires.org.

Additional resources such as a *FIRST* Tech Challenge AI Chatbot are provided as a helpful tool, but the Competition Manual is the final authority. In the event that a rule or description is modified in an alternate

version of this manual, the latest English PDF version as published on the Game and Season page is the authoritative version.

1.8 Team Updates

Team Updates are used to notify the *FIRST* Tech Challenge community of revisions to the official season documentation (for example, the manual, drawings, etc.) or important season news. Team Update posts are scheduled as follows:

- Every Thursday beginning on Kickoff day and ending two weeks prior to *FIRST* Championship.

Team Updates are posted on the Game and Season web page and are generally posted by 1pm Eastern.

Team Updates are indicated using the following formatting:

- Additions are highlighted in yellow. This is an example.
- Deletions are indicated with a strikethrough. ~~This is an example.~~

1.9 Question and Answer System

The Question and Answer System (Q&A) is a resource for teams to ask questions about gameplay, competition rules, judging and advancement, ROBOT build rules, and FIELD setup. Teams can search for previously asked questions and responses or pose new questions. Questions can include examples for clarity or reference multiple rules to understand the relationships and differences between them.

The Q&A opens on September 22, 2025, 12:00p.m. ET. Access to the Game Q&A forum is through the Lead Coach 1 or Lead Coach 2's account on the *FIRST* dashboard. Follow the instructions on how to create an official Q&A account. Teams may still create a separate view-only account to read the forum.

The Q&A may result in revisions to the text in the official manuals (which are communicated using the process described in section `1.8 Team Updates`).

Moderators will answer team questions beginning each Monday, and close on Thursday at 12:00pm ET. The responses in the Q&A do not supersede the text in the manual, although every effort will be made to eliminate inconsistencies between the two. While responses provided in the Q&A may be used to aid discussion at each event, REFEREES and INSPECTORS are the ultimate authority on rules. If you have concerns about enforcement trends by volunteer authorities, please notify *FIRST*.

The Q&A is not a resource for firm predictions on how a situation will play out at an event. Questions about the following may not be addressed:

- rulings on vague situations
- challenging decisions made at past events
- design reviews of a ROBOT system for legality
- questions that are overly broad, vague, and/or include no rule references

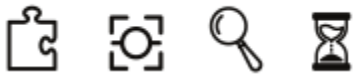
Some examples of questions that may not be answered in the Q&A are:

- how should the REFEREE have ruled when this specific gameplay happened?
- duplicate questions
- questions clearly defined/addressed in this manual

Good questions ask generically about features of parts or designs, gameplay scenarios, or rules, and often reference one or more relevant rules within the question. Some examples of questions that will likely be answered in the Q&A are:

- A device we are considering using on the ROBOT comes with purple AWG 40 wire, does this comply with R?? and R??
- We're not sure how to interpret Rule G?? applies if blue ROBOT A does X and red ROBOT B does Y, can you please clarify?
- If a ROBOT does this specific action, is it doing what this defined term is describing?

Questions from "FTC 1000" represent content asked by key volunteers (e.g., REFEREES, INSPECTORS), answered by *FIRST*, and are considered relevant to teams.



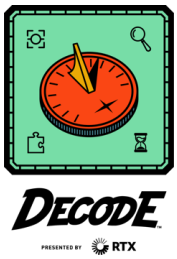
2 *FIRST* Season Overview

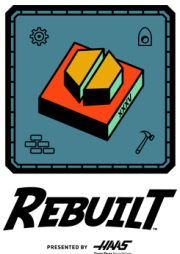
Uncover the Future

FIRST® is the sport where every kid can go pro. As the world's leading non-profit that prepares young people for the future, *FIRST* offers a suite of life-changing youth robotics programs that build skills, confidence, and resilience. Participants work collaboratively to solve the annual, themed robotics challenge.

Every artifact we uncover holds a story. Each tool, each innovation, each work of art connects us to the people and ideas that came before us. Using STEM skills and teamwork, today we can dig deeper into discoveries than ever before.

Welcome to *FIRST*® AGE™ presented by Qualcomm, our 2025-2026 robotics season inspired by archaeology. What will you uncover? **Join us for an experience for the ages.**





LEARN MORE: firstinspires.org/firstage

3 Competition Eligibility and Inspection (I)

3.1 Team Eligibility Rules

I101 ***Teams must be registered with *FIRST*.** Teams must be "competition ready" in order to compete in *FIRST* Tech Challenge official events and earn MATCH points or be eligible for judged awards.

A. North America - competition ready requirements:
   a. complete annual registration process through the *FIRST* dashboard
   b. pay annual registration fee
   c. two adults must be assigned in the Lead Coach 1/Lead Coach 2 roles and have passed Youth Protection Program (YPP) screening, and
   d. complete any additional Youth Protection screening requirements (may vary from region to region.
   e. register all youth team members on the *FIRST* dashboard
B. outside North America - competition ready requirements:
   a. complete annual registration process through the *FIRST* dashboard and
   b. complete any additional requirements by the local *FIRST* Program Delivery Partner with regards to program fees, registrations and youth protection screening.

> The local Program Delivery Partner may, in rare cases, make exceptions for delayed payment on a case-by-case basis. Teams who have not paid annual registration fees will not earn any official season record and will not be allowed to advance.

I102 ***Check-in at the event on time.** Teams must check-in by the check-in deadline listed on the public event schedule or as instructed by the Event Director per E105. Check-in must be completed by a team adult and at least one STUDENT must be present at the venue before check-in can be completed.

Additional check-in requirements will vary by region but may require one or more of the following items:

A. A current, completed team roster from the team's *FIRST* dashboard as specified by the local Program Delivery Partner,
B. local Program Delivery Partner team member registration or consent forms (varies by region),
C. a ROBOT built to play the current season's game if they intend to participate in MATCHES, and
D. printed team PORTFOLIO (optional, see section 6 Awards (A))

> All teams, regardless of how "ready" they think they are, are encouraged to participate in ROBOT MATCHES and judging. Teams are encouraged to reach out to their Program Delivery Partner and other teams to request help getting their ROBOT ready to compete before attending an event.

I103 ***A responsible adult must be present for the whole event.** At least one, preferably two, adult(s) responsible for the STUDENT team members must be present at all times during the event. Adults attending *FIRST* Tech Challenge events are expected to follow the same competition manual rules which dictate behavioral norms as youth participants while also following the *FIRST* Code of Conduct. Responsible adults must be listed on the team roster.

3.2 Awards Eligibility Rules

To be eligible for team judged awards a team must attend their assigned structured interview time (A203). For some awards submitting a PORTFOLIO as requested by the Event Director (A202) is also a required prerequisite. Complete details and rules about *FIRST* Tech Challenge awards can be found in section 6 Awards (A).

3.3 MATCH Eligibility Rules

This section describes the rules governing MATCH participation. A team has participated in a MATCH if any member of their DRIVE TEAM is in the ALLIANCE AREA, with or without the ROBOT on the FIELD, at the start of the MATCH.

This section describes the rules and requirements for team participation in MATCH play. ROBOTS are required to pass ROBOT inspections before being allowed to compete. These inspections are to help ensure that all section 12 ROBOT Construction Rules (R) are satisfied.

At each event, the Lead ROBOT INSPECTOR (LRI) has final authority on the legality of any COMPONENT, MECHANISM, or ROBOT. INSPECTORS may re-inspect ROBOTS at any time to ensure compliance with the rules. Teams are expected to consult with INSPECTORS or the LRI if they have any questions regarding the legality of a ROBOT or about how to make a ROBOT legal.

The inspection process may progress in blocks, i.e., it may pause for a team to make a correction or participate in a scheduled practice MATCH. The process may employ various INSPECTORS throughout the process based on availability. At the team's discretion, they may request a different INSPECTOR or invite the LRI to participate in their ROBOT'S inspection.

> ROBOTS are permitted to participate in scheduled practice MATCHES prior to passing inspection. However, the FTA, LRI, or Head REFEREE may determine at any time that the ROBOT is unsafe and may prohibit further participation in practice MATCHES until the condition is corrected and/or the ROBOT passes inspection.

Events may assign specific inspection time slots for teams to better facilitate a quick and orderly inspection process. Teams should plan to report to their assigned inspection times fully ready to complete inspection.

Prior to the start of a MATCH, any ROBOT which is unable or ineligible to participate in that MATCH, as determined by the team, *FIRST* Technical Advisor (FTA), LRI, or Head REFEREE, is DISABLED and can be removed from the FIELD with permission of the Head REFEREE or FTA. A team whose ROBOT is DISABLED or not present is eligible to receive qualification MATCH Points or playoff MATCH points provided that its ROBOT has passed inspection, per I302, and as long as at least one STUDENT DRIVE TEAM member is present in the ALLIANCE AREA.

> An Inspection Checklist (link coming soon) is available to help teams self-inspect their ROBOT before their event. Teams are strongly encouraged to self-inspect prior to their event.

I301 ***It is your team's ROBOT.*** The ROBOT and its MAJOR MECHANISMS must be built by the *FIRST* Tech Challenge team that has registered for the event and intends to use the ROBOT to participate in MATCHES or as part of judged awards.

A MAJOR MECHANISM is a group of COMPONENTS and/or MECHANISMS assembled together to address at least 1 game challenge: ROBOT movement, SCORING ELEMENT manipulation, FIELD element manipulation, or performance of a scorable task without the assistance of another ROBOT.

> This rule requires that the ROBOT and its MAJOR MECHANISMS were built by its team but is not intended to prohibit or discourage assistance from other teams (e.g., fabricating elements, supporting construction, writing software, developing game strategy, contributing COMPONENTS and/or MECHANISMS).
>
> Examples that would generally not be considered MAJOR MECHANISMS, and thus are not subject to this rule include, but are not limited to, the following:
> A. a gearbox assembly,
> B. a COMPONENT or MECHANISM that is part of a MAJOR MECHANISM, or
> C. COTS items.
>
> The intent of this rule is that a team's ROBOT is a product that's representative of the current team member experience and is intended to discourage complete solutions which are provided wholly by outside organizations or companies. Also see R301.

I302 ***Get inspected before playing a qualification/playoff MATCH.** A team is only permitted to participate in a qualification or playoff MATCH and receive RANKING POINTS if their ROBOT has passed an initial, complete inspection. INSPECTORS are available to help, but teams are expected to ensure their ROBOT and other supporting equipment are within the rules at all times when competing.

Violation: If prior to the start of the MATCH, the team is DISQUALIFIED and not eligible to participate in the MATCH. If after the start of the MATCH, the team receives a RED CARD for that MATCH.

I303 ***Bring the complete ROBOT and supporting equipment to inspection.** At the time of inspection, the OPERATOR CONSOLE and the ROBOT with battery must be presented with all MECHANISMS (including all COMPONENTS of each MECHANISM), configurations, and decorations that will be used on the ROBOT in MATCHES without re-inspection per I304.

A. ROBOTS are allowed to play MATCHES with a subset of the mechanisms that were present during inspection. Only mechanisms that were present during inspection may be added, removed, or reconfigured between MATCHES. The ROBOT should be assembled in a typical configuration used for MATCH play when reporting for inspection. ROBOT and all mechanisms must be inspected in every STARTING CONFIGURATION.
B. If MECHANISMS are swapped out between MATCHES, the reconfigured ROBOT must still meet all rules.
C. The total of all electronics (motors, servos, Android Devices, etc.) used to build all mechanisms and base ROBOT, whether they are used on the ROBOT at the same time or not, may not exceed the constraints specified in section 12 ROBOT Construction Rules (R).

I304 ***Unless the change is listed below, any change to a ROBOT must get re-inspected.** A ROBOT may play MATCHES with a subset of the MECHANISMS that were present during inspection provided the reconfigured ROBOT still complies with all ROBOT construction rules. Only MECHANISMS that were present during the inspection may be added, removed, or reconfigured between MATCHES without re-inspection per this rule. If a ROBOT is modified after its most recently passed inspection, it must be re-inspected before the ROBOT is eligible to participate in a MATCH.

Exceptions are listed below (unless they result in a significant change to the ROBOT'S size, legality, or safety).

A. addition, relocation, or removal of fasteners (e.g., cable ties, tape, and rivets),
B. addition, relocation, or removal of labeling or marking,
C. addition, relocation, or replacement of the team SIGN,
D. revision of ROBOT code,
E. replacement of a COMPONENT with an identical COMPONENT,
F. replacement of a MECHANISM with an identical MECHANISM (size, weight, material), and
G. additions, removals, or reconfiguration of ROBOT with a subset of MECHANISMS already inspected per I303

Violation: ROBOT must be inspected before participating in a MATCH or the team will receive a RED CARD.

I305 ***Do not exploit re-inspection.** Teams may not use the re-inspection process in I304 to circumvent any other rules.

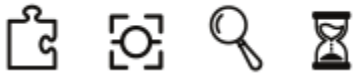
I306 ***ROBOTS may be powered on for inspection, as needed.** Teams are allowed to power up and enable their robot as part of the inspection process.

> While in general it is good practice to keep a robot powered off and in a configuration which minimizes stored energy whenever possible (e.g. springs relaxed), teams are allowed to power up and enable their robot as part of the inspection process. Team members should let INSPECTORS know if the robot must be powered on and/or enabled to meet any inspection criteria.
>
> Team members should also inform INSPECTORS if the robot in its inspection configuration has any stored energy (e.g. springs stretched) and collaborate with each other to ensure a safe inspection experience.

I307 ***STUDENTS must be present during the inspection process.** At least 1 STUDENT team member must accompany the ROBOT for any inspection efforts.

> Exceptions may be made for major conflicts, e.g., religious holidays, major testing, transportation issues, etc.

Violation: Inspection will not continue until a STUDENT is present.

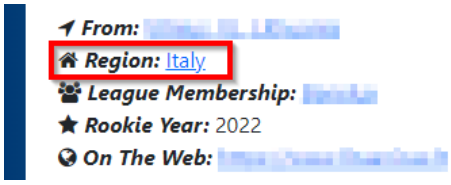


4 Advancement

Teams are only eligible to advance from events within their home region. Teams may be invited to compete at tournaments outside of their home region; however, they do so for the opportunity of additional gameplay and to compete with other teams from outside of their area and are not advancement eligible from these out-of-region events.

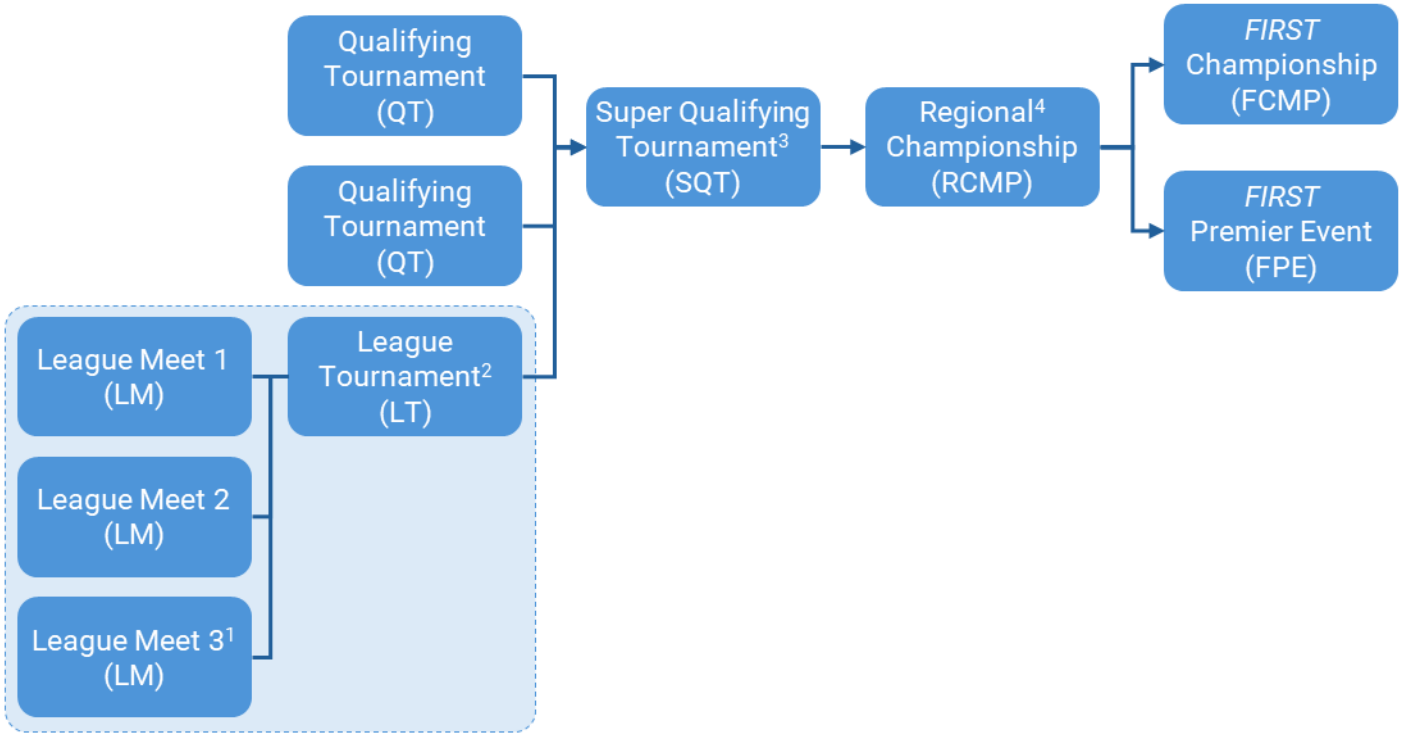
Teams can check what region they are assigned to on the FTC-Events page by looking up their team number. Teams in regions that do not have a local Program Delivery Partner, or who are geographically isolated within their home region can work with *FIRST* by emailing customerservice@firstinspires.org to get reassigned to another more accessible region once per season for advancement.

Figure 4-1: Region assignment display on FTC-Events page



FIRST Tech Challenge tournament progression is shown in Figure 4-2. Teams can advance from any of their first three entry-level events: Qualifying Tournaments (QT) and League Tournaments (LT). Teams may only participate in one league per season. See section 14 League Play Tournaments (L) for more details on League Tournaments. Teams may participate in more than 3 entry-level events but are not eligible to advance from them.

Figure 4-2: Tournament Advancement Structure



[1,3] *Optional Events, not offered in all regions*

[2] *All teams within a League play in the League Tournament*

[4] *Highest level of play within FIRST Tech Challenge Region. Can also be called State, Region, or Country Championship*

Teams may advance from their region's Qualifying Tournaments or League Tournament to either a Super Qualifying Tournament (SQT) or directly to a Regional Championship (RCMP). Super Qualifying Tournaments (SQT) are an optional advancement level often used in large regions which need more levels of competition. A team may only participate in one Super Qualifying Tournament(SQT).

