



Training and
Support

2018-2019 *FIRST*® Tech Challenge Robot Inspector Manual

ROVER RUCKUS



Presented By **Qualcomm**

www.firstinspires.org

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FOR INSPIRATION & RECOGNITION OF SCIENCE & TECHNOLOGY

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Thank you for taking the time to volunteer for a *FIRST®* Tech Challenge event. *FIRST®* and *FIRST®* Tech Challenge rely heavily on volunteers to ensure events run smoothly and are a fun experience for teams and their families, which could not happen without people like you. With over 5,500 teams competing yearly, your dedication and commitment are essential to the success of each event and the *FIRST* Tech Challenge program. Thank you for your time and effort in supporting the mission of *FIRST*!

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Contents

Contents.....	3
Introduction.....	5
What is <i>FIRST®</i> Tech Challenge?	5
<i>FIRST</i> Core Values	5
<i>Gracious Professionalism®</i>	5
Gracious Professionalism for Volunteers.....	5
<i>FIRST</i> Volunteer Rights and Responsibilities	5
NOTICE OF NON-DISCRIMINATION	5
Volunteer Rights and Responsibilities	6
Tournament Organization Structure.....	7
Job Description.....	8
Introduction	8
Volunteer Training and Certification	8
Event Time Commitment.....	8
Volunteer Minimum Age Requirement.....	8
Key Volunteer Role Minimum Age Requirement	9
Bring a Friend!	9
Overview of Responsibilities	9
Lead Robot Inspector.....	9
Prerequisite for Lead Robot Inspector Role	9
Robot Inspector.....	9
Pre-Event Day Responsibilities.....	10
Event Day Responsibilities	10
Helping Teams Succeed	11
Illegal Parts	11
Robot Inspection Process.....	13

Gracious Professionalism® - "Doing your best work while treating others with respect and kindness - It's what makes *FIRST*, first."

Collaborative Inspection Process	13
Robot Inspection Checklist – Robot Size Inspection.....	13
Interchangeable Mechanisms	14
Robot Inspection Checklist – Robot Weight Limit	14
Robot Inspection Checklist – General Robot Rules	14
Robot Controller and Electronics Mounting.....	14
Sharp Objects.....	15
Launching Scoring Elements	15
Robot Inspection Checklist – Robot Mechanical Parts and Materials	15
Robot Inspection Checklist – Robot Electrical Parts and Materials.....	15
Robot Main Power and Wire Color Coding	15
LEDs	16
Robot Inspection Checklist – Wheel or Tread Playing Field Damage Test	16
Inspection Troubleshooting.....	17
Repeated Failures.....	17
Re-inspection.....	17
Team Marker Inspection	17
Build and Inspection Rules.....	17
Inspection Process.....	18
2018-2019 Season Changes	18
Appendix A – Resources	19
Game Forum Q&A	19
<i>FIRST</i> Tech Challenge Game Manuals.....	19
<i>FIRST</i> Headquarters Pre-Event Support.....	19
<i>FIRST</i> Tech Challenge Event On-Call Support	19
<i>FIRST</i> Websites.....	19
<i>FIRST</i> Tech Challenge Social Media	19
Feedback.....	19
Appendix B – Robot Inspection Checklist	20

Introduction

What is FIRST® Tech Challenge?

FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. To learn more about FIRST® Tech Challenge and other FIRST® Programs, visit www.firstinspires.org.

FIRST Core Values

We express the FIRST® philosophies of *Gracious Professionalism®* and *Coopertition®* through our 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!*

Gracious Professionalism®

FIRST® uses this term to describe our programs' intent and *Gracious Professionalism®* is not clearly defined for a reason. It has different meanings 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.
- Gracious Professionals make valued contributions in a way that is pleasing to others and to themselves.

In the end, *Gracious Professionalism®* is part of everyday life. When professionals use their knowledge in a graciously and individuals act with integrity and sensitivity, everyone wins, and society benefits.

Watch Dr. Woodie Flowers explain *Gracious Professionalism* in this [short video](#).

Gracious Professionalism for Volunteers

It is a good idea to spend time going over this concept with volunteers. Provide volunteers with real-life examples of *Gracious Professionalism* in practice before, during, and after the event and recognize great *Gracious Professionalism* when you see it in action!

FIRST Volunteer Rights and Responsibilities

NOTICE OF NON-DISCRIMINATION

For Inspiration and Recognition of Science and Technology (FIRST®) does not discriminate based on race, color, national origin, sex, disability, age, status as a veteran who served in the military, religion, gender, gender identity, or gender expression in its programs and activities.

Keep updated at: <http://www.firstinspires.org/about/legal-notices>

Volunteer Rights and Responsibilities

Volunteers are the most valuable asset to FIRST®. Your selfless contribution of time and resources are instrumental in accomplishing our mission of inspiring the next generation of science, technology, engineering, and mathematics leaders and innovators. The foundation of the relationship between FIRST and our volunteers is respect.

It is your right to:

- Be treated with *Gracious Professionalism*®. *Gracious Professionalism* is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.
- Feel valued. FIRST recognizes the significant efforts that volunteers contribute. The time that you donate not only helps FIRST succeed but also builds the FIRST community.
- Understand your role. FIRST will inform you about what's expected of you, your schedule, any meals you will be provided, any changes to program or policy, and who to contact should you need assistance.
- Expect a safe environment. FIRST strives to create and maintain a safe environment for all volunteers and participants and will always factor safety into program planning.
- Receive fair treatment and inclusion. All volunteers will be treated with respect and dignity in inclusive environments. FIRST does not discriminate on the basis of race, color, national origin, sex, disability, age, status as a veteran who served in the military, religion, sexuality, gender, gender identity, or gender expression in its programs and activities.
- Reevaluate your time commitment. FIRST appreciates all of our volunteers and understands that volunteers experience life situations that may affect their commitment.
- Communicate with your Volunteer Coordinator or your local FIRST leadership about:
 - Concerns or limitations that are affecting your volunteer role.
 - Any mistreatment towards you or others. You may be required to fill out a [non-medical incident form](#).
 - Contact FIRST Headquarters directly if you feel that you are being treated improperly and attempts to resolve issues and conflicts at the local level are not successful. Volunteers can call (800) 871-8326 or email volunteer@firstinspires.org.