The local Program Delivery Partner determines the advancement numbers from each tournament in their region, up to a Regional Championship. *FIRST* Staff determine the advancement from each Regional Championship to the *FIRST* Championship and *FIRST* Premier Events.

4.1 Advancment Points Calculation

For each advancing event, teams will be ranked based on the advancement points they earn through their overall performance at that individual event. The top ranked teams not already advanced will qualify for the next level of play, up to the total allocated advancement spots for that event. Advancement points are awarded to teams based on Table 4-1 below.

Table 4-1: Advancement Point Assignment

Category	Advancement Points Earned
Qualification Round Performance	Normal distribution of points from 16 to 2 across the highest ranked team to the lowest based on the equation in 4.1.1. (This will result in a minimum of 2 points and a maximum of 16 points being awarded for qualification round performance.)
ALLIANCE CAPTAINS	Equal to 21 minus the ALLIANCE CAPTAIN number (e.g. 18 points for ALLIANCE #3 CAPTAIN)
Draft Order Acceptance	Equal to 21 minus the Draft Order Acceptance number (e.g. 18 points for the team which accepts the third draft position)
Playoff Advancement	40 points for 1st Place (Winners) 20 points for 2nd Place (Finalists) 10 points for 3rd Place 5 points for 4th Place (See Section 13.8 Dual Division Events for modifications to this section)
Team Judged Awards	60 points for Inspire Award 1st Place 30 points for Inspire Award 2nd Place 15 points for Inspire Award 3rd Place 12 points for all other 1st Place Awards 6 points for all other 2nd Place Awards 3 points for all other 3rd Place Awards (See A211 for a list of points-eligible awards)

If there is a tie in the point totals between teams, the higher ranked team will be determined using the following additional sorting criteria in Table 4-2.

Table 4-2 Advancement Sorting Criteria Including Tiebreakers

Order Sort	Criteria
1st	Total Advancement Points (as calculated in Table 4-1)
2nd	Judged Team Award Points
3rd	Playoff Advancement Points
4th	ALLIANCE Selection Results Points (ALLIANCE CAPTAIN or Draft Order Acceptance)
5th	Qualification Round Performance Points
6th	Average MATCH Score (excluding FOULS)
7th	Average AUTO Score
8th	Highest individual MATCH Score, regardless of whether that score occurred in a Qualification or Playoff MATCH (excluding FOULS)
9th	Second Highest individual MATCH Score, regardless of whether that score occurred in a Qualification or Playoff MATCH (excluding FOULS)
10th	Random Selection by Event Management System

4.1.1 Qualification Round Performance

The calculation of Qualification Round Performance points is done using the equation below. This equation is an inverse error function which utilizes the following variables:

- **R** – the qualification rank of the team at the event at the conclusion of Qualification MATCHES (as reported by the Event Management Software and defined in Section 13.6.3 Qualification Ranking)
- **N** – the number of *FIRST* Tech Challenge teams participating in the Qualification rounds at the event
- **Alpha (α)** – a static value (1.07) used to standardize the distribution of points at events

$$\boldsymbol{QualificationPoints}(\boldsymbol{R},\boldsymbol{N},\boldsymbol{\alpha}) = \left\lceil \boldsymbol{InvERF}\left(\frac{\boldsymbol{N}-2\boldsymbol{R}+2}{\boldsymbol{\alpha N}}\right)\left(\frac{7}{\boldsymbol{InvERF}\left(\frac{1}{\boldsymbol{\alpha}}\right)}\right)+9 \right\rceil$$

This formula generates an approximately normal distribution of Qualification Round Performance points at an event, based on rank, with most teams getting a moderate number of points, and fewer teams getting the highest or lowest numbers of points available.

Table 4-3 displays sample Qualification Round Performance points for variously ranked teams at a 28-team event. The system will automatically generate the appropriate points for each team based on their rank and the number of teams at the event.

Table 4-3 Sample Qualification Round Point Assignments

Rank	1	2	3	4	…	12	13	14	…	25	26	27	28
Points	16	15	14	14	…	10	10	10	…	6	5	5	4

4.1.2 ALLIANCE Selection Results

This attribute measures both individual team qualification round seeding performance and recognition by peers.

ALLIANCE CAPTAINS are recognized based on their qualification round seeding rank. This rank is a result of the rules of the game, which typically incorporate several team performance attributes, and are designed to eliminate ties in rank. ALLIANCE partners are rewarded based on peer recognition. To be invited to join an ALLIANCE, a team's peers have decided that the team has attributes that are desirable. Giving points for ALLIANCE selection also supports come-from-behind teams. A team taking several MATCHES to optimize their performance may be recognized as a late bloomer by a top seeded team, even if that performance isn't reflected in the rankings because of poor performance in early MATCHES. These points also have the potential to recognize teams employing a unique strategy with their ROBOT. Teams with unique or divergent ROBOT capabilities that complement the strengths of other ALLIANCE members may be selected to fill a strategic niche.

Note also that ALLIANCE CAPTAINS are given the same number of points as the team drafted in the same sequence. For example, the team who accepts the pick from the third ALLIANCE CAPTAIN receives the same number of points as the third ALLIANCE CAPTAIN. Numerical analysis supports the idea that ALLIANCE CAPTAINS are about as strong in ROBOT performance as equivalently drafted teams. An additional minor benefit to this system is that it allows teams who would traditionally not be a top ranked team the opportunity to be an ALLIANCE CAPTAIN.

4.1.3 Playoff Performance

This attribute measures team performance as part of an ALLIANCE

Teams earn points based on how far they progress into the playoffs. Points are given to all teams within the ALLIANCE as described in Table 4-1.

See Section 13.7.2 Playoff MATCH Bracket for more details on the number of ALLIANCES that are formed for the playoffs and an example of the playoff MATCH bracket.

4.1.4 Team Judged Awards

This attribute measures team performance with respect to team awards judged at the event.

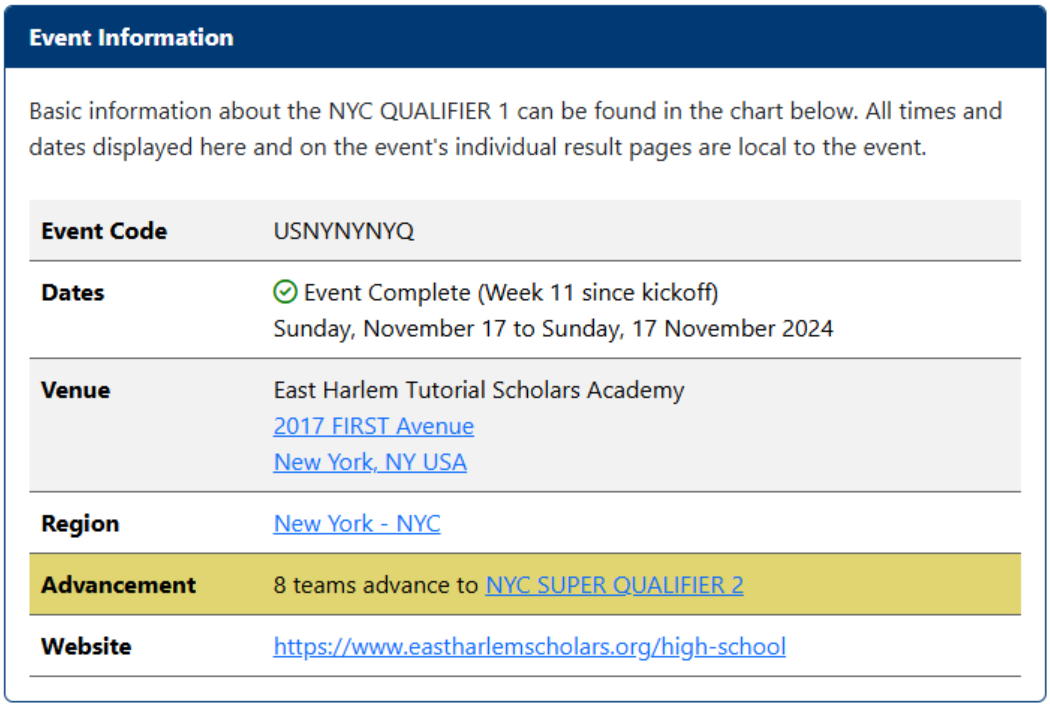
The points earned for team awards in this system are not intended to capture the full value of the award to the team winning the award, or to represent the full value of the award to *FIRST*. In many ways, the team's experience in being selected for awards, especially the Inspire Award, is beyond measure, and could not be fully captured in its entirety by any points-based system. Points are being assigned to awards in this system only to help teams recognize that *FIRST* continues to be "More than Robots®," and to assist in elevating award-winning teams above non-award-winning teams in the ranking system.

Teams only get points for team awards judged at the event. If an award is not judged, is not for a team (e.g. the Dean's List Award) or is not judged at the event (e.g. Safety Animation Award), no points are earned. Points for awards not given at the event are not assigned to any team. See A211 for the list of points-eligible awards.

4.2 Advancement Distribution by Region

Advancement within a region is determined by the Program Delivery Partner and minimum advancement numbers should be made publicly accessible to participating teams as early as possible before the event, and no later than when ALLIANCE selection begins. Advancement information may be published on the FTC-Events page as shown in Figure 4-3.

Figure 4-3 Event Advancement Information as shown on the ftc-events.firstinspires.org/ page



Advancement to the *FIRST* Championship and *FIRST* Premier Events is determined by *FIRST* Headquarters based on a number of factors including:

- Number of teams registered within the region before the cutoff date (this season November 17th)
  - Regions who meet minimum registration requirements
  - Total number of teams within the region
- New developing regions with a Program Delivery Partner
- Global and regional representation

Regional allocations of advancement slots information will be published on the FTC-Events page starting in early December. Regionally allocated slots which are not secured by the event deadline will be returned to *FIRST* HQ or Premier Event Host for reallocation which may include reallocation to a new region or waitlist team invitation.

5 Event Rules (E)

This section includes general rules which apply from the beginning of the public schedule when teams arrive through the end of the event with departure from the venue. These are high-level rules intended to promote an orderly and safe experience for all participants. The Event Director may specify additional restrictions beyond those listed here based on local venue requirements which in most circumstances will be communicated to teams in advance of the event.

> *Universal Violation Note: A violation of any `Event Rules (E)` will result in a warning from event volunteers. Egregious or repeated violations of an Event Rule will be addressed with a VERBAL WARNING from the Head REFEREE, the Lead ROBOT INSPECTOR (LRI) and/or Event Director. Subsequent violations of an Event Rule may result in escalation to FIRST Headquarters and/or disqualification for the team from MATCHES and awards. Criminal behavior will not be tolerated and will result in removal of individual(s) involved and/or disqualification for the team from the event.*
>
> *Any items that are deemed unsafe or outside specifications by FIRST personnel and/or the Event Director must be removed.*

Additional rule specific violations, if applicable, are listed with their corresponding rule.

Safety is always paramount, and many rules are intended to establish norms at each event that will mitigate injury risk to all participants.

The Event Director has the final decision authority for all safety-related issues within a venue.

5.1 General Rules

E101 ***Personal safety comes first.** All team members must observe the following safety practices throughout the event:

A. wear safety glasses or safety rated glasses with side shields (ANSI-approved, UL Listed, CE EN166 rated, AS/NZS certified, or CSA rated) while in and around the playing FIELD and in the pit area. Clear or lightly tinted safety glasses are preferred. Shaded glasses are allowed for those who need them and do not require a specific accommodation request. The only instances where teams are not required to wear safety glasses are in their first 10 minutes of their event load in, and for the first 10 minutes pits are open each day of the event as long as they're not working on the ROBOT or setting up their pit,
B. wear closed toed/heeled shoes,
C. control entanglement risks by tying back long hair and removing other dangling decorations including lanyards, spirit wear and rings as needed while working on or around a ROBOT or ROBOT related materials or tools,
D. wear appropriate clothing,
E. walk in the venue, and
F. comply with government and venue-specific health and safety requirements in place for that event (i.e., mask wearing).

Teams are responsible for bringing their own personal protective equipment.

For more information about safety at *FIRST* events, please reference the *FIRST* Safety Manual.

A partial list of footwear that is not allowed: Crocs, slides, sandals, flip flops, Birkenstocks, sandals with an ankle strap, clogs.

E102 ***Be Nice.** All participants should strive to be gracious and professional at all times while attending a *FIRST* Tech Challenge event. Uncivil behavior toward any participants is not tolerated.

Examples of inappropriate behavior include, but are not limited to:
A. use of offensive language or other uncivil conduct towards someone,
B. "weaponizing Gracious Professionalism" by accusing another person or team of being "not GP",
C. intentionally blocking the view of other participants or spectators for an extended period (Team members momentarily holding up team signs while directly supporting their team is not considered a violation of this rule.), and
D. jamming or interfering with the remote sensing capabilities of a ROBOT or the FIELD while in open-access spectator seating areas.

Examples of remote sensing capabilities include, but are not limited to, vision systems, acoustic range finders, sonars, and infrared proximity sensors.

Use of imagery that, to a reasonably astute observer, mimics the AprilTags employed on the FIELD is a violation of this rule.

Examples of particularly contemptible behavior that may result in ejection from the event include, but are not limited to, the following:
A. assault, e.g., throwing something that hits another person (even if unintended),
B. threat, e.g., saying something like "if you don't reverse that call, I'll make you regret it,"
C. harassment, e.g., badgering someone with no new information after a decision has been made or a question has been answered,
D. bullying, e.g., using body or verbal language to cause another person to feel inadequate or unsafe,
E. insulting, e.g., telling someone they do not deserve to be on a team,
F. swearing at another person (versus swearing under one's breath or at oneself), and
G. yelling at another person(s) in anger or frustration.

E103 ***Children with adults, please.** Children under 12 must be accompanied in the pits by an adult at all times.

E104 ***Respect the venue.** Teams may not damage the venue, including but not limited to bleachers, floors, walls, railings, in any way. This includes littering with team giveaways including candies, flyers, and stickers.

E105 ***Teams must check in.** An adult team member must check in at the Pit Administration station, or the designated check in location, no later than 45 minutes before qualification MATCHES are scheduled to start unless otherwise specified or approved by the Event Director.

Violation: Failure to check in may result in a team not participating in the event.

E106 ***Event resources are for competing teams only.** Only teams registered for an event may use that event's competition FIELD, practice FIELD, and inspection unless pre-approved by the Event Director or

the Program Delivery Partner. Host teams supplying practice FIELD elements and/or machine shop resources may use them, however teams registered for that event must be granted priority.

E107 ***Practice only when/where permitted.** Teams may only practice with their ROBOT in their pit space, in the designated event practice areas, or while in a practice MATCH.

> Teams may not set up their own practice equipment outside their pit in other areas of the event venue. If the Event Director determines a pit practice setup is unsafe or interferes with activity in adjacent pits or aisles, the team must discontinue the activity.
>
> Demonstrating robot functionality to guests or JUDGES is not considered practice.

E108 ***Work in designated areas only.** At the event venue, teams may only produce FABRICATED ITEMS as follows:

A. in their pit area,
B. in another team's pit area with permission from that team,
C. while queued for a MATCH or practice FIELD (given space constraints, extra scrutiny regarding safety is required),
D. any area designated by event staff (e.g., playoff pit area), or
E. as permitted at provided machine shops that are available to all teams.

E109 ***Some things do not belong at events.** Do not bring or use the following:

A. Skateboards,
B. 'hoverboards',
C. drones,
D. bottled gas tanks (e.g., helium),
E. noisy devices or noisemakers, such as floor stompers, whistles and/or air horns,
F. walkie-talkies, or
G. scooters, except for those used for accommodations.

E110 ***Do not arrange for additional utilities.** Do not arrange for power, internet access, or phone lines from venue service providers or attempt to use venue internet connections reserved for event purposes (e.g., *FIRST* event management software or webcasting).

E111 ***Do not sell stuff.** Teams may not conduct sales at an event. This includes, but is not limited to, raffle tickets, food, hats, shirts, candy, water, soft drinks, fruit, or any promotional products unless specifically allowed by the Event Director.

E112 ***Make *FIRST* loud, but with restrictions.** Do not invite or bring live bands to play in the audience. Do not play loud music.

E113 ***Hang banners with care.** Be respectful when hanging your banners.

A. Do not cover or move other team or sponsor signs already in place.
B. Share the available space fairly with other teams.
C. Do not obstruct the view of spectators.
D. Get permission from the Event Director before hanging banners outside of your pit.
E. Hang signs and banners in a safe manner.
F. Banners hung outside team pits must not be larger than 25 $ft.^2$ (2.3 m^2).

We encourage teams to bring team flags and/or signs for display in their pits and/or the ARENA.

Respect venue-specific rules regarding sign location and hanging methods. At the end of the event, safely remove all signs and anything used to hang the signs (tape, string, etc.).

E114 ***Limit flag and flagpole size if used in the ARENA.** Flags and flagpoles may not be of unreasonable size and weight if they are going to be used around the FIELD.

As a guideline, reasonable flags are less than 3 ft. by 5 ft. (~91 cm by 152 cm) in size and weigh less than 2 lbs. (~907g). Reasonable flagpoles may not be more than 8 ft. (~243 cm) long and must weigh less than 3 lbs. (~1360g).

E115 ***No firearms or other weapons.** Firearms or other weapons are prohibited at all *FIRST* events for all *FIRST* programs, including without limitation, all official *FIRST* Events posted here. This rule includes prop or simulated weapons which appear to be real. This policy does not apply to law enforcement or venue security personnel.

E116 ***Inspection required for practice FIELD access.** A team may only use a practice FIELD with a ROBOT that has passed an initial, complete inspection. This rule only applies to events not using scheduled inspection times.

E117 ***Do not record anyone at the event without their consent.** Do not record interactions with anyone at an event, without the person's consent. *FIRST* event staff and volunteers are empowered to excuse themselves from an interaction in which they are being recorded after declining consent.

Please note that many *FIRST* events are livestreamed and *FIRST* participants have given permission to appear in footage from *FIRST*. This does not mean that people can record specific interactions without additional consent.

Laws regarding recording of conversations vary state-to-state and country-to country, and, in some cases, recording without consent may be criminal. Introducing the idea of recording a conversation with an implied reason of proving someone's error can escalate a discussion and is likely to increase its adversarial nature.

5.2 Machine Shops and Host Team Build Spaces

Rarely, some events host a machine shop or open their team's build space, during specific hours (see the event public agenda), to help teams with repair and fabrication of their ROBOT. Machine shops are typically sponsored by the local host organization. In most cases, the machine shop is on site and readily accessible to all teams. All competing teams should have access to the same resources.

5.3 Wireless Rules

E301 ***No wireless communication.** Teams may not set up their own Wi-Fi (802.11a/b/g/n/ac/ax/be) wireless communication (e.g., access points or ad-hoc networks), Bluetooth, or any other communications systems using 2.4GHz or 5GHz wireless in the venue.

A wireless hot spot created by a cellular device, camera, smart TV, etc. is considered an access point.

Some smart TVs have access points enabled by factory default. Please make sure that functionality is disabled for any TVs brought to the event.

Bluetooth uses 2.4GHz frequencies to communicate which can interfere with venue and ROBOT systems.

Many R/C toys (including drones, wireless vehicles, FPV systems) use 2.4GHz and 5GHz communications. Do not operate these in the venue.

E302 ***Don't interfere with wireless networks.** Participants may not interfere, attempt to interfere, or attempt to connect with any other team or *FIRST* wireless network without expressed permission.

Teams are encouraged to report suspected wireless security vulnerabilities to the *FIRST* Technical Advisor (FTA) or Event Director if at the event or to *FIRST* via customerservice@firstinspires.org to report a suspected issue after the event.

5.4 Load-In

Some large events (often multi-day events) may set specific time frames, published on the event public schedule, in which teams are invited to load their ROBOT and equipment into their pit areas before pits officially open.

Load-in can be stressful for teams and volunteers, which can be mitigated by preparation and planning. Unanticipated factors, like traffic or weather, can change a team's scheduled arrival time, making the process difficult. The most important things a team should remember are to be safe, gracious, and professional. Teams who experience smooth and easy load-ins are encouraged to check with others to see if they can help and make their experience as positive as possible.

5.5 Pits

A team pit is the designated space, typically a 10 ft. by 10 ft. by 10 ft. (~3 m x 3 m x 3 m) area, where a team may work on their ROBOT. Each team is assigned a pit space typically marked with their team number. This helps team members, judges, and visitors find teams easily. Pit spaces may vary based on competition venue size limits.

The pit area refers to the general area where team pits are located which encompasses the aisles between the pits, pit admin, ROBOT inspection, practice FIELD, or other areas where ROBOTS may be active or worked on. All pit rules apply to the full pit area.

Additional limitations beyond those listed below may be imposed by the Event Director but they should be clearly communicated at least 48 hours before the event start time and applied to all teams fairly. Team pits may or may not have a table and power outlet. If individual team outlets are not provided, the venue must provide access to team-usable outlets in the pit area for charging batteries. Power may not be available overnight for a multi-day event.

Teams, volunteers, *FIRST* staff, and guests spend a lot of time in the pits. Get to know other teams and help each other when you can. Time is short and help is very often right "next door" in the adjacent team pits.

Small, bench-top machinery, with appropriate guards, is permitted in team pits. 'Small' machinery is machinery that can be easily lifted by one person and examples include, but are not limited to: 3D printers, small band saws, small drill presses, desktop CNC mills, and sanders.

E501 ***Pits are unavailable if closed.** Teams may not access their pit area outside the designated hours.

E502 ***Stay in your pit.** Teams should set up their allowed equipment fully within their assigned pit space. Teams may not:

A. run power or internet lines from their team pit to any other area except as instructed or allowed by the Event Director,
B. swap team pits with other teams if pits have assigned team numbers, or
C. move themselves to empty team pits without Event Director approval.

E503 ***Keep aisles clear.** Aisles must be kept clear.

E504 ***No sparks or flames.** Tools that throw sparks or produce open flames are prohibited.

> Examples of tools that violate this rule include, but are not limited to welders, bench and angle grinders, and gas torches.

E505 ***Nothing too big.** Floor standing power tools are prohibited.

> Examples include but are not limited to full-size drill presses, and band saws.

E506 ***No brazing or welding.** Brazing/welding is prohibited.

E507 ***Solder with specific tools only.** Soldering may be done using an electric iron/gun only.

E508 ***Structures must be safe.** Teams may not build any structure that supports the weight of people or stores items overhead. Structures may not block or inhibit fire sprinkler systems or otherwise be unsafe.

E509 ***Secure team identification assets.** Team signs, flags, and displays must be securely mounted to the pit structure.

E510 ***Only use aerosol or other chemicals with noxious fumes in approved areas.** Any aerosol or chemical that produces noxious fumes or spray particulates should only be used in approved areas. Not all venues will allow the use of these products anywhere on site.

5.6 ROBOT Carts

Most teams use carts to transport their ROBOT throughout an event. Carts are not required but are recommended (to minimize risk of muscle strains, dropped ROBOTS, and other hazards). In addition to the rules listed below, teams are encouraged to put the team's number on the cart, refer to the *FIRST* Safety Manual for key safety guidelines and practices.

E601 ***Carts must be safe and easy to use.** Carts must be easy to control, maneuver, and pose no risk to bystanders.

E602 ***Carts should not be too big.** Carts must fit through a standard 30-inch door.

E603 ***Carts cannot park anywhere.** Carts must remain in the team pit (or other venue designated cart staging areas) when not in use.

E604 ***No noisy carts.** Carts may not be equipped with music or other sound-generating devices.

E605 ***No motor driven carts.** ROBOT carts may not use powered propulsion.

5.7 Ceremonies

At most events, there are opening and closing ceremonies to show honor and respect for represented countries, sponsors, teams, mentors, volunteers, and award winners. Ceremonies provide everyone with the opportunity to collectively applaud the successes of all participants. They also give teams a chance to "meet" the volunteers and other people and sponsors involved with the event. Closing ceremony elements are at the end of most events and are integrated into and presented between playoff MATCHES.

At the awards ceremony, *FIRST* presents trophies and medallions to outstanding teams. All team members are encouraged to attend the ceremonies, be punctual, and show appreciation to volunteers that staffed the event.

E701 ***Quiet in the pits during ceremonies.** During ceremonies outside of playoff MATCHES, team members may not:

A. use power tools
B. use loud hand tools (hammers, saws, etc.), or
C. shout, yell, or use loud voices, unless as a demonstration of approval during a ceremonial activity.

E702 ***Pit person limit during ceremonies is 5.** No more than 5 team members may be in the pits during ceremonies outside of playoff MATCHES. Each team must have at least 1 representative observing ceremonies to be responsible for relaying important information to the entire team.

> All teams are encouraged to have as many people in the stands for ceremonies as possible. This is important both to celebrate all who are recognized during ceremonies, but also to listen for important day-of information from event organizers which might be critical for your team.

E703 ***Be respectful during anthems.** Team members, including any remaining in the pits, should exhibit peaceful behavior during the presentation of all national anthems. If team members wish to abstain from traditional anthem observance behaviors, they have a right to do so, as long as they remain silent and non-disruptive.

5.8 In the Stands

E801 ***No saving seats.** Teams are not permitted to save or designate seats for team members that are not actively using them.

> Teams may not hang banners or ribbons or otherwise designate seating. (Event staff will remove and discard any banners, roping, etc., used to designate seating.) Please take turns sitting in the bleachers/stands if seating is limited. If there is a crowding problem, we ask that you kindly leave after your team's MATCH and return later, if possible.
>
> The Event Director may reserve seats for attendees who require accessible seating, for certain volunteers, or to ensure teams in the playoffs have seats to watch their teams play.

E802 ***No throwing items from the stands.** Items may not be thrown from the audience seating.

6 Awards (A)

FIRST Tech Challenge celebrates the excitement of competition both on and off the field. Through the following awards, we celebrate the *FIRST* Core Values which makes us so much "More than Robots". Please note that different event types (e.g., League Tournaments, Regional Championship, *FIRST* Championship) or event sizes may offer different sets of awards. Not every award is presented at every *FIRST* Tech Challenge event. No awards are presented at League Meets, see section 14 League Play Tournaments (L), additional details by event type are available in the sections below.

Judged awards are determined by volunteers from the community who prepare for the event with thorough training and certification. There are two key judging volunteer roles:

- JUDGES – meet with teams to learn about and celebrate the unique journey and accomplishments of each team and evaluate these against award requirements. JUDGES interact with STUDENTS during the interview process, and in the pits. As a group, JUDGES determine the teams that receive awards at events.
- JUDGE Advisor (JA) – trains, directs, and supervises JUDGES throughout the event. JUDGE Advisors oversee the judging processes and procedures to make sure they are in accordance with *FIRST* Tech Challenge judging guidelines.

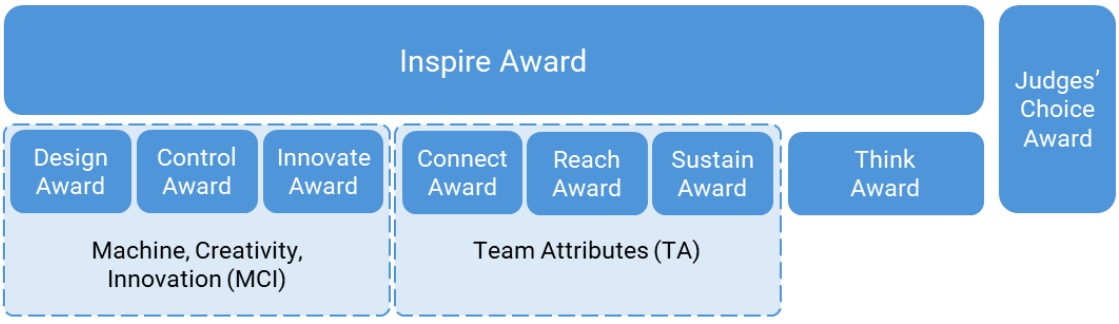
FIRST Tech Challenge judging is delivered in one of two ways. Most events will have in-person ("traditional") judging along with the standard in-person gameplay. The second is hybrid format which has in-person gameplay, but judging is done remotely before in-person gameplay. This manual will primarily describe the traditional in person judging process. The remote judging process follows the same overall judging standards and requirements, but interviews are conducted online, and in-person meetings may not occur.

Teams may also read the Judge and Judge Advisor Manuals to gain more insight into the complete judging process.

6.1 Team Judged Awards Overview and Schedule

Most *FIRST* Tech Challenge awards fall into two broad categories: Machine, Creativity, and Innovation (MCI), and Team Attributes (TA). In addition to MCI and TA awards, there are also two other separate awards, the Think Award and the Judges' Choice Award. The final award is the Inspire Award which is a special overarching award (Figure 6-1). The local Program Delivery Partner may elect to give additional awards to celebrate local sponsors or initiatives, but these awards are not considered Team Judged Awards for the purposes of advancement calculations as described in Section 4 Advancement.

Figure 6-1: Award hierarchy



- The **Inspire Award** recognizes teams who excel in MCI, TA, and Think award accomplishments. This team is an all-around inspiration for others.
- **MCI awards** recognize the technical accomplishments of teams in the brainstorming, design, construction, operation, and control of their ROBOTS.
- **TA awards** recognize teams who have expanded their skillset, created a plan to sustain their program and team, and spread the message of *FIRST* throughout their outreach.
- The **Think Award** recognizes teams who masterfully document their team's process and ROBOT using their PORTFOLIO.
- **Judges' Choice Award** recognizes a team whose unique efforts, performance, or dynamics merit recognition, but does not fit into any of the other award categories.

The JUDGES will gather information from the teams through several different pathways (Figure 6 2). All teams will have the opportunity to submit a team PORTFOLIO which should document aspects of their team which directly support the judged award criteria or information which they wish the JUDGES to consider. Teams can participate in two different types of interviews: a structured interview and pit interview(s).

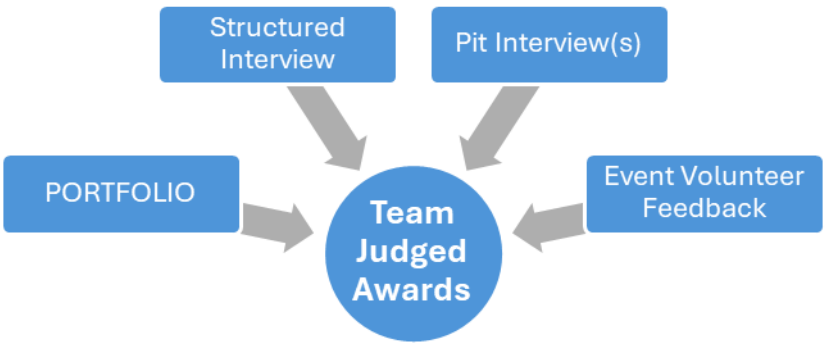
All award winners chosen by the JUDGES are recognized as being positive examples of the award guidelines, not necessarily the "best" team.

Teams may participate in judging regardless of the inspection status of their ROBOT and are eligible for awards even if they are attending the event without a ROBOT.

6.1.1 Sources of Information Considered for Awards

In addition to the information provided in a team's PORTFOLIO (if submitted) and the interviews, JUDGE Advisors may also accept feedback about teams at the event from other volunteers to help inform their understanding of the team. All of the sources in Figure 6-2 help JUDGE Advisors facilitate discussions with JUDGES when award deliberations begin.

Figure 6-2: Sources of Information for Team Judged Awards.



In addition to the specific information sources JUDGES use to evaluate teams, there are also sources of information which are specifically disallowed. JUDGES are strictly instructed to only consider information from the current event and the current season and cannot consider information from outside what they have seen or heard at the current event. This means that information like past performance (good or bad), personal knowledge of a team, and external sources like websites and social media are not considered. JUDGES also do not consider ROBOT performance (for example, how many scoring tasks are completed) in an award unless it is specifically listed as part of the required or encouraged evaluation criteria. A team's ROBOT placement in a competition (winner or finalist, etc.) or qualification ranking is not considered when evaluating teams for a judged award.

The awards are a method *FIRST* uses to inspire STUDENTS and open their eyes to building a better future together. The awards process should foster a positive STUDENT interaction with JUDGES who are independent caring adults and can recognize their achievements and encourage them to continue learning.

6.1.2 Structured Interview

All teams are encouraged to prepare for a structured interview session where the team can present a prepared oral presentation to a small panel of JUDGES, followed by a Q&A session. These interviews follow a standard timeline (Figure 6-3) and last at least 10 minutes long, per A205.

Figure 6-3: Structured Interview Timeline

1. Team arrives and JUDGES welcome the team.
2. Teams may present to the JUDGES interrupted for up to 5 minutes.
3. JUDGES will ask open ended questions to the team for the remining of the scheduled structured interview time.
4. Team departs from the interview space.
5. JUDGES discuss the structure interview and complete the feedback form.
6. JUDGES welcome the next team into the structured interview location and repeat the process.

Teams are encouraged to review the Judge Interview Question Bank*(link coming soon)* prior to their judging interviews to understand the type of questions that may be asked by the JUDGES. At each event, the JUDGE Advisor will select two questions from the question bank that all teams will be asked at the start of the structured interview's question and answer session. One question will be focused on the MCI award category, and one question will be focused on the TA award category. After the first two questions are asked and answered, JUDGES may ask additional questions to help evaluate the team's performance against the award criteria.

> Additional questions asked during interviews may come from the question bank but teams should be prepared to answer questions that are not listed within the document.

6.1.3 Pit Interview(s)

After all the judging panels have finished, the JUDGES compare notes and may elect to follow up with the teams in the pit area during the competition and conduct informal pit interviews. During pit interviews, teams have the opportunity to expand upon materials presented in the structured interview and share additional content with the JUDGES (for example, ROBOT prototypes, design artifacts, and photos or letters from outreach events). A team does not need to prepare another presentation for a pit interview but should be ready to answer questions from the JUDGES.

6.1.4 Sustained Outreach and Demonstrating Impact by Numbers

In general, JUDGES will consider ongoing, sustained outreach to be of higher quality than occasional or one-off outreach. JUDGES will seek to understand what is the impact of the outreach to the individuals being reached by the activity.

> Teams are encouraged to review the Award Terms and Definitions Document to understand the requirements behind specific terms (starting a *FIRST* team, running an event, reaching x number of people). JUDGES may ask specific questions when a specific term listed in this document is mentioned in a team's PORTFOLIO or during an interview.

6.2 Team Judged Award Rules

A201 ***Team PORTFOLIOS have limits.** Teams have the opportunity to submit a team PORTFOLIO to be used as part of the judging process. No other printed or digital content not directly included in this document will be collected by the JUDGES to consider during deliberations. Team PORTFOLIOS must meet the following requirements:

A. must consist of 1 cover page including the team number and optionally: team name, PORTFOLIO table of contents, team organizations, sponsors, logo, motto, and picture of the ROBOT and/or team,
B. no more than 15 pages of judged content (if printing front and back, 8 sheets of paper, including the cover page),
C. use only US Letter (8.5" x 11") or A4 (210 x 297 mm) size paper,
D. if submitted digitally, the complete submission must be less than 15MB in size, and
E. must only include progress, challenges, and accomplishments which have taken place since January 1, 2025.

> None of the content of the cover page will be used by JUDGES to evaluate any awards criteria. Any content beyond the allowed 15 pages will not be reviewed by the JUDGES.
>
> Teams are encouraged to limit Personally Identifying Information (PII) in the PORTFOLIO. Best practices would be to use only first names and optionally last initials of STUDENTS. Photographs including images of STUDENT team members are acceptable. The JUDGES use the cover page to identify the team associated with the PORTFOLIO. Teams who forget to include a cover page may be disqualified from judging if the JUDGES cannot determine what team the PORTFOLIO is associated with.
>
> Teams should carefully consider font size, color, and graphic design when making their PORTFOLIO so that all JUDGES are able to read their submission. Teams whose design choices include small fonts (<10 pt) or low contrast text on images will not be excluded from consideration but understand that JUDGES will not be able to use anything they cannot read. Teams can use various free accessibility tools, like WebAIM Contrast Checker, to help them design with readability in mind.
>
> JUDGES will not open, view, or use any included links to other documents, websites, or videos referenced to linked to from the PORTFOLIO. JUDGES may

read additional information during pit interviews but will not bring back additional printed content to be referenced as part of the JUDGE deliberations.

Teams may use writing and research aids including Artificial Intelligence (AI) to help them compose their PORTFOLIOS. If AI or other resources are used, they must be credited via footnote or endnote, and respect intellectual property rights and licenses. Proper Credit can look like this :"PORTFOLIO created by Team XXXXX and ChatGPT".

A team may reference previous seasons (for example, in a team or organizational plan) to demonstrate growth, but the emphasis must be on the current season.

A202 ***PORTFOLIOS must be submitted on time and as requested.** Teams must submit their PORTFOLIO as instructed by the Event Director and by the stated deadline if they wish to have it considered during the judging process. If no other instructions are provided, teams should submit 1 printed copy of their PORTFOLIO during the structured interview.