It is your responsibility to:

- Treat others with *Gracious Professionalism*®.
- Follow the schedule and the role description provided for your position. Contact your local FIRST leadership if there are any issues.
- Respect others, treat them fairly and kindly. Be inclusive and follow the non-discrimination policy of FIRST.
- Follow safety rules and ensure safety of others. Adhere to all [FIRST Youth Protection Program \(YPP\) policies](#). Report any injuries or safety concerns within 48 hours.
- Adhere to the [FIRST Code of Conduct](#).
- Have FUN!

Tournament Organization Structure

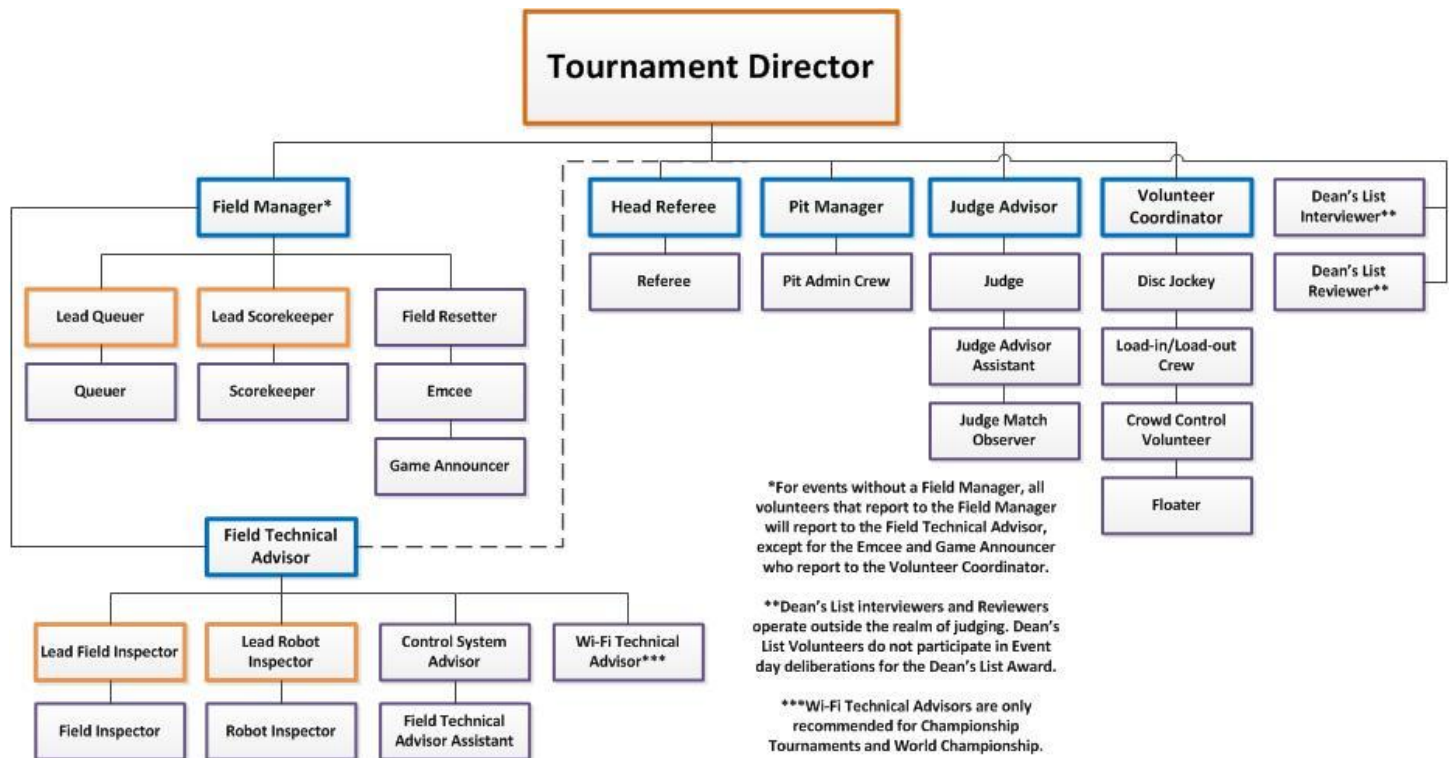


Figure 1 - League Championship, Qualifying Tournament, Championship Tournament Organization

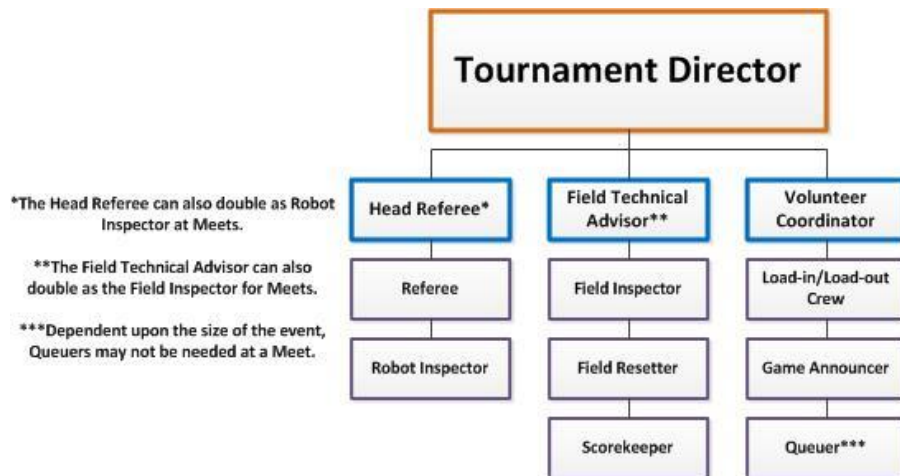


Figure 2 - League Meet Organization

Learn more about the roles of volunteers on our [Volunteer Resources page](#), "Volunteer Role Description".