Instructions about when and how teams should submit their PORTFOLIOS should be communicated by the Event Director before the event.

If circumstances prevent a team from following the PORTFOLIO submission instructions, the Event Director should work with the JUDGE Advisor to make reasonable accommodations to accept all team PORTFOLIOS unless doing so poses an undue burden to the judging process.

A203 ***Teams must attend a structured interview session.** To be considered for any judged awards the team must attend their assigned structured interview session.

Teams should be informed of their assigned time by the Event Director or local Program Delivery Partner in advance of the event. If there is a schedule conflict or the team misses their structured interview slot due to unforeseen circumstances the team should work with the Event Director or local Program Delivery Partner to make reasonable alternate accommodations for a judging interview at the event if possible.

A204 ***Bring the right resources with you for your structured interview.** Teams attending their judging interview time slot should come prepared with the following:

A. no less than 2 STUDENT representatives for teams of 2 STUDENTS and larger,
B. a printed copy of their team PORTFOLIO (optional, submit as instructed by the Event Director),
C. "show and tell" demonstration items which may include the team's ROBOT (encouraged, but optional),
D. 1 silent observer per A208 (optional), and
E. 1 support person to fill accommodation needs per A209 (optional, as needed).

Teams are encouraged to have as many STUDENTS as possible involved in the structured interview process.

A team does not have to have a ROBOT to participate in judging or be eligible for judged awards. If the team brings a ROBOT to present to the JUDGES it does not have to be inspected but should be built to be compliant with the current season's *FIRST* Tech Challenge ROBOT construction rules and designed to play

this season's game. The ROBOT brought to judging must comply with I301 and G209.

Teams may power on and demonstrate their robot functions during the structured interview unless explicitly disallowed by the Event Director or Local Program Delivery Partner. All teams should have the same demonstration restrictions.

A205 ***Everyone gets equal structured interview time.** All teams will be scheduled for the same length structured interview of at least 10 minutes with a minimum of 10 minutes reserved between judging interviews for JUDGES to confer.

A206 ***The structured interview timer starts when the team starts.** The timer starts after the team has entered the room and when they begin their presentation. Teams who take an extended amount of time to begin will be warned by the JUDGES to begin promptly and then the judging interview timer will be started regardless of the readiness of the presenting team.

Teams should enter the room and prepare to begin speaking in an expedited manner. This rule is aimed at letting large teams get lined up and oriented in the room and for the JUDGES to introduce themselves and provide reminders of the interview format.

Do not attempt to abuse the delayed start timer to set up equipment or otherwise gain an advantage.

A207 ***Prepared structured presentation time should not be interrupted.** The first 5 minutes of the judging interview are reserved for the team to present a prepared oral presentation uninterrupted, if they choose. The uninterrupted presentation time may be ended early by the team. Any remaining time should be a question and answer conversation with the STUDENTS and led by the JUDGES.

A208 ***One adult silent observer is welcome.** One adult mentor may attend the judging session and be present for any interaction between the JUDGES and the STUDENT team members. Adult mentor(s) may be present for any interactions between the JUDGES and the STUDENT team members outside of the structured interview. The adult observer and mentor(s) may not interact or actively coach during any interaction between the JUDGES and the STUDENT team members.

The purpose of the adult silent observer is to provide silent confidence to the STUDENT team members presenting in an unknown environment with new people.

A209 ***Translator and/or Sign Language Interpreter accommodations will be made for teams who need it.** Teams who need to use a translator to communicate with the JUDGES may provide one if the team's native language does not match that of the event host site provided JUDGES. This includes sign language or other adaptive technology. Teams who intend to interview with the assistance of a translator must work with the Event Director in advance to request additional interview time of between 2 and 5 minutes, if needed. The translator may be an adult and can be in addition to the silent observer in A208.

In most cases the translator will need to be provided by the team. If other accommodation is needed, the team should contact your local leadership to discuss options.

A210 ***No Video or Audio recording during judging interview.** In addition to the restrictions of E117, teams may not record any video or audio during their structured judging interview.

A211 ***The number of awards given scales with event size.** The total number of awards given is based on the number of teams checked in at the event. Not all awards are given at every competition. Only the awards specified in Table 6-1 based on the event size are points-eligible for advancement.

Table 6-1: Total judged awards available based on all event participating teams

Total Event Participating Teams					
Award		4-10 Teams	11-20 Teams	21-40 Teams	41-64 Teams
Inspire Award		1st Place	1st Place 2nd Place	1st Place 2nd Place 3rd Place	1st Place 2nd Place 3rd Place
Think Award		1st Place	1st Place	1st Place 2nd Place	1st Place 2nd Place *(3rd Place*)*
TA Awards	**Connect Award**	1st Place (Only one of Connect, Reach, or Sustain will be given)	1st Place	1st Place *(2nd Place*)*	1st Place 2nd Place *(3rd Place*)*
	Reach Award		1st Place	1st Place *(2nd Place*)*	1st Place 2nd Place *(3rd Place*)*
	Sustain Award		1st Place	1st Place *(2nd Place*)*	1st Place 2nd Place *(3rd Place*)*
MCI Awards	**Design Award**	1st Place (Only one of Innovate, Control or Design will be given)	1st Place	1st Place *(2nd Place*)*	1st Place 2nd Place *(3rd Place*)*
	Innovate Award		1st Place	1st Place *(2nd Place*)*	1st Place 2nd Place *(3rd Place*)*
	Control Award		1st Place	1st Place *(2nd Place*)*	1st Place 2nd Place *(3rd Place*)*
Judges' Choice Award		Optional*	Optional*	Optional*	Optional*

**Discretionary awards*

Check the Judge and Judge Advisor Manuals for exact details.

See section 13.8 Dual Division Events for the modified dual division version of this rule.

A212 ***Judging feedback is provided to all teams.** All teams will receive feedback from their structured interview session. The JUDGES complete a form immediately following the structured interview based on their initial impression of the team. This feedback form is not used during deliberations and does not include any updated feedback based on later interactions by the JUDGES with the team.

The feedback form will either be returned with the PORTFOLIO for in-person judging near the end of the event, or the Lead Coach 1 will receive access to a digital version in FTC-Scoring following the event in the case of remote judging.

A213 ***Teams are only eligible to win the Inspire Award in their own region.** Teams are only eligible to be considered for the Inspire Award (1st, 2nd or 3rd place) when competing at a tournament within their own region.

A214 ***Teams cannot win the Inspire Award at multiple Qualifying or League Tournaments.** Teams are only eligible to win 1st place Inspire Award once per season from any Qualifying or League Tournament. Teams who have won 1st place Inspire may not be considered for 1st, 2nd, or 3rd place Inspire at subsequent Qualifying or League Tournaments.

A215 ***Teams can only get one judged AWARD.** Teams are only eligible to win or be a runner-up for a single judged AWARD at the event.

6.3 Team Judged Award Descriptions

6.3.1 Inspire Award

The team that receives this award is a strong ambassador for *FIRST* programs and a role model *FIRST* team. This team is a top contender for many other judged awards and is a gracious competitor.

The Inspire Award winner is an inspiration to other teams, acting with Gracious Professionalism® both on and off the playing FIELD. This team shares their experiences, enthusiasm, and knowledge with other teams, sponsors, their community, and the JUDGES. Working as a unit, this team will have shown success in performing the task of designing and building a ROBOT.

Table 6-2: Inspire Award Criteria

Inspire Award Criteria		
Required	1	Team must submit a PORTFOLIO.
Required	2	The Inspire Award celebrates the strongest qualities of all the judged awards. A team must be a strong contender for at least one award in each of the following judged award categories: A. Machine, Creativity, and Innovation Awards, B. Team Attributes Awards, and C. Think Award.
Required	3	Team must be positive and inclusive, and each team member contribute to the success of the team.
Required	4	Team is able to describe, demonstrate, document, or display their experiences and knowledge to the JUDGES.

6.3.2 Think Award

This judged award is given to the team that best reflects the journey the team took as they experienced their season. The content within the PORTFOLIO is the key reference for JUDGES to help identify the most deserving team. The team could share or provide additional detailed information that is helpful for the JUDGES.

Table 6-3: Think Award Criteria

Think Award Criteria		
Required	1	Team must submit a PORTFOLIO. The PORTFOLIO must include engineering content which includes at least one of the following: A. evidence of use of the engineering process, B. lessons learned and implemented related to the design of their ROBOT, C. trade off analysis /cost benefit analysis, and/or D. mathematical analysis used to make design decisions.
Encouraged	2	Team PORTFOLIO may include information about resources which includes any number of the following examples: A. how the team learns from team mentors, and/or a development plan for team members to learn new skills, B. how the team recruited new people into *FIRST,* and/or C. how the team identified goals and tracked progress towards their goals throughout the season.
Encouraged	3	PORTFOLIO information is organized in a clear and intuitive manner

6.3.3 Connect Award

This judged award is given to the team that connects with their local science, technology, engineering, and math (STEM) community to learn and adopt new tools through effort and persistence. This team has a team plan and has identified steps to achieve their goals. A PORTFOLIO is not required for this award.

Table 6-4: Connect Award Criteria

Connect Award Criteria		
Required	1	Team must describe, display, or document a team plan that covers all of the following: A. The team's goals for the development of team member skills, and B. The steps the team has taken or will take to reach those goals
Encouraged	2	Provide examples of developing in person or virtual connections with individuals in the engineering, science, or technology community.
Encouraged	3	Provide examples of how it actively engages with the engineering community.

6.3.4 Reach Award

This award celebrates a team that has introduced and recruited new people into *FIRST*. Through their efforts, they have sparked others to embrace the *FIRST* culture. A PORTFOLIO is not required for this award.

Table 6-5 Reach Award Criteria

Reach Award Criteria		
Required	1	Team must discuss, describe, display, or document their outreach objectives.
Required	2	Team must discuss, describe, display, or document their successful recruitment of new teams, or coaches, or mentors and/or volunteers who are not otherwise active within the *FIRST* community.
Encouraged	3	Is an ambassador for *FIRST* programs in a way that makes *FIRST* loud.
Encouraged	4	Has a creative and evolving approach to outreach materials that market their team and *FIRST*.

6.3.5 Sustain Award

Sustainability and planning are essential for a *FIRST* team, because they ensure the program's long-term success. This award celebrates the team that has considered their future team members and has worked to ensure that their team or program will continue to exist long after they have gone on to develop their careers. A PORTFOLIO is not required for this award.

Table 6-6 Sustain Award Criteria

Sustain Award Criteria		
Required	1	Team must discuss, describe, display, or document their plan(s) which includes **at least one** of the following: A. finances and financial sustainability plan, B. season project planning, and/or C. team sustainability plans and/or objectives.
Required	2	Team must discuss, describe, display or document how a team tracks their progress towards their plan(s) listed above.
Encouraged	3	Team has clear team roles for all members of the team and a process for developing leadership.
Encouraged	4	Team can discuss, describe, display, or document how they manage the team's constraints and/or risks.

6.3.6 Innovate Award sponsored by RTX

The Innovate Award celebrates a team that thinks imaginatively and has the ingenuity, creativity, and inventiveness to make their designs come to life. This judged award is given to the team that has an innovative and creative ROBOT design solution to any specific COMPONENTS in the *FIRST* Tech Challenge game. Elements of this award include design, robustness, and creative thinking related to design. This award may address the design of the whole ROBOT or of a MECHANISM attached to the ROBOT and should work consistently during MATCHES, but does not have to work all the time to be considered for this award. A PORTFOLIO is not required for this award.

Table 6-7: Innovate Award Criteria

Innovate Award Criteria		
Required	1	Team must describe, display, or document examples of the team's engineering content that illustrate how the team arrived at their design solution.
Required	2	ROBOT or ROBOT MECHANISM is creative and/or unique in its design.
Required	3	The innovative element must be stable, robust, and contribute positively to the team's game objectives most of the time.
Encouraged	4	Designs often come with risks, the team should discuss, describe, display or document how they mitigated that risk.

6.3.7 Control Award

The Control Award celebrates a team that uses sensors and software to increase the ROBOT'S functionality during gameplay. This award is given to the team that demonstrates innovative thinking and solutions to solve game challenges such as autonomous operation, improving mechanical systems with intelligent control, or using sensors to achieve better results. The solution(s) should work consistently during MATCHES but does not have to work all the time. Solutions considered for this award are not solely limited to the AUTO period of the MATCH and may also be used during the TELEOP period. The team's PORTFOLIO must contain a summary of the software, sensors, and mechanical control but would not include copies of the code itself.

Table 6-8: Control Award Criteria

Control Award Criteria		
Required	1	Team must submit a PORTFOLIO. The PORTFOLIO must include all of the following: A. hardware and/or software control COMPONENTS on the ROBOT, B. which challenges each COMPONENT or system is intended to solve, and C. how does each COMPONENT or system work.
Required	2	Team must use one or more hardware or software solutions to improve ROBOT functionality by using external feedback and control.
Encouraged	3	The control solution(s) should work consistently during most MATCHES.
Encouraged	4	Team could discuss, describe, display, or document how the solution should consider reliability either through demonstrated effectiveness or identification of how the solution could be improved
Encouraged	5	Use of the engineering process to develop the control solutions (sensors, hardware and/or algorithms) used on the ROBOT includes lessons learned.

6.3.8 Design Award

The Design Award celebrates the team that demonstrates an understanding of industrial design principles by striking a balance between form, function, and aesthetics while meeting the needs of this season's challenge. The design process used should result in a ROBOT which is efficiently designed and effectively addresses the game challenge. A PORTFOLIO is not required for this award.

Table 6-9: Design Award Criteria

Design Award Criteria		
Required	1	A team must be able to describe or demonstrate how their ROBOT is elegant, efficient (simple/executable), and practical to maintain.
Required	2	The entire machine design, or the detailed process used to develop the design, is worthy of this recognition, and not just a single COMPONENT.
Encouraged	3	The ROBOT distinguishes itself from others by its aesthetic and functional design.
Encouraged	4	The basis for the design is well considered (that is inspiration, function, etc.).
Encouraged	5	Design is effective and consistent with the team's game plan and/or strategy.

6.3.9 Judges' Choice Award

This award is optional and not given at all *FIRST* Tech Challenge events.

During the competition, the judging panel may meet a team whose unique efforts, performance, or dynamics merit recognition, but does not fit into any of the other award categories. To recognize these unique teams, *FIRST* offers a Judges' Choice Award.

6.4 Tournament ALLIANCE Awards

6.4.1 Winning Alliance Award

This award will be given to the winning ALLIANCE represented in the final MATCH of the playoffs of a single-division Tournament or Championship event. If the event is a dual-division or multi-division event, there will be Winning Alliance Awards awarded to both the division playoff winners and the event finals playoff winner.

6.4.2 Finalist Alliance Award

This award will be given to the finalist ALLIANCE represented in the final MATCH of the playoffs of a single-division Tournament or Championship event. If the event is a dual-division or multi-division event this will be awarded to the division playoff finalists and the event finals playoff finalist.

6.5 Individual Awards

6.5.1 Dean's List Award

In an effort to recognize the leadership and dedication of the most outstanding secondary school STUDENTS from *FIRST*, the Kamen family sponsors awards for selected 10th or 11th grade STUDENTS known as the *FIRST* Tech Challenge *FIRST* Dean's List Award.

The STUDENTS who earn *FIRST* Dean's List status as a semi-finalist, finalist or winner, are great examples of current STUDENT leaders who have led their teams and communities to increased awareness for *FIRST* and its mission. It is the goal of *FIRST* that these individuals will continue, post-award, as great leaders, STUDENT alumni, and advocates of *FIRST*.

Please visit the Dean's List Award Website to see complete award submission details and to see past *FIRST* Tech Challenge winners.

> For regions of the world that do not use grade levels such as this to identify years of schooling: This award is intended for STUDENTS who are two (2) to three (3) years away from entering college or university. STUDENTS that would be attending college or university in the next academic year are not eligible. Mentors will be asked for the year of graduation during the nomination process.

6.5.2 Compass Award

This is an optional award and is only offered at the Regional Championship tournament level of competition. All teams attending *FIRST* Championship will have an opportunity to submit for this award.

The Compass Award recognizes an adult coach or mentor who has given outstanding guidance and support to a team throughout the year and demonstrates to the team what it means to be a Gracious Professional. The winner of the Compass Award will be chosen from candidates nominated by *FIRST* Tech Challenge STUDENT team members, via a 40-60 second video submission. The video must highlight how their mentor has helped them become an inspirational team. The video should emphasize what sets the mentor apart.

Table 6-10: Compass Award Criteria

Compass Award Criteria		
Required	1	Team must be able to clearly articulate this mentor's contribution to the team and explain what sets this mentor apart.
Required	2	Submission must be in video format and meet the following requirements: A. submitted by the deadline established by the Event Director or local Program Delivery Partner instructions, B. be in one of the following formats: .mp4, .mov, .avi, or .wmv (no links to streaming services will be accepted), C. one video submission per team per event (videos can be updated or changed between events), D. all music must be used with permission from the copywrite owners and be indicated in the video credits, and E. videos cannot be longer than 60 seconds, including credits.

> Teams are encouraged to review the *FIRST* Branding and Style Guidelines before creating their video.

6.6 Project-Based Global Awards

Project-based global awards are awards that are only judged and awarded once per season and are open to all registered *FIRST* Tech Challenge teams. Each award has its own independent requirements and deadlines. These awards do not contribute towards team advancement.

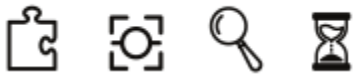
6.6.1 Digital Animation Award

> Specific award criteria and deadlines will be available after Kickoff. Check out last year's submission requirements and the 2025 Digital Animation Award Winners to learn more about this award.

6.6.2 Safety Animation Award sponsored by UL

NEW! For the 2025-26 Season, each *FIRST* Tech Challenge team will also be able to submit for the Safety Animation Award sponsored by UL. Specific submission details will be available after Kickoff.

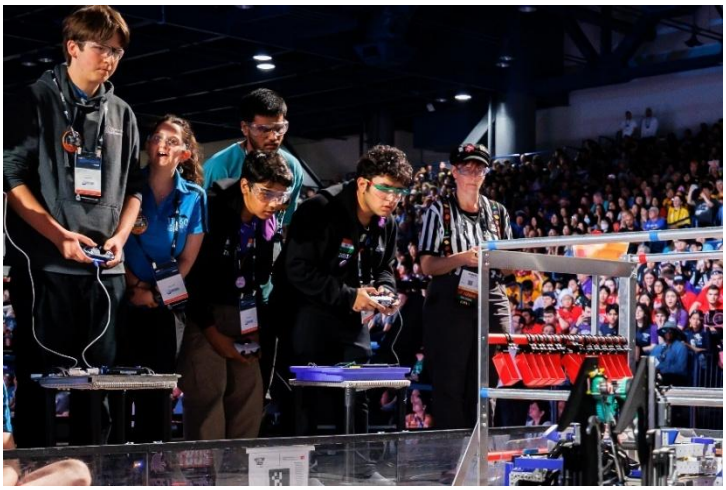
To learn more now, check out the 2025 *FIRST* Robotics Competition Safety Animation Award winner details.



7 Game Sponsor Recognition

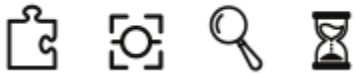
Thank you to the 2025-26 *FIRST® Tech Challenge season presenting sponsor, RTX*.

RTX



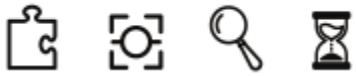
8 Game Overview

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



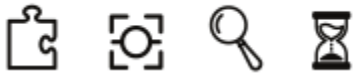
9 ARENA

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



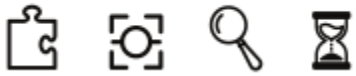
10 Game Details

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



11 Game Rules (G)

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



12 ROBOT Construction Rules (R)

The rules listed below explicitly address legal parts and materials and how those parts and materials may be used on a ROBOT. A ROBOT is an electromechanical assembly built by a *FIRST* Tech Challenge team to play the current season's game and includes all the basic systems required to be an active participant in the game –power, communications, control, and movement about the FIELD.

There are many reasons for the structure of the rules, including safety, reliability, parity, creation of a reasonable design challenge, adherence to professional standards, and impact on the competition.

Another intent of these rules is to have all energy sources and active actuation systems on the ROBOT (e.g., batteries, motors, servos, and their controllers) drawn from a well-defined set of options. This is to ensure that all teams have access to the same actuation resources and that the INSPECTORS can accurately and efficiently assess the legality of a given part.

> ROBOT construction rules in this section only apply to the construction of your ROBOT as it might be inspected. MATCH play rules and consequences for violating rules during MATCH play are outlined in section 11 Game Rules (G).

ROBOTS are made up of COMPONENTS and MECHANISMS. A COMPONENT is any part in its most basic configuration, which cannot be disassembled without damaging or destroying the part or altering its fundamental function. A MECHANISM is an assembly of COMPONENTS that provide specific functionality on the ROBOT. A MECHANISM can be disassembled (and then reassembled) into individual COMPONENTS without damage to the parts.

Many rules in this section reference Commercial-Off-The-Shelf (COTS) items. A COTS item must be a standard (i.e., not custom order) part commonly available from a VENDOR for all teams for purchase. To be a COTS item, the COMPONENT or MECHANISM must be in an unaltered, unmodified state (with the exception of installation or modification of any software). Items that are no longer commercially available but are functionally equivalent to the original condition as delivered from the VENDOR are considered COTS.

> Example 1: A team orders 2 ROBOT panels from RoboPanels Corp. and receives both items. They put 1 in their storeroom and plan to use it later. Into the other, they drill "lightening holes" to reduce weight. The first panel is still classified as a COTS item, but the second panel is now a FABRICATED ITEM, as it has been modified.
>
> Example 2: A team obtains openly available blueprints of a drive module commonly available from Wheels-R-Us Inc. and has local machine shop "We-Make-It, Inc." manufacture a copy of the part for them. The produced part is not a COTS item, because it is not commonly carried as part of the standard stock of We-Make-It, Inc.
>
> Example 3: A team obtains openly available design drawings from a professional publication and uses them to fabricate a gearbox for their ROBOT. The design drawings are considered a COTS item and may be used as "raw material" to fabricate the gearbox. The finished gearbox itself would be a FABRICATED ITEM, and not a COTS item.

Example 4: A COTS part that has non-functional label markings added would still be considered a COTS part, but a COTS part that has device-specific mounting holes added is a FABRICATED ITEM.

Example 5: A team has a COTS gearbox which has been discontinued. If the COTS gearbox is functionally equivalent to its original condition, it may be used.

A VENDOR is a legitimate business source for COTS items that satisfies all the following criteria:

A. has a Federal Tax Identification number. In cases where the VENDOR is outside of the United States, they must possess an equivalent form of registration or license with the government of their home nation that establishes and validates their status as a legitimate business licensed to operate within that country.
B. is not a "wholly owned subsidiary" of a *FIRST* team or collection of teams. While there may be some individuals affiliated with both a team and the VENDOR, the business and activities of the team and VENDOR must be completely separable.
C. should maintain sufficient stock or production capability so they are able to ship any general (i.e., non-*FIRST* unique) product within a timely manner. It is recognized that certain unusual circumstances (such as a global supply chain disruption and/or 1,000 *FIRST* teams all ordering the same part at once from the same VENDOR) may cause atypical delays in shipping due to backorders for even the largest VENDORS. Such delays due to higher-than-normal order rates are excused. This criterion may not apply to custom-built items from a source that is both a VENDOR and a fabricator.

For example, a VENDOR may sell flexible belting that the team wishes to procure to use as treads on their drive system. The VENDOR cuts the belting to a custom length from standard shelf stock that is typically available, welds it into a loop to make a tread, and ships it to a team. The fabrication of the tread takes the VENDOR 2 weeks. This would be considered a FABRICATED ITEM, and the 2-week ship time is acceptable. Alternately, the team may decide to fabricate the treads themselves. To satisfy this criterion, the VENDOR would just have to ship a length of belting from shelf stock (i.e., a COTS item) to the team within 5 business days and leave the welding of the cuts to the team.

D. makes their products available to all *FIRST* Tech Challenge teams. A VENDOR must not limit supply or make a product available to just a limited number of *FIRST* Tech Challenge teams.

The intent of this definition is to be as inclusive as possible to permit access to all legitimate sources, while preventing ad hoc organizations from providing special-purpose products to a limited subset of teams in an attempt to circumvent any applicable cost accounting rules.

FIRST desires to permit teams to have the broadest choice of legitimate sources possible, and to obtain COTS items from the sources that provide them with the best prices and level of service available. Teams also need to protect against long delays in availability of parts that will impact their ability to complete their ROBOT. The build season is brief, so the VENDOR must be able to get their product, particularly *FIRST* unique items, to a team in a timely manner.

Ideally, chosen VENDORS should have effective distribution channels. Remember, *FIRST* Tech Challenge events are not always near home – when parts fail, local access to replacement materials is often critical.

A FABRICATED ITEM is any COMPONENT or MECHANISM that has been altered, built, cast, constructed, concocted, created, cut, heat treated, machined, manufactured, modified, painted, produced, surface coated, or conjured partially or completely into the final form in which it will be used on the ROBOT.

> Note that it is possible for an item (typically raw materials) to be neither COTS nor a FABRICATED ITEM. For example, a 20 ft. (~610 cm) length of aluminum which has been cut into 5 ft. (~152 cm) pieces by the team for storage or transport is neither COTS (it is not in the state received from the VENDOR), nor a FABRICATED ITEM (the cuts were not made to advance the part towards its final form on the ROBOT).

Teams may be asked to provide documentation (i.e., reference the relevant rule in this manual) proving the legality of items during inspection where a rule specifies limits for a legal part (e.g., motors, servos, current limits, COTS electronics).

Some of these rules make use of English unit requirements for parts. If your team has a question about a metric-equivalent part's legality, please e-mail your question to customerservice@firstinspires.org for an official ruling. This process should also be employed to seek approval for alternate parts/devices for inclusion in future *FIRST* Tech Challenge seasons.

FIRST Tech Challenge can be a high-contact competition and may include rigorous gameplay. While the rules aim to limit severe damage to ROBOTS, teams should design their ROBOTS to be robust.

12.1 General ROBOT Design

R101 ***STARTING CONFIGURATION is limited to an 18-inch Cube.** In the STARTING CONFIGURATION (the physical configuration in which a ROBOT starts a MATCH), the ROBOT must be fully self-contained within an 18-inch wide, by 18-inch long, by 18-inch-high volume. The only exceptions are:

A. preloaded SCORING ELEMENTS may extend outside the starting size constraint, and
B. minor protrusions up to 0.25 inches (6.4 mm) by flexible materials (e.g., zip tie, surgical tube, string) may extend beyond the 18-inch (45.7 cm) size constraint.

> If a ROBOT uses interchangeable MECHANISMS per I303, teams should be prepared to show compliance with this rule and R104 in all configurations.

R102 ***ROBOTS may assist in holding the STARTING CONFIGURATION.** In the STARTING CONFIGURATION, ROBOTS must be fully self-supported (i.e., does not exert force on the sides or top of a sizing tool). ROBOTS may accomplish this using any combination of:

A. mechanical means while powered-off, and/or
B. initializing an OpMode that pre-positions servos and motors to a desired stationary position. OpMode may control motors and servos to hold their position to maintain the STARTING CONFIGURATION.

> ROBOTS holding STARTING CONFIGURATION during inspection or waiting for a MATCH to start may have to do so for several minutes and should limit the possibility of thermal failure (e.g., not having motors stalled against a hard stop). Teams must also be especially cautious when operating a running ROBOT during inspection, notifying the INSPECTOR that the ROBOT is live and taking every precaution to ensure the process is carried out safely.

R103 ***There is no ROBOT weight limit.** There is no explicit weight limit for *FIRST* Tech Challenge ROBOTS.

While there is no official weight limit, teams should still consider the impact of a ROBOT'S weight on various factors, including but not limited to:

- FIELD TILE damage
- battery consumption
- ROBOT transportation
- total ROBOT performance

R104 ***Keep it together.** Robots may not be designed to intentionally detach COMPONENTS.

R105 **There are expansion limits.** After the MATCH has started, ROBOTS may expand beyond the STARTING CONFIGURATION but are still subject to sizing constraints. The sizing constraints are:

A. *[game specific rules will be added at Kickoff on 9/6/2025]*

Figure 12-1: Expansion Limits

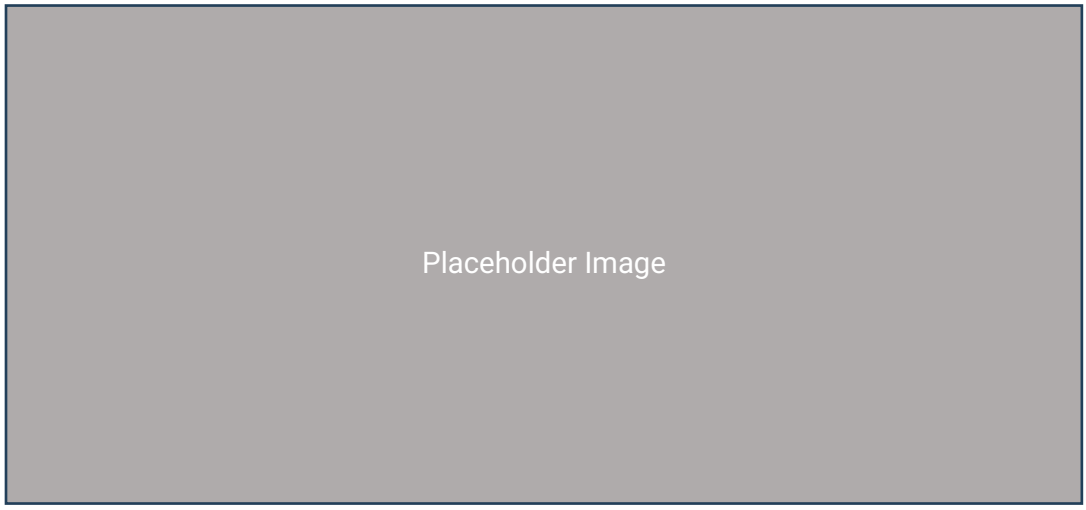
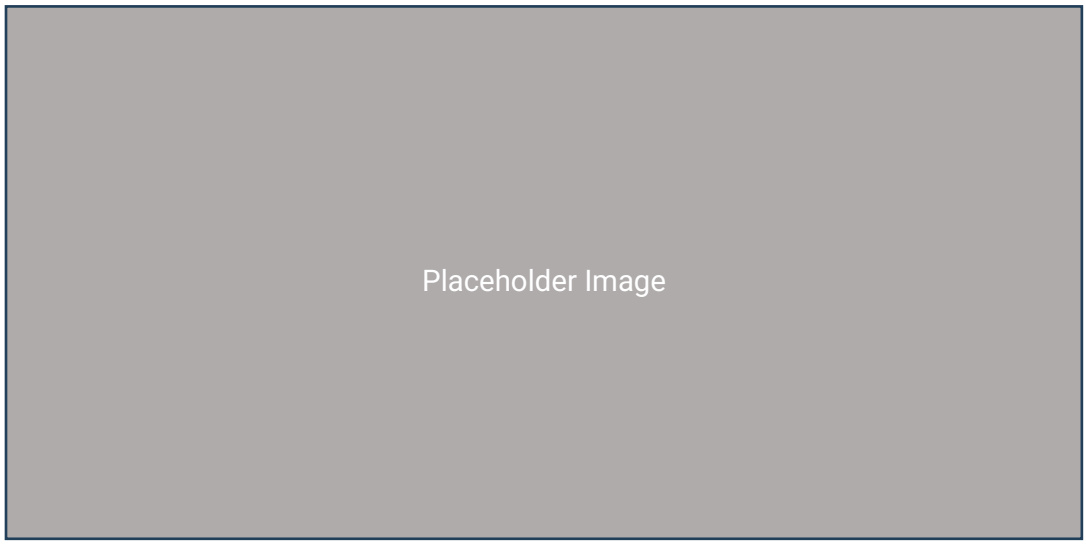


Figure 12-2: Expansion Limit Examples



12.2 ROBOT Safety & Damage Prevention

R201 ***Do not damage the TILE floor.** Traction devices must not have surface features which are known to damage the TILE floor. Traction devices are all parts of the ROBOT that are designed to transmit any propulsive and/or braking forces between the ROBOT and the FIELD.

> Examples of traction devices known to cause damage when used directly on TILE floors are high traction wheels (for example, AndyMark am-2256) and high grip tread (for example, Roughtop, AndyMark am-3309). While these (and other) COMPONENTS are not outright prohibited, e.g., used as part of an intake, MECHANISMS that involve these COMPONENTS contacting the TILE floor are not allowed.

R202 ***No exposed sharp edges.** Protrusions from the ROBOT and exposed surfaces on the ROBOT shall not pose hazards to the ARENA elements (including SCORING ELEMENTS) or people.

R203 ***Design ROBOTS for safety and fair play.** ROBOT parts shall not be made from hazardous materials, be unsafe, cause an unsafe condition, or interfere with the operations of other ROBOTS. Examples of items that will violate this rule include (but are not limited to):

A. shields, curtains, or any other devices or materials solely designed or used to obstruct or limit the vision of any DRIVE TEAM members and/or interfere with their ability to safely control their ROBOT,
B. speakers, sirens, air horns, or other audio devices that generate sound at a level sufficient to be a distraction,
C. any devices or decorations specifically intended to jam or interfere with the remote sensing capabilities of another ROBOT, including vision systems, acoustic range finders, sonars, infrared proximity detectors, etc. This includes imagery on your ROBOT that utilizes or closely mimics 36h11 AprilTags,
D. flammable gasses,
E. any device intended to produce flames or pyrotechnics,
F. hydraulic fluids or hydraulic items,
G. switches or contacts containing liquid mercury,
H. exposed, untreated hazardous materials (e.g., lead weights) used on the ROBOT. These materials may be permitted if painted, encapsulated, or otherwise sealed to prevent contact. These materials may not be machined in any way at an event,
I. high intensity light sources used on the ROBOT may only be illuminated for a brief time while targeting and may need to be shrouded to prevent any exposure to participants. Complaints about the use of such light sources will be followed by re-inspection and possible disablement of the device,
J. animal based materials,
K. any device designed to damage or flip competing ROBOTS, and
L. devices or conditions that pose an unnecessary risk of entanglement.

> Flashing lights can be particularly distracting and can cause harm to some individuals. Decorative or functional lighting which flashes at greater than 2Hz will invite additional scrutiny and teams may be asked to disable or modify their lighting at the discretion of the Head REFEREE and/or LRI.

R204 ***SCORING ELEMENTS stay with the FIELD.** ROBOTS must allow removal of SCORING ELEMENTS from the ROBOT and the ROBOT from FIELD elements while powered off.

> Teams must make sure that SCORING ELEMENTS and ROBOTS can be quickly, simply, and safely removed.
>
> Teams are encouraged to consider G501 when developing their ROBOTS.

R205 ***Do not make a mess on the FIELD.** ROBOTS may not contain any materials which if unintentionally released would damage the FIELD, other ROBOTS or delay the start of a MATCH due to required clean-up or decontamination. Lubricants may be used only to reduce friction within the ROBOT and must not contaminate the FIELD or other ROBOTS.

> Lubricants (e.g. grease) used on the ROBOT must not be excessively applied such that they spin off or drip off during normal ROBOT operations on the FIELD.
>
> Additional examples of items that will violate this rule include (but are not limited to):
>
> – any ballast not secured sufficiently, including loose ballast such as sand, coffee beans, kitty litter, or ball bearings, such that it may be released on the FIELD during a MATCH
> – liquid or gel materials
> – tire sealant, and
> – other lubricants

R206 ***Do not damage SCORING ELEMENTS.** ROBOT elements likely to contact SCORING ELEMENTS shall not pose a significant hazard to the SCORING ELEMENT.

> SCORING ELEMENTS are expected to undergo a reasonable amount of wear and tear as they are handled by ROBOTS, such as scratching or marking. Gouging, tearing off pieces, or routinely marking SCORING ELEMENTS are violations of this rule.

R207 ***No air power on the ROBOT.** ROBOTS may not use any closed air devices such as but not limited to pneumatic solenoids or cylinders, gas storage vessels, gas springs, compressors, or vacuum generating devices. Air-filled (pneumatic) wheels are exempt from this rule.

R208 ***No grabbing the floor.** ROBOTS may not use any mechanism which is designed to increase downforce by either grabbing FIELD surfaces or by using some form of generated airflow to provide downward suction.

12.3 Fabrication

R301 ***COTS MECHANISMS are legal but have limits.** COTS MAJOR MECHANISMS (as defined in I301) purposefully designed to complete a game task are prohibited. Allowed exceptions to this rule are:

A. COTS drive CHASSIS, provided none of the individual parts violate any other rules, and
B. COTS MAJOR MECHANISMS created as part of the official *FIRST* Tech Challenge Starterbots (as listed with the Season Materials)

> COTS parts are intended to help teams design and build ROBOT MECHANISMS to complete game tasks and solve challenges but are not intended to be purpose-built complete bolt-on out-of-the-box solution to complete game objectives.