Job Description

Introduction

The Robot Inspector is responsible for ensuring that each robot is built of allowable parts and is safe to operate. The robot inspection involves filling out a checklist for every robot and placing a label or other unique tag on the robot after passing inspection. This manual will walk an Inspector through their role and responsibilities in greater detail.

- **Physical/Technical Requirements:**
 - Technical – Medium
 - Physical – Low
 - Administrative – Low
 - Communication – High
- **Time commitment:**
 - Pre-event training: Robot Inspectors should expect to spend two to three hours to go through required reading and training before the event.
 - Event Day: A Robot Inspector may only volunteer at an event for 2 hours, as the robot inspections happen in the morning. Robot Inspectors might also serve in another role once robot inspection is complete. If a Robot Inspector has indicated in their application they are available for the full day, the Tournament Director may assign them another role once robot inspections are completed.
- **Proper Attire:**
 - Wear comfortable, close-toed and closed-back shoes. Most of the day will be spent standing or walking in the pit area.
 - ANSI Z87.1 certified safety glasses are required in the competition area.

Volunteer Training and Certification

Volunteers must apply to their role using the [Volunteer Registration System](#). After the volunteer has applied to their role, FIRST Tech Challenge will send an email to the volunteer with access instructions to training and certifications (if applicable). Emails with access to the training and certifications will be sent within one business day from applying to the role. If you have applied for a role but have not received access to the training, please email FTCTrainingSupport@firstinspires.org.

FIRST Tech Challenge requires Robot Inspectors to be trained before volunteering in the role. Training, including review of the current year's manual, supplemental manual review (for example, Game Manual Part 1), training video, and the robot inspection certification test will take roughly two to three hours.

Event Time Commitment

Most FIRST Tech Challenge events are whole-day events. While robot inspection happens at the start of the event, many Robot Inspectors fill other volunteer roles at an event. Robot Inspectors may be called on for up-to-date inspection of a robot during the competition.

Volunteer Minimum Age Requirement

FIRST requires that FIRST Event volunteers be at least 13 years old for most roles. There are exceptions listed below. The Regional Planning Committee can increase the age requirement as needed. Adult volunteers cannot have children with them while volunteering nor be responsible for supervising children at the event. Children under the minimum age are welcome at FIRST Competitions with suitable supervision by someone other than a volunteer.

Key Volunteer Role Minimum Age Requirement

Volunteers MUST be at least 21 years old before they can serve in a Key Volunteer Role for the *FIRST* Tech Challenge. Key Volunteer positions include: Volunteer Coordinator, Head Referee, Judge Advisor, Field Manager, Field Technical Advisor, Lead Robot Inspector, Lead Field Inspector, and Lead Scorekeeper. Local Affiliate Partners can make case by case exceptions to these guidelines by contacting *FIRST* for approval.

Bring a Friend!

Volunteers are such a vital part of the *FIRST* Tech Challenge Program and continuing to inspire students to pursue science, technology, engineering, and math (STEM) careers. *FIRST* Tech Challenge needs your help in recruiting new volunteers to keep our programs thriving for future generations! If you have a friend or co-worker you think would be interested in volunteering at an event, there are just a few easy steps to help get them involved!

1. Check out our full list of [volunteer opportunities](#) online!
2. Have them apply for the event in the [Volunteer Registration System](#). Volunteers must be screened before volunteering.
3. Have them contact FTCTeams@firstinspires.org with any questions they may have.

If they are concerned about jumping in head first, no worries! Job shadowing at a *FIRST* Tech Challenge event is a great way to get a taste of what a full day's worth of competition looks like. New volunteers can discover ways they can fit their personal skills into a volunteer position!



Overview of Responsibilities

The Robot Inspector is responsible for inspecting robots to ensure they are safe, sized correctly, and are made up of legal parts. Most events have an experienced Lead Robot Inspector that oversees a Robot Inspector crew.

Lead Robot Inspector

Robot Inspectors perform required robot inspections to ensure compliance with robot construction rules. Lead Robot Inspectors supervise the Robot Inspectors and act as a resource to the Robot Inspectors performing the inspections. The Lead Robot Inspector's responsibilities include:

- Collaborate with the Tournament Director and Field Inspector to create an inspection schedule. Check with the Tournament Director if the schedule will be created before the event, or on event day.
- Assure the required robot inspection tools and materials are available on event day.
- Work closely with the Lead Field Inspector so the entire inspection runs smoothly, and all robots pass inspection before the opening ceremony.
- Provide periodic progress updates to the Tournament Director and Field Technical Advisor.

Prerequisite for Lead Robot Inspector Role

To serve as a Lead Robot Inspector, previous experience as a Robot Inspector is required.

Robot Inspector

Robot Inspectors ensure that every robot follows the guidelines outlined in the [FIRST Tech Challenge Game Manual Part 1](#) and are ready to compete on the field. The inspection process involves filling out a checklist for every robot and placing a label or other unique tag on the robot after it passes inspection.

Pre-Event Day Responsibilities

Robot Inspectors must participate in training before volunteering at an event. They also must pass a certification test. Training and the certification test are provided by FIRST Headquarters.

Required reading before training and certification:

- The Robot Inspector Manual.
- Sections 8 and 9 of the [Game Manual Part 1](#).
- The robot inspection checklist.
- [Legal and Illegal Parts](#) document.
- Game Q&A Forum – The Robot Inspection and Build Rules section.