R302 ***Legal COTS parts and raw materials can be modified.** Allowed raw materials and legal COTS parts can be modified (drilled, cut, painted, etc.) as long as no other rules are violated.

> Raw materials refers to unfinished building stock such as but not limited to:
>
> – sheet stock
> – extruded shapes
> – metals, plastic, rubber, and wood
> – magnets

R303 ***COTS must be single DoF.** COTS COMPONENTS and MECHANISMS must not exceed a single degree of mechanical freedom (DoF). Examples of allowed COTS single degree of freedom MECHANISMS and COMPONENTS are as follows:

A. linear slide kit,
B. linear actuator kit,
C. single speed (non-shifting) gearboxes,
D. pulley,
E. turntable,
F. lead screw, and
G. single DoF gripper.

Allowed exceptions to this rule are:

H. ratcheting devices (wrenches, bearings, etc.),
I. holonomic wheels (omni or mecanum),
J. dead-wheel odometry kits,
K. items that transfer motion between misaligned COMPONENTS (such as universal joints, flexible shaft couplers, and similar items), and
L. items that connect structures at variable angles (such as ball joint linkages, rod ends, and similar items).

> The intent of this rule also extends to disallow highly specialized individual COMPONENTS only designed to assemble into a multiple DoF COTS COMPONENT.
>
> The general test for a single degree of freedom MECHANISM is whether the orientation and position of each COMPONENT in the MECHANISM can be generally predicted based on the orientation and position of a single COMPONENT (such as the input) of the system.
>
> Example 1: A mecanum drivetrain is made up of four independent drive modules, each with a single DoF (ignoring the DoF of the mecanum wheels as allowed by this rule), attached to a common structure (e.g., chassis). The overall MECHANISM is still a single DoF.
>
> Example 2: Dead wheel odometry modules, allowed by this rule, are typically composed of a 1 DoF wheel (ignoring the effect of the holonomic wheel) providing forward/backwards motion and a spring force providing an additional unique rotational or vertical motion, creating a two DoF system.
>
> Example 3: Simple gripper claws, comprised of a single actuator moving two gripper jaws simultaneously or double actuators each controlling an independent gripper jaw, are by and large a single DoF. However, grippers that incorporate

additional actuators providing additional twisting and/or bending actions (like a wrist) add degrees of freedom that are prohibited in COTS MECHANISMS.

R304 ***Custom parts can be reused year to year.** FABRICATED ITEMS created before Kickoff are permitted.

R305 ***Custom designs and software can be reused year to year.** ROBOT software and designs created before Kickoff are permitted.

R306 ***SCORING ELEMENTS are not allowed for ROBOT construction.** Current season SCORING ELEMENTS or replicas of SCORING ELEMENTS are not allowed to be used as part of ROBOT construction or for any other team supplied SCORING ELEMENTS.

R307 ***During an event, work can occur outside of pit hours.** During an event a team is attending (regardless of whether the team is physically at the event location), the team may work on or practice with their ROBOT or ROBOT elements outside of the hours that pits are open.

For teams who chose to work offsite during an event please work smart and safely. Ensure team members get adequate rest and have sufficient adult supervision during afterhours and off-site work.

Note that E107 and E108 impose additional restrictions on work done on the ROBOT or ROBOT materials while attending an event.

12.4 ROBOT SIGN Rules

A ROBOT SIGN is a required assembly which attaches to the ROBOT. A ROBOT SIGN simultaneously identifies a ROBOT'S team number as well as its ALLIANCE affiliation for FIELD STAFF. Criteria used in writing these rules include the following:

- Maximize FIELD STAFF'S ability to determine team number and ALLIANCE of a ROBOT,
- Minimize the amount of design challenge in creating ROBOT SIGNS, and
- Increase consistency in displaying ROBOT identification.

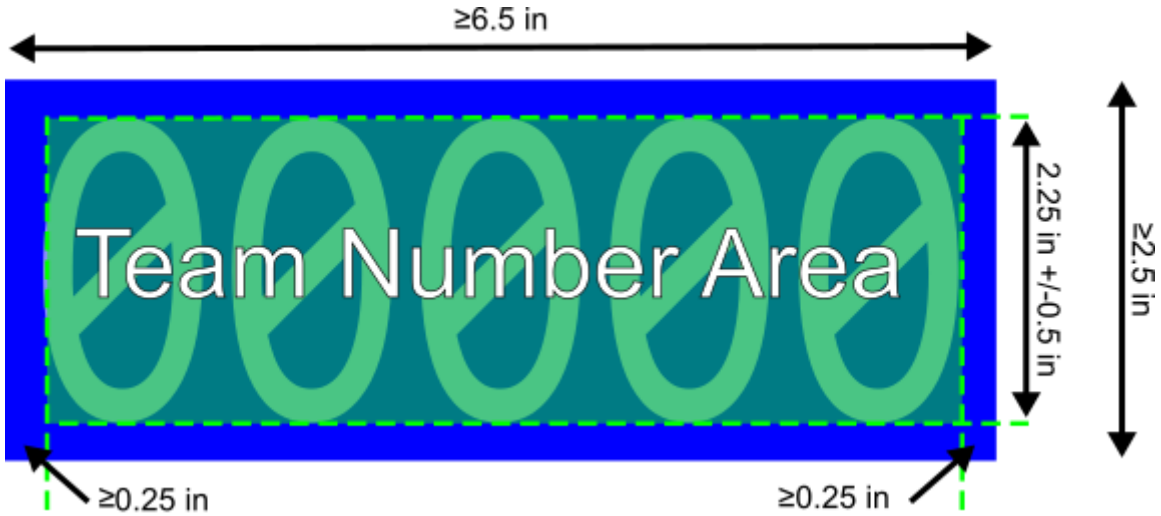
R401 ***Two ROBOT SIGNS per ROBOT.** ROBOT SIGNS must be placed in at least two separate locations on the ROBOT. These locations must be on opposite or adjacent surfaces of the ROBOT, ≥90 degrees apart. All ROBOT surfaces visible to FIELD STAFF can be used for placing ROBOT SIGNS including the top of the ROBOT. ROBOT SIGNS must meet the following criteria:

A. be made of a robust material,
B. minimally be 6.5 inches (16.5 cm) wide),
C. minimally be 2.5 inches (6.4 cm) tall (Figure 12-3), and
D. be supported by the structure/frame of the ROBOT.

The intent of this rule is for FIELD STAFF to easily view ROBOT SIGNS from at least 12 feet (3.66 meters) away before, during, and after the MATCH.

Examples of robust materials that satisfy this rule include, but are not limited to, acrylic, plastic laminated paper, wood, and metal. ROBOT SIGNS must be designed to withstand vigorous game play.

Figure 12-3: Team Number ROBOT SIGN Sizing



R402 ***ROBOT SIGNS indicate your ALLIANCE.** Each ROBOT SIGN must contain a rectangle with a solid red or blue opaque background at least 6.5 in. by 2.5 in. (16.50 cm by 6.35 cm) in size to indicate their ALLIANCE color (Figure 12-3), as assigned in the MATCH schedule at the event. Visible markings on ROBOT SIGNS when installed on the ROBOT, other than the following, are prohibited:

A. those required per R403,
B. solid white *FIRST* logos no larger than 1.5 in. (3.80 cm) in height (Figure 12-5),
C. small amounts of hook-and-loop tape, hard fasteners, or functional equivalents,
D. narrow areas of differing colors exposed at corners, folds, or cutouts,
E. dark narrow markings on background solely for template purposes, and
F. cannot be powered or rely on power from any sources to illuminate/reveal ALLIANCE color.

ROBOT SIGNS that are reversible or configurable must not allow the opposite ALLIANCE color to be visible to FIELD STAFF, except where permitted by this rule.

Figure 12-4: Minimum sized ALLIANCE rectangle

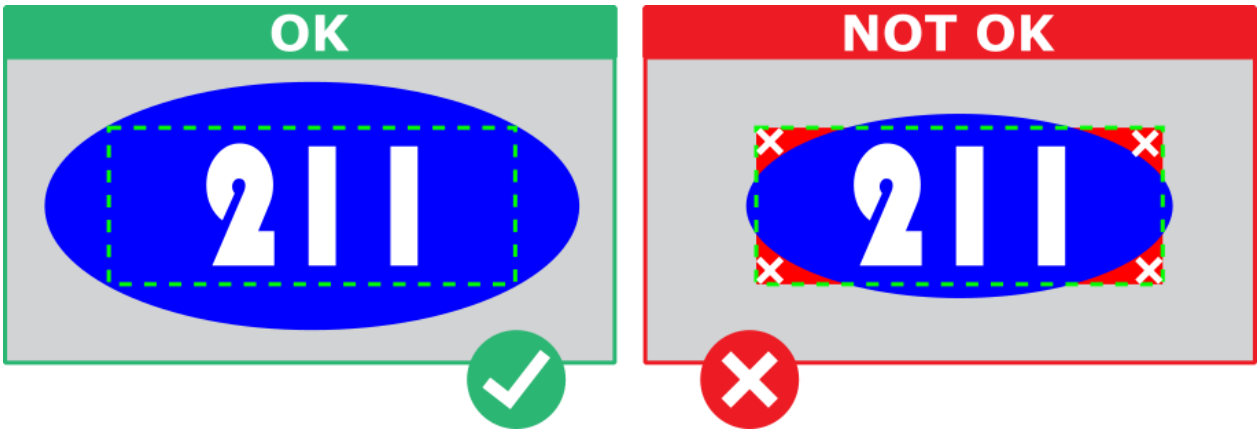


Figure 12-5: Legal team number display for team 117 playing on the red ALLIANCE

R403 ***Team number on ROBOT SIGNS,** Team numbers must be displayed and positioned on the ROBOT SIGN as shown in Figure 12-3, Figure 12-6, and Figure 12-7 and meet the following additional criteria:

A. consist of solid opaque white Arabic numbers (e.g., 1,2,3,4) which are 2.25 in. (+/-0.5 in.) tall 5.70 cm. (+/- 1.25 cm.),
B. there must be a minimum of 0.25 in. (0.60 cm) of background surrounding the numbers,
C. numbers may not be vertically stacked (Figure 12-7),
D. be made of robust materials, and
E. cannot be powered or rely on power from any sources to illuminate/reveal numbers.

Figure 12-6: Legal number for team 21001 playing on the blue ALLIANCE

Figure 12-7: Team number orientation examples for team 1355 playing on the blue ALLIANCE

If a team at an event does not have completely legal ROBOT SIGNS, and there is no color printer or other means available at the event to create a legal ROBOT SIGN, the Head REFEREE may approve an alternate substitute for use at the event.

Team numbers must be robust enough to withstand the rigors of MATCH play. Example robust materials include:

- self-adhesive numbers (mailbox or vinyl numbers)
- ink jet or laser printed numbers on paper and laminated or protected from ROBOT-to-ROBOT interaction.

Examples of prohibited team numbers on ROBOT SIGNS include but are not limited to:

- team numbers only visible by edge lit engraved plastic
- LED Display numbers

12.5 Motors & Actuators

R501 ***Allowable motors.** The only allowed motor actuators are:

Table 12-1: Motor allowances

Motor Name	Part Numbers Available	Notes
AndyMark NeveRest 12V DC	am-3104, am-3104b	
AndyMark NeveRest Hex 12V DC	am-3104c	
goBILDA Yellow Jacket 520x Series 12V DC	5201-0002-0026, etc.	5201, 5202, 5203, and 5204 series
goBILDA 5000 Series 12V DC	5000-0002-4008, etc.	
Modern Robotics / MATRIX 12V DC	5000-0002-0001	
REV Robotics HD Hex 12V DC	REV-41-1291	
REV Robotics Core Hex 12V DC	REV-41-1300	
Studica Robotics Maverick 12V DC	75001	
TETRIX MAX 12V DC	739530, 39530	Discontinued
TETRIX MAX TorqueNADO 12V DC	W44260	
[Additional motors may be added on or after Kickoff]	TBD	
Factory installed vibration and autofocus motors resident in COTS computing devices (e.g., rumble motor in a smartphone); can only be used as part of the device and cannot be removed and/or repurposed. These motors do not count toward the limit in R503.		
Motors integral to a COTS sensor (e.g., LIDAR, scanning sonar), provided the device is not modified except to facilitate mounting. These motors do not count toward the limit in R503.		

Additional motors may be added to the legal motor list in future competition manual updates.

Many legal gearmotors are sold with labeling based on the entire assembly. These motors may be used with or without the provided gearbox, and/or with any other compatible gearbox.

R502 ***Allowable servos.** Servo actuators must meet the requirements below. Servos must be compatible with the power regulation devices they are ultimately used with (per R505) and may include additional servo position output interfaces (e.g., 4th Wire Position Feedback).

Table 12-2: Servo Requirements at 6V

Actuator Class	Mechanical Output Power	Stall Current	Example Servos (including, but not limited to)
Servo	≤ 8 watts @6V	≤ 4 amps @6V	AndyMark High-Torque Servos (am-4954)
			Axon MAX+ Servo (Axon MAX+)
			DSSERVO 35KG Coreless (DS3235MG)
			FEETECH Digital Servo (FT5335M-FB)
			goBILDA Dual Mode Servo (2000-0025-0003)
			REV Robotics Smart Servo (REV-41-1097)
			Studica Multi-Mode Smart Servo (75002)
Linear Servo	N/A	≤ 1 amps @6V	Actuonix Micro Linear Servo (P8-100-252-12-R)
			Hitec Linear Servo (HLS12-3050-6V)
			Studica Linear Servo RC Actuator (75014)
Servo mechanical output power is approximated by the following formula (using 6V data reported by manufacturer): • **Mechanical Output Power** = **0.25** x (**Stall Torque** in *N-m*) x (**No Load Speed** in *rad/s*)			

Servos must meet both requirements to be legal for use. Refer to the Inspection Quick Reference *(link coming soon)* document for a list of servos that are pre-approved, otherwise teams must be able to provide documentation verifying servo specifications. Use the online calculator to verify output power compliance.

If a manufacturer does not provide 6V specs, any specs for voltages that exceed 6V are allowed to be used.

Stall current is the maximum stall current possible for the device at the specified voltage, regardless of any user or VENDOR adjustable software limits that may be available within the servo.

It is important to ensure the voltage provided by the intended power regulation device is within the operating voltage range of the desired servo. The REV Control Hub and REV Expansion Hub provide 5V to servos, and the goBILDA Servo Power Injector, REV Servo Power Module, Studica Servo Power Block, and REV Servo Hub provide 6V to servos. While virtually all servos are compatible with 6V, servos with an operating voltage range of 6-8.4 DCV, for example, may not work properly when only provided 5V.

R503 ***ROBOTS are limited to a total of 8 motors and 10 servos.** A ROBOT may not have more than 8 motors and 10 servos from the allowable actuator lists per R501 and R502 for all MECHANISMS used in all configurations.

> If a ROBOT has multiple configurations used at a single event which use different MECHANISMS, the sum total of all motors and servos must be less than or equal to the limit set in this rule.
>
> For servos, note that each REV Expansion Hub and REV Control Hub provide 5V and are limited to a max current output of 5A total shared across all servo ports and the +5V auxiliary power port, with a 2A maximum limit across paired servo ports (10W of maximum electrical output power per port pair, 25W total). Teams should make sure that their total servo power usage always remains below this limit.
>
> Given the extensive number of motors and servos allowed on the ROBOT, teams are encouraged to consider the total power available from the ROBOT battery during the design and build of the ROBOT. Drawing large amounts of current from many motors and/or servos at the same time could lead to drops in ROBOT battery voltage that may result in exceeding the battery fuse limits or browning out the control system leading to power loss or communications loss.

R504 ***Do not modify actuators unless explicitly allowed.** The integral mechanical and electrical system of any motor or servo must not be modified. Motors and servos used on the ROBOT shall not be modified in any way, except as follows:

A. the mounting brackets and/or output shaft/interface (including pinion gears) may be modified to facilitate the physical connection of the motor to the ROBOT and actuated part,
B. the electrical leads may be trimmed to length as necessary and connectors or splices to additional wiring may be added (per R503), and purely electrical enclosures can be substituted with functionally equivalent replacements,
C. servos may be modified as specified by the manufacturer (e.g., re-programming or modification for continuous rotation),
D. minimal labeling may be applied to indicate device purpose, connectivity, functional performance, etc. as long as the team applied label does not obstruct the markings used to identify the device,
E. insulation may be applied to electrical terminals,
F. repairs, provided the original performance and specifications are unchanged, and
G. maintenance recommended by the manufacturer.

R505 ***All actuators must be controlled and powered through approved devices.** With the exception of servos, fans, or motors integral to sensors of COTS computing devices permitted in R501, all actuator control signals must originate from a power regulating device. The only power regulating devices for actuators permitted on the ROBOT are:

Table 12-3: Power Regulators and Limits

Power Regulating Device	Part Number	Load Limit per Device
goBILDA 6V Servo Power Injector	3125-0001-0001	2 Servos per Port
REV Control Hub or Expansion Hub Motor Ports	REV-31-1153 / REV-31-1595	2 Motors per Port
REV Control Hub or Expansion Hub Servo Ports	REV-31-1153 / REV-31-1595	2 Servos per Port
REV Servo Power Module	REV-11-1144	2 Servos per Port
REV Robotics Servo Hub	REV-11-1855	2 Servos per Port
REV SPARKmini	REV-31-1230	2 Motors per Device
Studica Servo Power Block	75005	2 Servos per Port

R506 ***No relays or alternative electrical actuation.** The application of electromechanical actuation through the use of additional relays, electromagnets, electrical solenoid actuators, or related systems is prohibited. In addition, the use of relays and electromagnets is also prohibited.

12.6 Power Distribution

In order to maintain safety, the rules in this section apply at all times while at the event, not just while the ROBOT is on the FIELD for MATCHES.

R601 ***Battery limit – everyone has the same main ROBOT power.** The only legal source of electrical energy for the ROBOT control system and actuation during the competition, the ROBOT battery, must be 1 and only 1 approved 12V NiMH main battery. The ROBOT main battery must have a COTS equivalent in-line 20A ATM mini blade fuse installed. Installed connectors may be replaced with other popular connectors such as Anderson Powerpole, XT30, or any connector with a comparable power rating. The only allowed ROBOT main power battery packs are:

Table 12-4: Legal ROBOT Main Power Battery Packs

Battery Pack	Part Number	Notes
AndyMark Flat Pack Battery DC 12V	am-5290	
goBILDA 12V NiMH Nested Battery	3100-0012-0020	
Matrix 12V 3000mAh NiMH	14-0014	May be labeled as “Modern Robotics”
REV 12V Slim Battery	REV-31-1302	
Studica 12V 3000mAh NiMH	70025	
TETRIX MAX 12V 3000mAh NiMH	W39057	Formerly 739023

There are many other similar style batteries available from multiple VENDORS, but only the listed manufactures and part numbers are legal for use at *FIRST* Tech Challenge Events.

Batteries should be charged in accordance with manufacturer's specification. (Please see the *FIRST* Safety Manual for additional information.)

R602 ***Other batteries are only allowed for peripheral devices and LEDs only.** COTS USB battery packs with a capacity of 100Wh or less (27,000mAh at 3.7V), with 5V/5A max output or 12V/5A max output using USB-PD per port, and batteries integral to a self-contained camera (e.g., GoPro style camera) may be used provided they are:

A. connected only using unmodified COTS cables,
B. charged according to manufacturer recommendations,
C. securely fastened to the ROBOT,
D. not supplement power to any of the ROBOT actuators, and
E. not used by any devices receiving control signals from the ROBOT control system (i.e., COTS USB battery packs must remain electrically isolated from the ROBOT power systems.). Exceptions to part E of this rule are:
   i. powered USB Hubs, and
   ii. ROBOT CONTROLLER smartphones.

For example, a REV Blinkin powered by a COTS USB battery pack cannot be controlled by signals from a REV Control or Expansion Hub. Any device receiving signals from a REV Control or Expansion Hub must be powered by the main ROBOT battery.

R603 ***Charge batteries with safe connectors.** Any battery charger used to charge a ROBOT battery must have a corresponding polarized connector installed.

Batteries must never be charged using alligator clips or similar.

R604 ***Charge batteries at a safe rate.** Any battery charger used to charge a ROBOT battery may not be used such that it exceeds a 3-amp average charge current. Follow all manufacturer recommendations when charging batteries.

R605 ***Batteries are not ballast.** No batteries other than those allowed per R601 and R602 are allowed on the ROBOT, whether or not they are being used to supply power.

For example, teams may not use additional batteries as extra weight on their ROBOTS.

R606 ***Batteries should be securely mounted.** The ROBOT battery must be secured such that it will not dislodge during vigorous ROBOT interaction including if the ROBOT is turned over or placed in any arbitrary orientation. Batteries must be mounted such that they are protected from direct contact with other ROBOTS or any sharp edges.

R607 ***Electrical connections should be robust and must be insulated.** All electrical paths may include intermediate elements such as COTS connectors (Anderson Powerpole, XT30, and similar crimp or quick-connect style connectors), splices, COTS flexible/rolling/sliding contacts, and COTS slip rings, as long as the entire electrical pathway is via appropriately gauged/rated elements and all connections are protected from accidental electrical shorts

Teams are strongly encouraged to insulate all exposed electrical terminations or provide physical barricades to protect from accidental electrical shorts.

R608 ***Limit non-battery energy.** Non-electrical sources of energy used by the ROBOT (i.e., stored at the start of a MATCH) shall come only from the following sources:

A. a change in the altitude of the ROBOT center of gravity, or
B. storage achieved by deformation of ROBOT parts including, but not limited to, springs, rubber bands, surgical tubing, etc.

R609 ***Connect the ROBOT battery though the Main Power Switch.** Exactly one main power switch must control all power provided by the ROBOT battery pack to all power regulating devices on the ROBOT (except as specified by R602) such that all the following conditions are met:

A. must be one of the following approved power switches:

Table 12-5: Legal Power Switches

Power Switch	Part Number
AndyMark FTC Power Switch w/ Bracket	am-4969
goBILDA Floodgate Power Switch	3103-0005-0001
REV Switch Cable and Bracket	REV-31-1387
Studica On/Off Power Switch Kit	70182
TETRIX R/C Switch Kit	W39129

B. must be mounted or located where it is accessible to the team and FIELD STAFF
C. secondary power switches can be used on the 12V line downstream of the main power switch.

There are no specific location requirements for the main power switch, but it should be located clear of any moving parts and other obstructions that would block its access during normal ROBOT operations.

Examples considered not “quickly and safely accessible” include main power switches covered by an access panel or door, or mounted on, underneath or immediately adjacent to moving COMPONENTS.

The main power switch should be mounted on the ROBOT, so it is protected from ROBOT-to-ROBOT contact to avoid inadvertent actuation or damage.

R610 ***Fuse ratings should not be altered.** Fuses must not be replaced with fuses of higher rating than originally installed or according to manufacturer's specifications; fuses may not be shorted out. Fuses must not exceed the rating of those closer to the battery. If necessary, a fuse may be replaced with a smaller rating. Replaceable fuses must be single use only; self-resetting fuses (breakers) are not allowed.

R611 ***The ROBOT frame is not a wire.** All wiring and electrical devices shall be electrically isolated from the ROBOT frame. The ROBOT frame must not be used to carry electrical current. Electrically grounding the control system electronics to the frame of the ROBOT is only permitted such that all of the following conditions are met:

A. straps/cables used must be from the following approved parts:

Table 12-6: Legal ROBOT Grounding Straps

Grounding Strap	Part Number
AndyMark Resistive Grounding Strap	am-4648a
REV Resistive Grounding Strap	REV-31-1269
Swyft Grounding Cable	SR-Ground-01

B. the strap/cable must directly connect to a fully COTS COMPONENT with an XT30 connector, and also must connect directly to the frame of the ROBOT (via the resistive terminal), and
C. no ROBOT COMPONENTS or MECHANISMS are designed to electrically ground the ROBOT frame to the FIELD.

> Compliance with this rule can be checked by unplugging the battery from the ROBOT main power switch assembly and observing a >120Ω resistance between the (+ / red) input terminal of the ROBOT main power switch assembly in the "ON" position or the (- / black) input terminal of the ROBOT main power switch assembly and any electrically connected point on the ROBOT. Most aluminum has a clear anodizing layer or oxidation layer on it that acts as an insulator. In order to make a good electrical connection with the grounding strap to the frame, it may be necessary to scratch/file/remove the anodize/oxidation layer from the area of contact with the metal first.
>
> Note that some cameras, decorative lights, and sensors (some encoders, some IR sensors, etc.) have grounded enclosures or are manufactured with conductive plastics. These devices must be electrically isolated from the ROBOT frame to ensure compliance with this rule.
>
> Examples of devices with COTS XT30 connectors include but are not limited to the REV Control Hub (REV-31-1595), a COTS XT30 power distribution block (such as a REV-31-1293), or a COTS Anderson Powerpole to XT30 Adapter (such as REV-31-1385). For additional details on installation of the grounding strap, please see the ROBOT Wiring Guide.

R612 ***Electrical system must be inspectable.** All power regulating devices (per R505), associated wiring, and all fuses must be visible for inspection.

> "Visible for inspection" does not require that the items be visible when the ROBOT is in STARTING CONFIGURATION, provided the team can make the items viewable during the inspection process.

R613 ***No high voltage allowed except for LEDs.** Any active electrical item that is not an actuator (specified in R501) or power regulation device (specified in R505) is considered a CUSTOM CIRCUIT. CUSTOM CIRCUITS shall not provide regulated output voltages exceeding 5V, except if solely used for powering LEDs, but may pass through unregulated battery voltage.

R614 ***Energize Power Regulating Devices as specified.** All power regulating devices (R505) must be powered per the manufacturer's instructions and the following table must be true:

Table 12-7: Power Regulation Device Power Requirements

Power Regulating Device	Part Number	Method of Powering
goBILDA 6V Servo Power Injector	3125-0001-0001	Only powered using the XT30 connectors on the device by the ROBOT main battery
REV Control Hub / REV Expansion Hub	REV-31-1153 / REV-31-1595	Only powered using the XT30 connectors on the device by the ROBOT main battery
REV Servo Power Module	REV-11-1144	Only powered using the screw terminals and must only be powered by the ROBOT main battery
REV Robotics Servo Hub	REV-11-1855	Only powered using the power terminals and must only be powered by the ROBOT main battery
REV SPARKmini	REV-31-1230	Only powered by the Power input and must only be powered by the ROBOT main battery
Studica Servo Power Block	75005	Only powered by JST-VH power connector, and must only be powered by the ROBOT main battery

R615 ***Use appropriately sized wire.** All circuits shall be wired with appropriately sized insulated copper wire (SIGNAL LEVEL cables do not have to be copper):

Table 12-8: Wire sizing requirements

Application	Minimum Wire Size
12V Main Battery Power	18 AWG (19 SWG or 1 mm^2)
Motor Power (unless otherwise listed)	
11-20A fuse protected circuit	
Motor Power - TETRIX MAX 12V DC Motors, REV Robotics Core Hex (REV-14-1300)	22 AWG (22 SWG or 0.5 mm^2)
PWM / Servo	
LEDs (5V / 12V)	
≤10A fuse protected circuit	
SIGNAL LEVEL circuits (i.e., circuits which draw ≤1A continuous and have a source incapable of delivering >1A, including but not limited to: I2C, DIO, Analog, encoder and RS485 connections)	28 AWG (29 SWG or .08 mm^2)

Integrated wires originally attached to legal COTS devices or wires included/sold by the manufacturer are considered part of the device and by default legal. Such wires are exempt from this rule.

In order to show compliance with these rules, teams should use wire with clearly labeled sizes if possible. If unlabeled wiring is used, teams should be prepared to demonstrate that the wire used meets the requirements of this rule (e.g., wire samples and evidence that they are the required size).

R616 ***Use specified wire colors.** All non-SIGNAL LEVEL wiring with a constant polarity (i.e., except for outputs of motor controllers, or sensors) shall be color-coded along their entire length from the manufacturer as follows:

A. red, yellow, white, brown, or black-with-stripe on the positive (e.g. +12VDC, +5VDC, etc.) connections, and
B. black or blue for the common or negative side (-) of the connections.

Exceptions to this rule include:

C. wires that are originally attached to legal devices and any extensions to these wires using the same color as the manufacturer.

> Multi-conductor (also known as multi-core) cables that do not adhere to the specified color-coding may be used, on the condition that the insulation of all exposed conductors is re-identified to comply with the rule. This can be achieved by applying colored electrical tape, colored heat shrink, or another compliant method to distinguish each conductor.

R617 ***Powered USB hubs must draw energy from approved sources.** Powered USB hubs used on the ROBOT can only be powered through one of the following ways:

A. an approved COTS USB battery Pack per R602, or
B. the 5V auxiliary power port on the REV Expansion Hub or REV Control Hub.

R618 ***Do not modify critical power paths.** CUSTOM CIRCUITS shall not directly alter the power or control pathways between:

A. the ROBOT battery and main power switch,
B. the main power switch and a power regulating device (per R609),
C. any two power regulating devices (per R613), or
D. power regulating devices and actuators.

> Custom high impedance voltage monitoring or low impedance current monitoring circuitry connected to the ROBOT'S electrical system is acceptable if the effect on power pathways is inconsequential.
>
> Altering a power pathway includes, but is not limited to, altering the voltage of the power pathway using a boost (DC voltage step-up) or buck (DC voltage step-down) converter or otherwise altering the natural variable DC voltage provided by the ROBOT battery to create a constant DC voltage.
>
> Devices that modify actuator control signals or power (except those allowed by R505) are prohibited, such as the goBILDA Servo Travel Tuner.

R619 ***Do not mix and match power on or between power regulation devices.** The following rules must be adhered to when using power on any power regulation device (per R505):

A. other than power used to energize the power regulation device (per R614) no power originating outside the power regulation device may be used on or with devices connected to the power regulation device. The only exceptions are connections intended for communication between devices (RS485/USB/PWM/etc.),

> Example 1: The +5V port on a REV Expansion Hub cannot be used to power devices connected to a REV Control Hub's I2C ports.

Example 2: A regulated 5V output provided by a CUSTOM CIRCUIT cannot be used to power an I2C device connected to a REV Control Hub.

B. power originating from ports/connectors on power regulation devices may only be used for devices directly connected to that port/connector. The only exception to this is +5V power from the +5V power port on the REV Control Hub or REV Expansion Hub may be used in conjunction with any Analog, Digital, or I2C port on that device. In addition, the +5V power port may be used to power external devices, and

Example 1: The power provided by Digital Port 0-1 on a REV Control Hub should not be used to power devices connected to I2C Port 0. However, power provided by Digital Port 0-1 can be used to power devices connected to both signal channels N and N+1 on Digital Port 0-1.

Example 2: The +5V power can be used to power external devices such as externally powered USB hubs (per R617).

Example 3: The power provided by multiple servo ports cannot be combined into a single power bus for one or more servos.

C. 6V power provided by the goBILDA 6V Servo Power Injector, REV Servo Power Module, REV Robotics Servo Hub, or Studica Servo Power Block may only be used for powering servos.

12.7 Control, Command & Signals System

R701 ***Control the ROBOT with a single ROBOT CONTROLLER.** ROBOTS must be controlled via 1 programmable ROBOT CONTROLLER. The ROBOT CONTROLLER is the only source of control for the ROBOT actuators and must be comprised of:

A. REV Control Hub (REV-31-1595), or
B. an allowed smartphone Android device connected to a REV Expansion Hub (REV-31-1153)

In addition to A or B, a ROBOT may also contain:

C. no more than one additional REV Expansion Hub (REV-31-1153).

R702 ***Teams may not alter coprocessor software.** Modifying software on coprocessors, unless explicitly permitted in this rule or rule R703, is not allowed by teams. Firmware updates in binary form provided by the manufacturer may be applied as directed by the manufacturer.

The following are examples of allowed devices:

Example 1: The Adafruit BNO055 Absolute Orientation Sensor is an IMU package with an onboard ARM Cortex-M0 based coprocessor to crunch sensor data and produce composite output. Its coprocessor contains software that is not intended by the manufacturer to be modified by users.

Example 2: The SparkFun Optical Tracking Odometry Sensor is a laser and IMU tracking device that uses an onboard microcontroller to perform complex calculations and produce simplified results. SparkFun does provide the source code and toolchain for advanced users to modify/update the software, which is not permitted by this rule. Firmware updates provided by SparkFun are allowed to be applied to the device.

Example 3: The Digital Chicken Labs OctoQuad FTC Edition is an 8-channel encoder/PWM interface, utilizing a Raspberry Pi Pico coprocessor. Teams are not permitted to modify software running on the device, including replacing the software with their own. Updates provided in binary form by the manufacturer (Digital Chicken Labs) may be applied to the device.

R703 ***Some vision coprocessors can be programmed.** Programmable vision coprocessors that are natively supported by the FTC SDK may be programmed. The programmable vision coprocessors that are supported are:

Table 12-9: Supported programmable vision coprocessors

Device	Part Number
Limelight Vision Limelight 3A	LL_3A

Example 1: Optical Flow sensors are an example of a sensor that utilizes a vision coprocessor that is treated no differently than other coprocessors per R702.

Example 2: The DFRobot HuskyLens and the Charmed Labs Pixy2 are examples of vision coprocessors that are configurable but not programmable and are treated no differently than other coprocessors per R702.

Example 3: The OpenMV Cam, Luxonis OAK-1, and LimeLight Vision Limelight 3G are examples of programmable vision coprocessors that are prohibited.

See R715 for more information regarding vision coprocessor support.

R704 ***Use only legal Android smartphone devices.** Android smartphone devices, if used, must minimally be running the Android 7 (Nougat) operating system. The following table lists the legal Android smartphones:

Table 12-10: Legal Android Smartphones

Phone	Notes
Motorola Moto G4 Play	Sometimes noted as “4th Generation”
Motorola Moto G5	
Motorola Moto G5 Plus	
Motorola Moto E4	USA versions only, includes SKUs XT1765, XT1765PP, XT1766, and XT1767
Motorola Moto E5	XT1920
Motorola Moto E5 Play	XT1921

Some supported models still using Android 6.x (Marshmallow) might be updatable by the Motorola Software Fix Tool.

Teams outside North America with extenuating circumstances (such as international purchasing limitations) are allowed to use alternate Android smartphones if necessary. Teams doing so must send an email each season to customerservice@firstinspires.org with the following details:

- Subject of email should be: “Alternate FTC Android Phone Use”
- Team number and region, including reason for using an alternate smartphone
- Smartphone make and model, including version of Android OS in use

R705 ***Smartphone android devices used as a ROBOT CONTROLLER must connect to the REV Expansion Hub using USB.** If used as a ROBOT CONTROLLER, the smartphone android device must be connected via its integrated micro-USB port to a REV Expansion Hub either:

A. a mini-USB to OTG Micro Cable, or
B. any combination of Mini USB Cable, a USB Hub (powered or unpowered) and an OTG Micro adaptor (the OTG functionality can be integrated into the USB Hub).

R706 ***Bandwidth is restricted.** Software with access to the ROBOT network must limit the amount of data being streamed (i.e., continuous transmission of data) over Wi-Fi. Software may only stream robot control data, debugging data, and telemetry to and from the ROBOT. No continuous video stream is allowed.

R707 ***Configure devices for your team number.** The ROBOT CONTROLLER, DRIVER STATION, and any spares used must be configured/named to correspond to the correct team number as follows:

A. ROBOT CONTROLLER should be named <team number>-RC (e.g., 12345-RC),
B. DRIVER STATION should be named <team number>-DS (e.g., 12345-DS), and
C. If a spare ROBOT CONTROLLER or DRIVER STATION is configured, a letter designator may be added <team number>-<letter>-RC/DS (e.g., 12345-A-DS, 12345-B-DS)

See the DRIVER STATION Instructions and ROBOT CONTROLLER Instructions for a detailed procedure for updating DRIVER STATION and ROBOT CONTROLLER “names.”

R708 ***Do not interfere with the ROBOT networks.** During a MATCH, all communications signals must originate from only the ROBOT CONTROLLER device or the DRIVER STATION device using the ROBOT CONTROLLER Wi-Fi network. No other devices may attempt to connect to, interfere with, or alter the ROBOT CONTROLLER Wi-Fi network.

Teams are allowed to connect programming laptops and other devices to the ROBOT CONTROLLER Wi-Fi network outside of a MATCH. These devices must be disconnected from the ROBOT CONTROLLER Wi-Fi network prior to and during a MATCH.

R709 ***No other wireless allowed.** No form of wireless communication shall be used to communicate to, from, or within the ROBOT, except those specified per R706 and R708.

Devices that employ signals in the visual spectrum (e.g., cameras) and non-RF sensors that do not receive human-originated commands (e.g., “beam break” sensors or IR sensors on the ROBOT used to detect FIELD elements) are not wireless communication devices and thus this rule does not apply.