It is important before the event the Robot Inspector reviews these manuals and watches the prerecorded Robot Inspector training video. To access the proper training materials to fulfill this role, make sure to apply to the position in the Volunteer Registration System. An email will be sent providing access to Schoology, where you can access the training video, certification test, and copies of this manual as well as the Game Manual Part 1.

The [Game Q&A Forum](#) is updated throughout the season. It contains clarifications for the rules in the Game Manual Parts 1 and 2 and rulings about specific parts. Robot Inspectors are required to check the forum a day or two before an event so their knowledge is up-to-date.

Event Day Responsibilities

A typical robot inspection crew has a Lead Robot Inspector and several Robot Inspectors. The Lead Robot Inspector will explain the overall inspection process for the event and is the robot rule expert. Feel free to ask the Lead Robot Inspector about robot parts that are unfamiliar and for help with difficult pass or fail decisions. On-call FIRST Tech Challenge staff are available on event day to aid Robot Inspectors. The on-call telephone number is listed in Appendix A.

It is the responsibility of the Robot Inspector to:

- Greet the team. Inspectors are generally the first volunteer a team will interact with.
- Go through the inspection sheet with the team.
- Assess the team's robot and identify if there are illegal parts on the robot.
- Identify potential concerns of entanglement (loose cables).
- Help the team to be successful.
- Be fair and apply the same thoroughness for every team.
- Treat all teams with *Gracious Professionalism*®.

Robot inspections generally take place the morning of the event. The inspections run simultaneously with field inspections (where the Field Inspectors inspect the team's Android devices) and team judging appointments. Each inspection should take roughly 5-10 minutes, depending on the complexity of the robot design. Once you arrive at the inspection station you should have the following supplies available (provided by the Tournament Director or Lead Robot Inspector):

Supplies

- ☐ An 18 in x 18 in x 18 in (45.72 cm x 45.72 cm x 45.72 cm) sizing tool.
- ☐ A scale to weigh each robot.
- ☐ Inspection checklist for each team (found in the [Game Manual Part 1](#)).
- ☐ Pens.
- ☐ Yardstick.
- ☐ Tape Measure.
- ☐ Inspection stickers or other method of identifying robots that have passed robot inspection that can be placed onto the robot.
- ☐ Movable parts and power switch stickers.
- ☐ Optional – Team Marker sizing tool. If not available, a tape measure should be used to inspect the Team Marker.



Supporting Documentation

- ☐ Robot Inspector Manual.
- ☐ Sections 8 and 9 of the Game Manual Part 1.
- ☐ A printout of the relevant sections of the [Game Q&A Forum](#) (Forum responses are official and enforceable and override the Game Manual).
- ☐ Team list.

Helping Teams Succeed

A common theme you will read throughout this manual is the Robot Inspectors role is not just about the inspection. It is about helping a team succeed so they can compete. Teams spend countless hours, weeks and sometimes months working and reworking their robot design and strategies. After all this effort, some teams will still need a friendly Robot Inspector to help them create a strategy to fix unexpected illegal robot construction.

Illegal Parts

When a Robot Inspector comes across a team that has an illegal part installed, the Inspectors should not automatically fail the team. First, the Inspector should ask themselves the following questions:

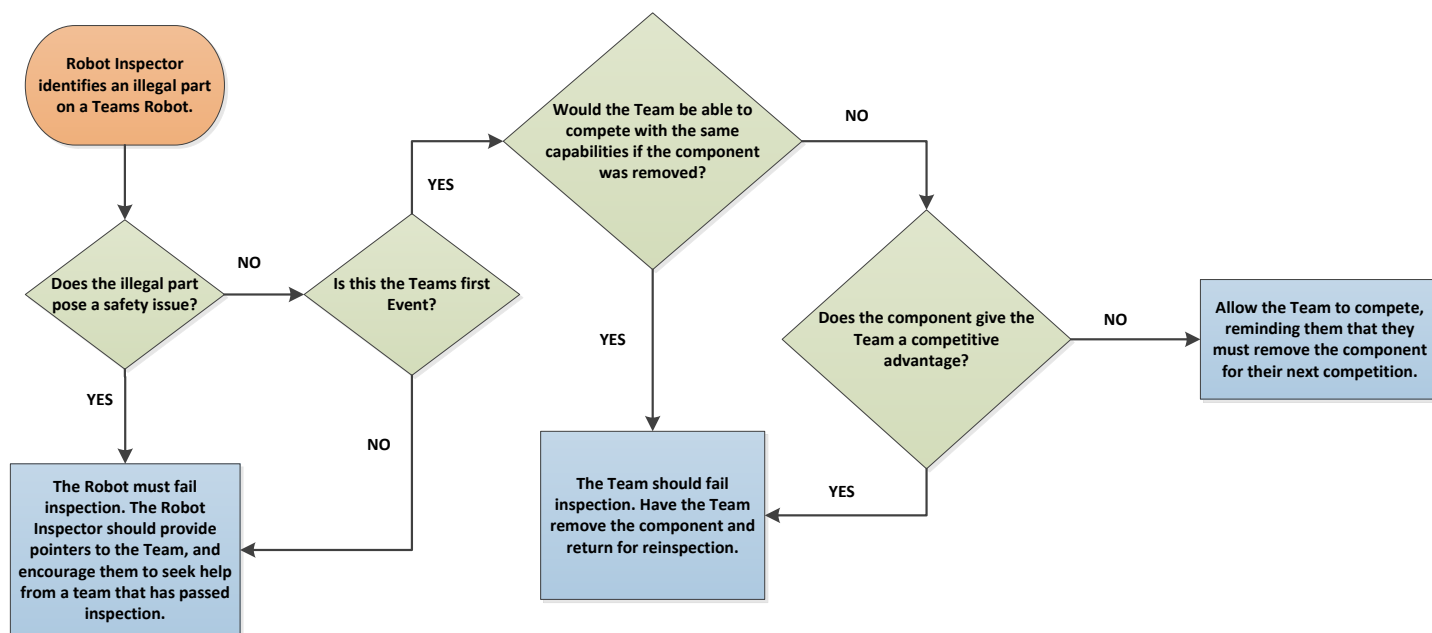
1. Is the part a safety issue?
2. Would the team be able to compete if the part was removed?
3. Does the part give the team a competitive advantage or disadvantage?
4. Could the robot achieve the same ability with legal parts?