R710 ***Use assigned Wi-Fi bands and/or channels if requested.** Teams may be asked by the Event Director to use a specific Wi-Fi frequency band or channel on the day of competition. If requested, teams are required to do so. Teams may work with the FTA or wireless technical advisor (WTA) to find an alternate frequency band or channel if the suggested band/channel is deemed problematic by the FTA or WTA.

R711 ***ROBOT CONTROLLER must be visible for inspection.** The ROBOT CONTROLLER device must be mounted on the ROBOT such that the diagnostic lights, or device screen if applicable, can be visible for inspection.

> "Visible for inspection" does not require that the items be visible when the ROBOT is in STARTING CONFIGURATION or normally during a MATCH, provided the team can make the items viewable during the inspection process if necessary.
>
> Teams are strongly encouraged to make the diagnostic lights visible during normal MATCH play ROBOT configurations. If diagnostic LEDs are not visible during a MATCH, FIELD STAFF may not be able to provide comprehensive support to the team.
>
> Teams are encouraged to mount the ROBOT CONTROLLER device away from noise generating devices such as motors and EMF shielding materials like sheets of metal.

R712 ***Only specified modifications to core control system devices permitted.** The DRIVER STATION device and software, Android-based ROBOT CONTROLLER device, main and secondary power switch(es), power regulation devices, fuses, and batteries shall not be tampered with, modified, or adjusted in any way (tampering includes drilling, cutting, machining, rewiring, disassembling, painting, removing enclosures and replacing with custom enclosures, etc.), with the following exceptions:

A. wires, cables, and signal lines may be connected via the standard connection points provided on the devices,
B. fasteners (including adhesives) may be used to attach devices to the OPERATOR CONSOLE or ROBOT or to secure cables to the device,
C. thermal interface material may be used to improve heat conduction,
D. labeling may be applied to indicate device identification, purpose, connectivity, functional performance, etc. as long as they do not cover labels or markings used to identify the product,
E. jumpers may be changed from their default location,
F. jumpers or switches may be moved to configure devices per the manufacturer's manual,
G. device firmware may be updated with manufacturer supplied firmware,
H. integral wires on motor controllers and batteries may be cut, stripped, and/or connectorized,
I. devices except batteries may be repaired, provided the performance and specifications of the device after the repair are identical to those before the repair,
J. add insulating material to exposed conductors,
K. tape may be applied for debris protection, and
L. power switch mounting brackets can be modified or replaced.

> Please note that while repairs are permitted, the allowance is independent of any manufacturer's warranty. Teams make repairs at their own risk and should assume that any warranty or return options are forfeited. Repairs must be functionally equivalent to original device condition.
>
> Be aware that diagnosing and repairing COMPONENTS such as these can be difficult.
>
> For example, "repairs" that change connector types, include device footprint modifications, or provide mechanical enhancements, are prohibited.

R713 ***Always keep control system device software up to date.** The following table lists the recommended software versions for each core control electronics module, and a link on how to update this software. Note that some devices have multiple pieces of software that may need to be updated each season, and not all software is available prior to Kickoff each season. Check the *FIRST* Tech Challenge Blog for release announcements.

Regardless of the versions selected, it is highly recommended that the installed ROBOT CONTROLLER App and DRIVER STATION App versions match major and minor values to ensure compatibility as not all software versions are compatible with each other.

Table 12-11: Recommended Software for Control System Devices

Device	Software and Minimum Recommended Versions	How to Update
REV Control Hub (REV-31-1595)	Control Hub OS Recommended: 1.1.2	Updating the Control Hub OS
REV Control Hub (REV-31-1595)	Hub Firmware Recommended: 1.8.2	Updating the Hub Firmware
REV Control Hub (REV-31-1595)	ROBOT CONTROLLER App Recommended: 11.0	Updating the ROBOT CONTROLLER App
REV Expansion Hub (REV-31-1153)	Hub Firmware Recommended: 1.8.2	Updating the Hub Firmware
Android Smartphone (ROBOT CONTROLLER device)	ROBOT CONTROLLER App Recommended: 11.0	Updating the ROBOT CONTROLLER App
Android Smartphone (DRIVER STATION device)	DRIVER STATION App Recommended: 11.0	Updating the DRIVER STATION App
REV Driver Hub (REV-31-1596)	Driver Hub OS Recommended: 1.2.0	Updating the Driver Hub OS
REV Driver Hub (REV-31-1596)	DRIVER STATION App Recommended: 11.0	Updating the DRIVER STATION App
REV Servo Hub (REV-11-1855)	REV Servo Hub Firmware Recommended: 25.0.2	Updating the REV Servo Hub

Software at or above the recommended versions have the latest bugfixes and updates. Teams are highly encouraged to update their software minimally to the recommended version. FIELD STAFF will not be able to provide comprehensive support to teams with software older than the recommended version.

Teams may choose to run older versions without affecting their ROBOT inspection status.

R714 ***USB is for vision.** Only the following devices may be connected to the ROBOT control system using USB:

A. webcams and optical vision sensors per R715,
B. USB hub or USB switch, and
C. a REV Expansion Hub.

R715 ***Use only supported USB vision.** Only single image sensor vision devices that are natively supported by the ROBOT CONTROLLER app are allowed to connect to USB (stereoscopic cameras are not allowed). This includes the following:

A. all UVC compatible USB webcams (Logitech C270, and related), and
B. Vision coprocessors allowed per R703.

> UVC compatible USB webcams may only use the UVC provided stream / data. No other interfaces or data provided by the webcam may be used.
>
> To request support (or to provide sample drivers) for alternate USB vision devices for inclusion in future *FIRST* Tech Challenge seasons, please send an email to customerservice@firstinspires.org with the following details:
>
> – Subject of email should be: "USB Vision Future Support Request"
> – Contact details for providing feedback or clarifications
> – Details on the device requesting support

R716 ***Recording devices are okay.** Self-contained video recording devices (GoPro or similar) are allowed providing they are used only for non-functional post-MATCH viewing and the wireless capability is turned off.

R717 ***Lasers must be safe.** Lasers are not allowed unless they meet all of the following criteria:

A. must be part of a sensor,
B. must be rated as IEC/EN 60825-1" Class I" or IEC/EN 62471 "Exempt," and
C. non-visible spectrum.

R718 ***Configure Android devices appropriately.** ROBOT CONTROLLER and DRIVER STATION Android devices (smartphones, REV Control Hub, REV Driver Hub) must additionally be configured in the following ways:

A. REV Control Hub users must change the Wi-Fi password to a non-default password,
B. smartphone users must enable Airplane Mode,
C. on ROBOT CONTROLLER and DRIVER STATION Android devices, Wi-Fi must be enabled and Bluetooth must be disabled,
D. on smartphones and REV Driver Hub, remove all remembered Wi-Fi Direct Groups and Wi-Fi connections, leaving only the ROBOT CONTROLLER Wi-Fi connection.

12.8 Pneumatic Systems

In order to maintain safety, the rules in this section apply at all times while at the event, not just while the ROBOT is on the FIELD for MATCHES.

R801 ***No Pneumatics.** No closed air systems are allowed on *FIRST* Tech Challenge ROBOTS except for those explicitly listed in R207.

12.9 OPERATOR CONSOLE

R901 ***Use only a specified DRIVER STATION device.** The OPERATOR CONSOLE may only have one approved android-based DRIVER STATION device connected and powered on. The OPERATOR CONSOLE must have at least one of the following:

A. REV Driver Hub (REV-31-1596), or
B. Approved Android Device from rule R704 with one OTG cable and COTS USB cable to connect the required gamepad controller(s).

Teams who wish to have a spare DRIVER STATION device as part of their OPERATOR CONSOLE may do so as long as only one DRIVER STATION device is connected and powered on at a time.

R902 ***The OPERATOR CONSOLE must make the touch screen accessible.** The OPERATOR CONSOLE, the set of COMPONENTS and MECHANISMS used by the DRIVE TEAM to relay commands to the ROBOT, must make the touch screen of the DRIVER STATION device accessible. The DRIVER STATION device must be positioned within the OPERATOR CONSOLE so that the screen display can be clearly seen during inspection and in a MATCH. The DRIVER STATION device touch screen must be functional without the requirement of additional aides (e.g., mouse) in order to be used.

R903 ***Only limited gamepads are supported**. The OPERATOR CONSOLE may have no more than two (2) electrically unmodified gamepads in any combination from the following list connected to the DRIVER STATION at any time:

Table 12-12: Allowed Gamepads on OPERATOR CONSOLE

Gamepad	Part Number	Notes
Logitech F310 gamepad	940-00010	
Xbox 360 Controller for Windows	52A-00004	
Sony DualShock 4 Wireless Controller for PS4	N/A	Operating in wired mode only (i.e., connected through USB cable without being Bluetooth paired to any device) This DOES NOT include the Sony DualSense Edge Wireless Controller in any configuration
Sony DualSense Wireless Controller for PS5	N/A	
Etpark Wired Controller for PS4	REV-39-1865	Newer versions of this device may not support all functionality provided by the FTC SDK
REV Robotics USB PS4 Compatible Gamepad	REV-31-2983	
Quadstick game controller in Xbox 360 Emulation Mode	any model	

Enhancements to the gamepad that do not modify the electronics are legal. Adding a ferrite cable clip to gamepad cables close to the USB connector is highly recommended. Different color gamepads are allowed provided they are the same model as the allowed gamepad.

Teams are strongly encouraged to use short USB cable extenders with the USB ports on the DRIVER STATION device. These extenders are used to reduce the wear and tear on the DRIVER STATION device ports from frequent plugging and unplugging – instead of plugging/unplugging directly into the DRIVER STATION device, gamepads are plugged and/or unplugged from the cable extenders. The extenders are intended to remain forever plugged into the DRIVER STATION device and, with proper strain relief employed, can protect the port from accidental damage.

Teams who wish to have spare gamepad(s) available as part of their OPERATOR CONSOLE may do so as long as no more than two gamepads are connected at any time.

R904 ***OPERATOR CONSOLE physical requirements.** The OPERATOR CONSOLE including all power sources must not exceed a volume of 3ft wide, 1ft deep and 2 ft tall (91.4cm by 30.5cm by 61.0 cm) excluding any items that are held or worn by the DRIVERS during the MATCH

Please note that while there is no hard weight limit, OPERATOR CONSOLES that weigh more than 20 lbs. (~9 kg.) will invite extra scrutiny as they are likely to present unsafe circumstances.

Teams who wish to have a spare external USB hub as part of the OPERATOR CONSOLE may do so as long as only one USB hub is connected at any time.

R905 ***ROBOT application wireless communication only.** Other than the connection controlled by the ROBOT CONTROLLER app running on the ROBOT and the DRIVER STATION app running on the DRIVER STATION device, no other form of wireless communications shall be used to communicate to, from, or within the OPERATOR CONSOLE during a MATCH.

Examples of prohibited wireless systems include, but are not limited to, active wireless network cards and Bluetooth devices.

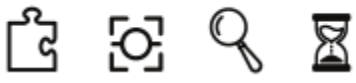
Because this system uses a built-in wireless radio, teams are strongly encouraged to ensure there is no metal material blocking the line-of-sight between the DRIVER STATION device and the ROBOT CONTROLLER device which could impede the signal quality.

R906 ***No unsafe or unfair OPERATOR CONSOLES.** OPERATOR CONSOLES shall not be made using hazardous materials, be unsafe, cause damage, cause an unsafe condition, distract, or interfere with other DRIVE TEAMS or the operation of other ROBOTS.

DRIVER STATION sounds which are distracting or which mimic MATCH sounds are examples of disallowed OPERATOR CONSOLE features.

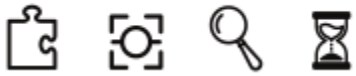
Sounds which are frequent or continuous which serve no apparent value to the MATCH play would likely be considered distracting.

The intent of this rule is to allow teams to use a container to store, organize, and transport the DRIVER STATION device and supporting electronics. The OPERATOR CONSOLE rules are not intended to allow systems that function as a ROBOT cart or replace a competition-provided OPERATOR CONSOLE stand, table, etc.



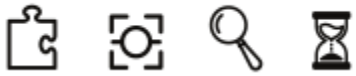
13 Tournament (T)

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



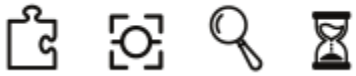
14 League Play Tournaments (L)

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



15 *FIRST* Championship (C)

This section will be updated with the Kickoff Competition Manual release on September 6, 2025.



16 Glossary

The following definitions and terms are used for a *FIRST* Tech Challenge game DECODE. Defined terms are in ALL CAPITAL LETTERS throughout the manual (for example, ALLIANCE). Competition rules mean what they plainly say. If a word is not given a game definition, then you should use its common conversational meaning.

Term	Definition
ALLIANCE	a cooperative of two FIRST Tech Challenge teams
ALLIANCE AREA	volume formed by placing ALLIANCE colored tape onto the flooring surface outside of the FIELD.
ALLIANCE CAPTAIN	The designated STUDENT representative from each ALLIANCE lead is called the ALLIANCE CAPTAIN.
ARENA	includes all elements of the game infrastructure that are required to play this season's FTC game including: the FIELD, SCORING ELEMENTS, queue area, team media area, and all equipment needed for FIELD control, ROBOT control, and scorekeeping
ARENA FAULT	an error in ARENA operation
AUTO	the first portion of the MATCH, during which DRIVERS may not provide input to their ROBOTS, so ROBOTS operate with only their pre-programmed instructions
CHASSIS	A ROBOT'S MAJOR MECHANISM that enables it to move around a FIELD
COMPONENT	any part in its most basic configuration, which cannot be disassembled without damaging or destroying the part or altering its fundamental function
COTS	a standard (i.e., not custom order) part commonly available from a VENDOR for all teams for purchase
CUSTOM CIRCUIT	Any active electrical item that is not an actuator (specified in R501) or power regulation device (specified in R505)
DISABLED	The REFEREE instructs the team to stop the ROBOT which will deactivate all outputs, rendering the ROBOT inoperable for the remainder of the MATCH
DISQUALIFIED	the state of a team in which they receive 0 MATCH points and 0 RANKING POINTS in a qualification MATCH or causes their ALLIANCE to receive 0 MATCH points in a playoff MATCH
DRIVE COACH	a guide or advisor
DRIVE TEAM	a set of up to 4 people from the same FIRST Tech Challenge team responsible for team performance for a specific MATCH

Term	Definition
DRIVER	an operator and controller of the ROBOT
DRIVER STATION	Android device (smartphone or REV Driver Hub) that runs the DRIVER STATION App software to communicate with a ROBOT per R901
FABRICATED ITEM	any COMPONENT or MECHANISM that has been altered, built, cast, constructed, concocted, created, cut, heat treated, machined, manufactured, modified, painted, produced, surface coated, or conjured partially or completely into the final form in which it will be used on the ROBOT
FIELD	an approximately 12 ft. (3.66m) by 12 ft. (3.66m) tile area bounded by the outside edge of the extrusion that frames the walls
FIELD STAFF	volunteers present in and around the ARENA that are responsible for making sure the MATCHES are cycled through efficiently, fairly, safely, and with a spirit of cooperation, Gracious Professionalism®, and generosity of spirit
FTA	FIRST technical advisor, an event volunteer role
HUMAN PLAYER	a SCORING ELEMENT manager
INSPECTOR	a person determined by *FIRST* to accurately and efficiently assess the legality of a given part or the whole of a ROBOT, an event volunteer role
JUDGE	JUDGES meet with teams to learn about and celebrate the unique journey and accomplishments of each team and evaluate these against award requirements. JUDGES interact with STUDENTS during the interview process, and in the pits. As a group, JUDGES determine the teams that receive awards at events
LRI	the lead ROBOT INSPECTOR, an event volunteer role
MAJOR FOUL	a credit of X points towards the opponent's MATCH point total
MAJOR MECHANISM	a group of COMPONENTS and/or MECHANISMS assembled together to address at least 1 game challenge: ROBOT movement, SCORING ELEMENT manipulation, FIELD element manipulation, or performance of a scorable task without the assistance of another ROBOT.
MATCH	an AUTO period, an 8 second transition period between AUTO and TELEOP, and a TELEOP period in which the ROBOT plays the current season game
MECHANISM	an assembly of COMPONENTS that provide specific functionality on the ROBOT. A MECHANISM can be disassembled (and then reassembled) into individual COMPONENTS without damage to the parts.

Term	Definition
MINOR FOUL	a credit of Y points towards the opponent's MATCH point total
OPERATOR CONSOLE	the set of COMPONENTS and MECHANISMS used by the DRIVE TEAM to relay commands to the ROBOT
PORTFOLIO	A document used as part of the judging process with requirements outlined in 6.2.
RED CARD	a penalty assessed for egregious ROBOT or team member behavior or rule violations which results in a team being DISQUALIFIED for the MATCH.
REFEREE	an official who is certified by *FIRST* to enforce the rules of the current season's game, an event volunteer role
ROBOT	an electromechanical assembly built by the *FIRST* Tech Challenge team to play the current season's game and includes all the basic systems required to be an active participant in the game –power, communications, control, and movement about the FIELD
ROBOT CONTROLLER	Android device (smartphone or REV Control Hub) that runs the ROBOT CONTROLLER app to control the ROBOT as defined in R701
ROBOT SIGN	A ROBOT SIGN simultaneously identifies a ROBOT'S team number as well as its ALLIANCE affiliation for FIELD STAFF.
SIGNAL LEVEL	a term used to characterize circuits which draw ≤1A continuous and have a source incapable of delivering >1A, including but not limited to REV Control and Expansion Hub sensor input/output signals (DIO, analog, I2C, encoder, 485)
STARTING CONFIGURATION	the physical configuration in which a ROBOT starts a MATCH
STUDENT	a person who has not completed high-school, secondary school, or the comparable level as of September 1 prior to Kickoff
SURROGATE	a team randomly assigned by *FIRST* event management software to play an extra qualification MATCH
TELEOP	The second period of each MATCH is called the teleoperated period (TELEOP). During TELEOP, DRIVERS remotely operate ROBOTS
TILE	flooring surface of the FIELD is made of 36 (nominal) 24 in. x 24 in. x 5/8 in. interlocking soft foam TILES
VENDOR	a legitimate business source for COTS items that satisfies criteria defined in section 12 ROBOT Construction Rules (R)
VERBAL WARNING	a warning issued by event staff or the Head REFEREE.
YELLOW CARD	a warning issued by the Head REFEREE for egregious ROBOT or team member behavior or rule violations

Term	Definition
WTA	wireless technical advisor , a volunteer role