If the answer to question #1 is yes and the part is a safety issue, the team must fail inspection. We want all teams to compete, however safety issues on a robot are nonnegotiable and must be fixed for the team to compete.

Questions #2 and #3 have some gray area. It is up to the Inspector to decide what is fair for the affected team and for their fellow competitors. Question #4 helps the Inspector to assess the extent of the illegal construction. FIRST Tech Challenge's goal is to make sure that all teams follow the rules to ensure the competition is fair for

all. However, there are circumstances when Inspectors can pass a team if the violation does not give the team a competitive advantage. Exceptions for illegal parts should only be made at the first Qualifying Tournament or Meet the team attends. Teams competing in their second competition or higher should have already been made aware of illegal parts and made proper changes to their robot.

The below flowchart is to help Robot Inspectors decide when faced with these scenarios at an event:



Robot Inspectors should feel empowered to let the team use the illegal part if:

- This is the team's first event;
- There is no competitive advantage to the illegal part;
- The robot's abilities would be significantly affected if the illegal part were removed.

If the illegal part leaves a team with a competitive disadvantage, the Robot Inspector should tell the team. Strongly recommend fixing the part before competing. In both circumstances, the Robot Inspector **must** coach the team and advise they cannot compete in the next competition with the same illegal part.

An illegal part gives a team a competitive advantage if the part enables a robot to perform an action that could not be performed using allowed parts, or perform an action more efficiently, faster or reliably. A few example parts that may give a robot competitive **advantages** that an Inspector should not allow when they are found on tournament day:

1. An illegal DC motor; it may outperform the allowed DC motors.
2. A multiple degree of freedom commercial off the shelf (COTS) part that is more robust, efficient, etc. than an equivalent team built part.
3. An illegal main battery pack; it may have a higher mAh rating than the allowed battery packs.
4. A driver station gamepad that provides capabilities that are not available on the allowed gamepads.

A few example competitive **disadvantages** that an Inspector should allow when they are found on tournament day:

1. Control System electronics mounted on robot to robot contact areas.

Robot Inspection Process

Collaborative Inspection Process

Stepping through the robot inspection checklist from top to bottom is an effective process for verifying compliance with the robot construction rules. However, a collaborative process will be more enjoyable and thorough for the team and the volunteers.

The preferred inspection method is to put aside the inspection checklist and ask that one or more student team members to thoroughly describe the robot's systems and how they work. Students are proud of their accomplishments and they enjoy showing off their robot's features. During this time, the Inspector should complement notable robot design or construction features and ask questions that help determine compliance with the rules. Avoid pointing out rule violations during this time. While listening to the students, the Inspector is looking for illegal parts, counting DC motors and servos, noting the electronics, and checking for safety. Sample questions to ask the team are:

- How are the LEDs powered and/or controlled?
- Does your robot have sensors? How are they connected to the robot control system?
- Did you determine that each servo controller is not overdriven by the attached servos?
- What challenges did you face while building this robot?
- Which subsystem are you most proud of?

When the students are finished describing the robot, Inspectors should look for checklist items that were not covered during the student's presentation. They should closely view all six sides of the robot to check for sharp edges. The knowledge gained about the robot during the collaborative inspection will now make it easy to complete the inspection checklist.

Thank the team for describing their robot's features and explain that it is now time to complete the inspection checklist. Feel free to take another look at the robot and ask follow-up questions while completing the checklist. Once the checklist is filled out, congratulate the team for passing inspection or clearly describe any rule violations and work with the team to find acceptable solutions. It is best if the team leaves inspection with a remediation plan that has received preliminary approval from an Inspector.

End the inspection session on a high note by complimenting the team or robot and offering a high-five. Ask the team if they have any questions about the inspection process. Remind the team that Field Inspection is separate and can be completed even if the robot has failed robot inspection.

The following information will help familiarize a Robot Inspector with the inspection checklist. The robot inspection checklist can be completed in any order.

Always keep in mind that as a Robot Inspector your role is not to fail a team. You are in a role to help a team pass inspection while keeping within the rules so that they can compete.

Robot Inspection Checklist – Robot Size Inspection

The robot sizing tool is the official gauge of whether a robot has met the match start size constraints of 18 in x 18 in x 18 in (45.72cm x 45.72cm x 45.72cm). Sizing tools can differ from event to event. Some events may use a box to inspect the size of the robot. Other events have come up with sizing tools that slide over the robot to measure the robot. Either method is okay.

Slide the robot into the open end of the sizing tool. Robot contact with the sides and top of the sizing tool is allowed unless the support provided by the sizing tool aids the robot in keeping within the 18 inch (45.72cm)

cube size constraint. There should be no undue pressure on any of the wall sides or back of the tool. Slide a flat plate or yardstick over the open side of the tool to verify compliance at the opening of the sizing tool.

Sometimes, a team will need to turn on robot main power and run the autonomous period initialization routine to command servos to their starting positions for the robot to fit into the sizing tool. This is acceptable if they understand they must do that for every match. The Robot Inspector should ask the team if their robot will expand upon initialization at the start of the match. If yes, the Inspector should have the team initialize their robot for the sizing inspection. They will also need to place a “Robot Moves” sticker on their robot near the robot’s main power switch, which should be visible for the referees and other field personnel for match play.

Interchangeable Mechanisms

Per Rule <I7> from the [Game Manual Part 1](#), teams can build mechanisms for their robot that are interchangeable for the game challenge based on which alliance they are on for a given match. If a team is on the red alliance for one match, they might need a specific mechanism on the right-hand side of their robot. If the team is on the blue alliance for another match, the team would need that same mechanism built for the left-hand side of their robot.

Teams must bring all exchangeable mechanisms as well as their robot to inspection. When the team reports to inspection at least one of the mechanisms should already be attached to the robot. The Robot Inspector should check to make sure the robot and mechanisms comply with the following rule:

<I7>c. The sum of all electronics (motors, servos, Core modules, Android devices, etc.) used to construct 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 the robot construction rules.

The Robot Inspector should check each configuration to make sure the robot complies with these rules, and does not violate any other robot construction rule.

Robot Inspection Checklist – Robot Weight Limit

Per rule <RG04> from the Game Manual Part 1, robots must not weigh more than 42 pounds (19.05kg) including battery. This weight constraint does not include the alliance flag or Team Marker. To account for variances between scales, there will be a .5 pound (.23kg) overage allowance on top of the 42 pound weight limit. If a team is using multiple mechanisms that will be swapped out from one match to the next, all components and the robot must be weighed together during weight inspection and must not weigh more than 42 pounds.

Robot Inspection Checklist – General Robot Rules

The next section of the robot inspection checklist helps the Inspector insure the robot complies with the general robot rules.

These key general inspection items are commonly overlooked by teams:

- Team number is displayed on two sides of the robot (180 degrees apart).
- Robot has an acceptable alliance flag holder.
- Robot does not contain sharp edges or corners.

Robot Controller and Electronics Mounting

There are no specific mounting requirements for electronics, except for the robot main battery. Robot Inspectors are encouraged to identify to teams, electronics that are mounted in a way that may place the team at a disadvantage. For example:

- It is recommended the robot controller be accessible and visible by competition personnel. If a team's robot controller is not accessible and visible to competition personnel, the team may not receive adequate support from the field personnel.
- Electrical parts (robot controller, batteries, motor and servo controllers, switches, sensors, wires, etc.) make poor bumpers and are unlikely to survive the rigors of game play when attached in a robot-to-robot contact area.

Sharp Objects

To test for sharp objects, gently run your hands over all corners and cut pieces of the robot. Make sure there are no sharp edges. If there are, ask the team to file them down and smooth them out.

Launching Scoring Elements

Robot Inspectors will not test for compliance with the launching scoring elements rule before the start of qualification match play. Referees watching match play will request reinspection of a robot if they feel the robot is launching scoring elements with excessive speed that would cause a safety issue if they were to leave the playing field. When asked by a Referee to inspect for compliance with rule <RG08> from Game Manual Part 1, robots must then show the Inspector that a launched game element cannot travel in the air more than 16 ft. (4.88 m) or more than 6 ft. (1.83 m) in elevation. This test should be performed in a controlled area for safety.

Robot Inspection Checklist – Robot Mechanical Parts and Materials

The third part of the inspection checklist confirms the robot is built from allowed raw materials and Commercial Off The Shelf (COTS) parts.

Teams may use raw and post-processed materials to build their robots, provided they are readily available to most teams from standard distributors (for example, McMaster-Carr, Home Depot, Grainger, AndyMark, etc.).

COTS mechanical parts that have a single degree of freedom are allowed.

Review all mechanical parts of the robot and make sure that they are legal. The [Legal and Illegal Parts List](#) provides a pictorial guide of allowed parts, and pictures of the most common illegal parts you might see on a robot. Specific quantities, sizes, and parts are listed in the inspection checklist.



Robot Inspection Checklist – Robot Electrical Parts and Materials

The fourth part of the inspection checklist goes over the most complex part of the inspection process, robot electrical parts and materials.

Robot Main Power and Wire Color Coding

Robot Inspectors should pay close attention to ensure the robot's main power is labeled and accessible to the field personnel. The robot's main power switch must control all power provided by the robot main battery pack. FIRST requires teams to use either the TETRIX (part #W39129), MATRIX (part# 50-0030), or REV (REV-31-1387) power switch. Robots that only use the built-in switch on the Core Power Distribution module do not satisfy the requirements of rule <RE01>.

The main power switch must be easily accessible and labeled. Having the main power accessible is a safety feature, and therefore Robot Inspectors must be diligent to ensure each team follows this rule, and makes changes to their robot if needed.



For safety and ease of debugging, teams are expected to use consistent color coding for their electrical wiring.

If a team has an inconsistently wired robot, the Robot Inspector should point it out to the team. The Robot Inspector should let the team know this could hinder the ability for other volunteers to troubleshoot issues with the robot. The team should look to clean up the wiring before matches begin. It might not be possible for the team to make significant wiring changes to the robot before qualification matches start. Robot Inspectors must use judgment to decide what changes can be made in time for the team to participate in the first match of the day. The final robot modification solution for that day's event might not be ideal. However, we do not want to prevent a team from participating in the tournament because the location of their main power switch or wire color coding are not 100% compliant with the rule.

LEDs

LEDs are allowed to be functional (for example, signal information to the drive team) or decorative. Tracing wires to find out how the LEDs are powered or controlled can be a time-consuming task. The best approach is to ask the team to explain how the LEDs are powered or controlled.

Robot Inspection Checklist – Wheel or Tread Playing Field Damage Test

Robot Inspectors have the authority to ask that a team test their wheels and treads that they feel might cause damage to the playing field. Not every tread or wheel can be evaluated and posted as a legal or illegal part. The tread test is a quick way to decide if a team's wheels or treads are competition legal.

To perform this test, the robot should be placed on top of a field tile and against an immovable surface (wall), and should then run the wheels at full power for 15 seconds. Remember to cover the wall with a field tile to protect it from damage. If there is any physical damage to the floor tile, the wheels are not allowed. Discoloration or black marks alone are not considered field damage. Remember, the test must be done with the robot at the weight the robot will be at during the competition since this will affect the degree of damage.

Inspection Troubleshooting

Repeated Failures

If a team repeatedly fails inspection (robot or field inspection), identify the team to the Tournament Director and ask that they find someone to work directly with the team. Our goal is for every team to be successful, so please make every effort to help the team.

If a team cannot pass inspection, even with help, the Affiliate Partner or Tournament Director must decide how to continue.

Re-inspection

If a team makes significant changes to their robot or their programming during the day, they must undergo another inspection. It is not unusual for a team to ask for a reinspection of their robot.

The Head Referee may ask for a reinspection of a robot based on observations on the playing field. The Robot Inspector will reinspect the robot and report the results to the Head Referee. If the Robot Inspector and Head Referee disagree, the Robot Inspector should cite the supporting rule(s) and reason for the pass or fail recommendation. The Head Referee has the final authority over allowing a robot to compete.



Team Marker Inspection

The Team Marker is a team created scoring element that must be inspected with the robot before competing.

Build and Inspection Rules

The Team Marker is a new, game specific scoring element that will be used in the ROVER RUCKUSSM Presented by Qualcomm® game. The Team Marker must pass inspection before it allowed to be used in a match.

<TM01> Material Constraints - The Team Marker is subject to the *Robot* Mechanical Parts and Materials Rules in section 8.3.2.

<TM02> Size Constraints - The maximum size of the Team Marker is 4 inches (10.16 cm) by 4 inches (10.16 cm) by 8 inches (20.32 cm). The minimum size of the Team Marker is 3 inches (7.62 cm) by 3 inches (7.62 cm) by 4 inches (10.16cm).

<TM03> Team Number - Team Markers must be labeled with their *Team* number (numerals only, for example "12345") The letters must be legible when viewed from a distance of 12 inches away. The Team number needs to appear only once on the Team Marker.

<TM04> Illegal Parts - The following types of mechanisms and parts are not allowed:

- a. Electronics.
- b. Any other part or material that violates *Robot* construction rules outlined in section 8.3.

<I9> Team Marker Inspection - Team Markers will be inspected prior to the start of the competition, and concurrently with *Robot* inspection. A Team Marker must be re-inspected if it is modified after initial inspection.

Inspection Process

The Team Marker inspection is meant to be a quick check to ensure that each team's marker is made up of legal parts and follows the size guidelines from rule **<TM02>**.

The team marker size inspection should be done using a tape measure, unless the event provides a team marker sizing tool. Inspectors should be able to quickly measure and identify if the team marker falls within the sizing guidelines.

Inspectors must also quickly assess if there are any illegal parts on the team marker. Items such as electronics, materials with sharp corners, or items that contain liquid or gels are just a few examples of illegal parts. Make sure to reference rule **<RG01>** from the Game Manual Part 1 for a full list of illegal parts.

2018-2019 Season Changes

The following modules will no longer be allowed starting in the 2018-2019 season:

- Legacy HiTechnic DC Motor Controller
- Legacy HiTechnic Servo Controller
- Legacy MATRIX DC Motor/Servo Controller
- Legacy Sensors (LEGO and NXT sensors)
- Core Legacy Module

Modern Robotics Core Control Modules, except the Core Legacy Modules, are still allowed for the upcoming season.

Appendix A – Resources

Game Forum Q&A

<http://ftcforum.usfirst.org/forum.php>

Anyone may view questions and answers within the FIRST® Tech Challenge Game Q&A forum without a password. To submit a new question, you must have a unique Q&A System User Name and Password for your team.

Volunteers that apply for a specific volunteer role will receive an email from FTCTrainingSupport@firstinspires.org with their username and password to the forum. You will receive access to the forum thread specific to your role.

FIRST Tech Challenge Game Manuals

Part 1 and 2 - <https://www.firstinspires.org/resource-library/ftc/game-and-season-info>

FIRST Headquarters Pre-Event Support

Phone: 603-666-3906

Mon – Fri

8:30am – 5:00pm

Email: FTCTeams@firstinspires.org

FIRST Tech Challenge Event On-Call Support

*These numbers are available for event personnel only. Please **do not** call these numbers if you are a team looking for a ruling, a decision, or assistance. We trust that you will not misuse this resource.*

Day of Event Robot Control System Support: 603-206-2450

All other Day of Event support: 603-206-2412

FIRST Websites

FIRST homepage – www.firstinspires.org

[FIRST Tech Challenge Page](#) – For everything FIRST Tech Challenge.

[FIRST Tech Challenge Volunteer Resources](#) – To access public Volunteer Manuals.

[FIRST Tech Challenge Event Schedule](#) – Find FIRST Tech Challenge events in your area.

FIRST Tech Challenge Social Media

[FIRST Tech Challenge Twitter Feed](#) - If you are on Twitter, follow the FIRST Tech Challenge Twitter feed for news updates.

[FIRST Tech Challenge Facebook page](#) - If you are on Facebook, follow the FIRST Tech Challenge page for news updates.

[FIRST Tech Challenge YouTube Channel](#) – Contains training videos, Game animations, news clips, and more.

[FIRST Tech Challenge Blog](#) – Weekly articles for the FIRST Tech Challenge community, including Outstanding Volunteer Recognition!

[FIRST Tech Challenge Team Email Blasts](#) – contain the most recent FIRST Tech Challenge news for Teams.

Feedback

We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!

Appendix B – Robot Inspection Checklist

Team Number: _____

Robot Inspection Status (circle): **PASS / FAIL**

Team	Insp.	Robot Size & Weight Inspection	Rule #
		Robot is presented at inspection with all mechanisms (including all components of each mechanism), configurations, and decorations that will be used on the Robot during the competition.	<I7>
		Separately test the Robot in all of its unique starting (pre-match setup) configurations. The Robot fits within the Sizing Tool without exerting undue force on the Sizing Tool sides and top.	<I7>a <RG02>
		Robot Motion Warning Label is attached if servo motors move during the Robot initialization.	<RG02>b(i)
		Robot weighs no more than 42 pounds (19.05kg). + .5 pound overage allowance	<RG04>
✓	✓	General Robot Rules	Rule #
		Robot does not contain any components that could damage the Playing Field or other Robots.	<RG01>a&b
		Robot does not contain materials that are hazardous.	<RG01>c
		Robot poses no obvious unnecessary risk of entanglement.	<RG01>d
		Robot does not contain sharp edges or corners.	<RG01>e
		Robot does not contain animal-based, liquid, or gel materials.	<RG01>f&g
		Robot does not contain materials that would cause a delay of game if released.	<RG01>h
		Robot does not contain elements that electrically ground the Robot frame to the Playing Field.	<RG01>i
		Robot does not contain closed gas devices.	<RG01>j
		Robot does not contain hydraulic devices.	<RG01>k
		Alliance Flag Holder is present and adequately holds the Flag during normal Robot operation.	<RG05>
		Team number is visible from at least 2 sides (180 deg. apart). Numerals must be at least 2.5 inches (6.35 cm high), at least in 0.5 inches (1.27 cm) stroke width.	<RG06>
		Energy used by the Robot, (i.e., stored at the start of a Match), shall come only from approved sources.	<RG07>
		Robot is not capable of launching its own components.	<RG08>
✓	✓	Robot Mechanical Parts and Materials Rules	Rule #
		All components on the Robot are from allowable raw materials and Commercial Off The Shelf products.	<RM01> <RM02>
✓	✓	Robot Electrical Parts and Materials Rules	Rule #
		The Main Power Switch is installed properly, labeled, readily accessible, and visible to competition personnel. The TETRIX, REV, and MATRIX switches are the only allowed Main Power Switch.	<RE01>
		All batteries are securely attached to the Robot in a location where they will not make direct contact with other Robots or the Playing Field.	<RE02>
		Exactly one (1) Robot Main Battery Pack of an approved type is on the Robot and it is properly connected to the Main Power Switch and either the Core Power Distribution Module or REV Expansion Hub.	<RE03> <RE05>a(i)
		Where present, fuses must not be replaced with fuses of higher rating than originally installed or according to manufacturer's specifications.	<RE04>
		Allowed electronic devices are powered by power ports on the Core Power Distribution Module or REV Expansion Hub except as noted in <RE05>a&b, <RE12>, and <RE13>.	<RE05>a

		The Core Power Distribution Module or REV Expansion Hub is powered by the Robot main battery. If a hybrid of Modern Robotics modules is used with the REV Expansion Hub, the REV Expansion Hub must be powered from a power port on the Core Power Distribution Module.	<RE05>a(i)
		REV SPARK Mini Motor Controllers are powered by the Robot main battery.	<RE05>a(ii)
		Allowed sensors may only receive power from the Core Device Interface Module, and/or the REV Expansion Hub.	<RE05>a(iii)
		Light sources (including LEDs) are not focused or directed in any way, except for the REV Robotics 2m Distance Sensor. Light sources are powered by allowed methods.	<RE05>a(iv) <RE12>
		Video recording devices, if used, are powered by an internal battery and their wireless communication capability is turned off.	<RE05>a(v) <RE13>
		The Robot Controller is powered by its internal battery or by the built-in charging feature of the REV Expansion Hub.	<RE05>b
		Exactly one (1) Core Power Distribution Module is mounted on the Robot if any Modern Robotics Core Control Modules are used.	<RE07>a
		No more than two (2) REV Expansion Hubs are mounted on the Robot.	<RE07>e
		No more than two (2) Core Device Interface Modules are mounted on the Robot.	<RE07>b
		Robot contains no more than eight (8) DC motors of the allowed models.	<RE09>
		Robot contains no more than twelve (12) servos. They must be compatible with the attached REV Expansion Hub, REV Servo Power Module, or servo controller and not exceed the manufacturer specifications for the controller.	<RE10>
		Robot contains only allowed sensors and they are connected only to the REV Expansion Hub or the Core Device Interface Module.	<RE11>
		Power and motor control wires must use consistent color coding with different colors used for the positive (red, white, brown, or black with a stripe) and Negative/Common (black or blue) wires.	<RE14>h
		Power, motor control, servo and encoder wires are the correct size.	<RE14>k
		Robot does not contain elements that are electrically grounded to the Robot frame.	<RE14>m
		Approved electrical and electronic devices may be modified to make them more usable; they may not be modified internally or in any way that affects their safety.	<RE15>
✓	✓	Wheel/Tread Playing Field Damage Test - Optional	Rule #
		Robot did not damage the Playing Field tile. [This is an optional test that is performed only when an Inspector believes that the drivetrain tread may damage a Playing Field tile.]	<I8>
✓	✓	Team Marker Inspection	Rule #
		The <i>Team Marker</i> is subject to the <i>Robot Mechanical Parts and Materials Rules</i> in section 8.3.2.	<TM01>
		Maximum size of the <i>Team Marker</i> is 4 inches (10.16cm) by 4 inches (10.16cm) by 8 inches (20.32 cm). Minimum size of the <i>Team Marker</i> is 3 inches (7.62 cm) by 3 inches (7.62 cm) by 4 inches (10.16cm).	<TM02>
		Team Markers must be labeled with their Team number (numerals only, for example "12345").	<TM03>

General Comments or Reason(s) for Failure (if any):

I hereby state that all the above is true, and to the best of my knowledge all Robot construction rules and regulations of the FIRST® Tech Challenge have been abided by:

Robot Inspector

Team Student Representative

Gracious Professionalism® - "Doing your best work while treating others with respect and kindness - It's what makes FIRST, first."