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Technologies

2021-2022 *FIRST*[®] Tech Challenge

Robot Inspector Manual

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Volunteer Thank You

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 6,500 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*!

Revision History		
Revision	Date	Description
1	7/13/2021	Initial Release

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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.

Gracious Professionalism®

FIRST® uses this term to describe our programs' intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

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

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

FIRST Privacy Policy

FIRST takes the privacy of our community seriously. As a nonprofit and a mission-driven youth-serving organization, we are compelled to understand who we are serving, how our programs are performing, and make improvements so that we can achieve our goals of making FIRST accessible to any youth who wants to be part of the fun, exciting and life-changing experience. Thus, we need to collect certain personal data from participants and volunteers to ensure we are meeting our goals and responsibilities as a youth-serving nonprofit organization.

As a volunteer, you may be asked to handle the personal data, or personally identifiable information (PII), of coaches, team members, and even other volunteers. It is critical that you understand and follow the [FIRST Privacy Policy](#) and complete any data protection and privacy training required by your role. If you have any questions regarding data protection and privacy, please reach out to the FIRST Data Governance Team at privacy@firstinspires.org.

Volunteer General Information

Volunteer Training and Certification

To Access BlueVolt and Complete a Volunteer Role Training Course:

Once you have applied for a volunteer role that requires certification a link will appear in your FIRST dashboard that will connect you to our learning management system BlueVolt.

1. Login to your FIRST Dashboard
2. On the grey menu below "Dashboard" Click on "Volunteer Registration"
3. Click on "Roles Missing Certification"
 - a. Click into the link to "Review Outstanding Tasks" which will take you to the BlueVolt site where you can complete your certifications and sign up for new training

How to Access BlueVolt After Certifications are Complete:

Once you complete your certifications, you will no longer see a “Roles Missing Certification” link or a link to “Review outstanding Tasks” to get to BlueVolt. If that is the case, follow the steps below to access BlueVolt courses and updates.

1. Login to your *FIRST* Dashboard
2. At the top right of the page, click on the dropdown under your name and go to “My Profile”
3. Once there, on the left menu of the page, click on the “Certifications” link which will take you to the BlueVolt site where you can view/print your existing certifications and sign up for new training

If you have applied for a role but do not see the link to training in your dashboard, or you have other training related questions please email FTCTrainingSupport@firstinspires.org.

Volunteer Minimum Age Requirement

FIRST requires that *FIRST* Event volunteers be at least 13 years old, however, 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 program delivery partners can make case by case exceptions to these guidelines by contacting *FIRST* for approval.

Bring a Friend!

Volunteers are a huge part of the *FIRST* Tech Challenge Program and continuing to inspire students to seek out careers in science, technology, engineering, and math (STEM). *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 Firsttechchallenge@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!

Job Description

Introduction

The robot inspector is responsible for ensuring that each robot is built of allowable parts, sized correctly, and is safe to operate. The robot inspection involves, interacting with student team members, examining hardware, 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 at the beginning of the tournament. 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 Safety 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 and pit areas.

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. Robot inspectors may be called on to reinspect a robot during the competition.

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 lead field inspector to create an inspection schedule.
- 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 playing 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

FIRST Tech Challenge tournaments squeeze a lot of activity into one day. One of the keys to running a smooth and successful event is for teams and volunteers to show up prepared. Teams spend countless hours preparing for competition day and we ask our volunteers to prepare for tournament day as well. 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 for training and certification:

- The Robot Inspector Manual.
- Sections 7 and 8 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. Upon application, an email will be sent providing access to the training video, certification test, call schedules for Robot and Field Inspector Monthly Key Role Discussion calls, recordings from past calls, and copies of this manual. The most current version of the Game Manual Part 1 is located on our [website](#).

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 checklist 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) or safety.
- 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 at the beginning of the event. The inspections run simultaneously with field inspections (where the field inspectors inspect the team's Android and REV Control Hub devices) and team judging appointments. Each inspection should take roughly 10-15 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) robot sizing tool.
- Inspection checklist for each team (found in the [Game Manual Part 1](#)).
- 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.
- Pens.
- Yardstick.
- Tape Measure.



Supporting Documentation (Electronic or Paper Copies)

- Robot Inspector Manual.
- Sections 7 and 8 of the Game Manual Part 1.
- The relevant sections of the [Game Q&A Forum](#) (Forum responses are official, 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.

The recommended inspection schedule and procedures were created with the expectation that teams and volunteers will have a low stress and successful experience. If inspection runs behind schedule, keep in mind that volunteers still need to give every team the best possible experience; be kind and do not rush teams.

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:

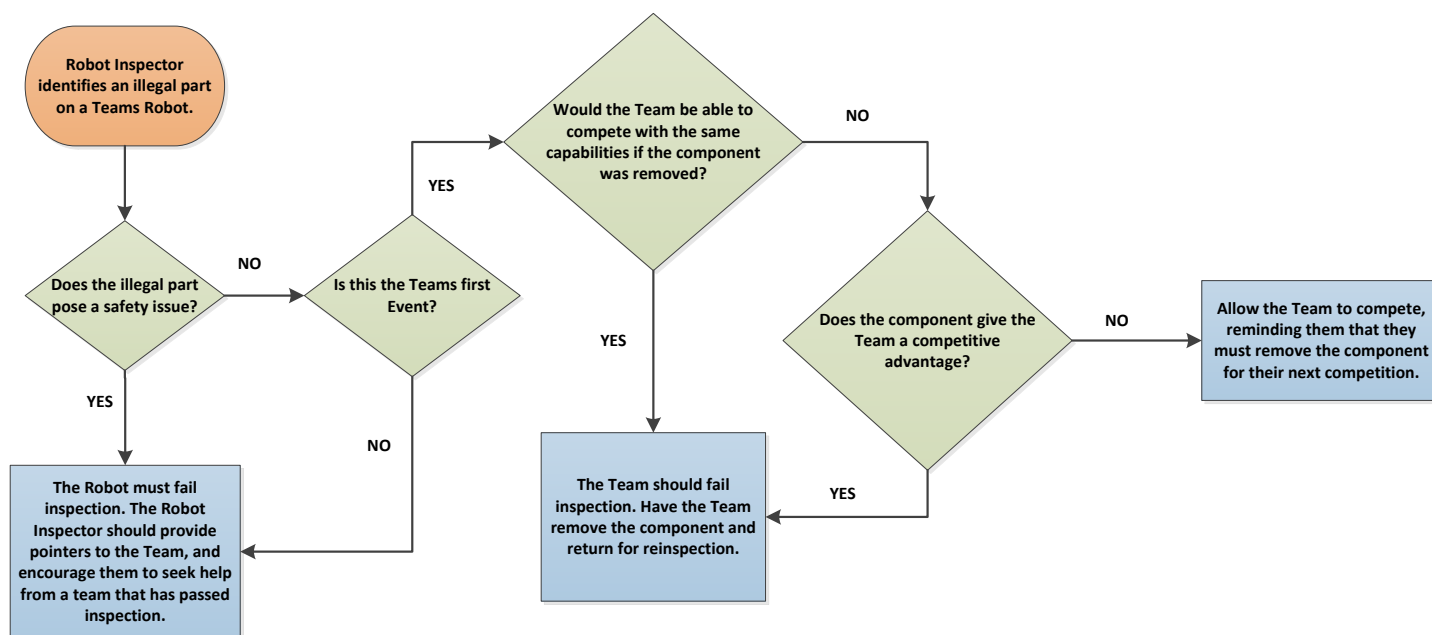
1. Is the part a safety issue?
2. Would the team be able to compete if the part was removed?
3. Does the part give the team a competitive advantage or disadvantage?
4. Could the robot achieve the same ability with legal parts?

If the answer to question #1 is yes, 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; and
- The robot's abilities would be significantly affected if the illegal part were removed.

The robot inspector **must** coach the team and advise that 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.

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 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?

If the inspector doesn't recognize a part of the robot, ask a student for additional information. If necessary, ask the team to identify the rule or post to the Q&A Forum that allows the part.

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 and rule compliance. 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. 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.

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.

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

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. Either method is okay.

If a sizing box is used, 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 software initialization. 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 <I06> 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:

<I06>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 the Robot 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. Inspectors should confirm that the team possesses both red and blue team-built Alliance Markers that comply with rule <RG05>.

Robot Inspection Checklist – General Robot Rules

The next section of the robot inspection checklist helps the inspector ensure 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 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 (Android Smartphone or REV Control Hub) 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 5 ft (1.52 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, REV Robotics, 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. No other power switches are allowed.

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

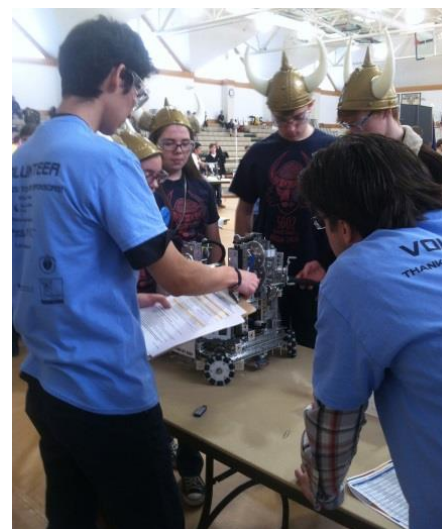
If a team repeatedly fails inspection (robot or field inspection), identify the team to the tournament director and ask that they find someone to work directly with the team. Our goal is for every team to be successful, so please make every effort to help the team.

If a team cannot pass inspection, even with help, the program delivery 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.



2020-2021 Season Changes and Topics for Emphasis

The prior season's update summary is included to aid veteran volunteers that did not participate in the 2020-2021 season.

The following items were added:

- REV Control Hub

The following items were eliminated:

- Robot Weight Limit
- Team Scoring Element
- Modern Robotics: Core Device Interface Module, Core Motor Controller, Core Power Distribution Module, and Core Servo Controller
- Vacuum based mechanisms
- Team Number stroke width minimum dimension

The following were modified:

- The maximum elevation for a launched scoring element is lowered to 5 ft (1.52 m)
- PWM (servo) wires are 22 AWG or larger

2021-2022 Season Changes and Topics for Emphasis

The following have been added:

- REV Driver Hub
- Team Scoring Element (section 7.4)
- Robot construction may not include current season game elements (<RM06>)

The following have been modified:

- Clarified robot power constraints (<RE05>)
- Changing internal servo components to convert a limited rotation angle servo to a continuous rotation servo or the reverse conversion are allowed (<RE16>)

Appendix A – Resources

Game Forum Q&A

<https://ftc-qa.firstinspires.org/>

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.

Volunteer Forum

Volunteers can request access to role specific volunteer forums by emailing FTCTrainingSupport@firstinspires.org. 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: Firsttechchallenge@firstinspires.org

FIRST Tech Challenge Event On-Call Support

The on call event support number is 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.

Event On-Call 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 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.	<I06>
		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	<I06>a <RG02>
		Robot Motion Warning Label is attached if servo motors move during the Robot initialization.	<RG02>
✓	✓	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
		Robot does not contain vacuum based mechanisms.	<RG01>l
		Team number is visible from at least 2 sides and meets requirements.	<RG04>
		Alliance Markers are present and meet requirements.	<RG05>
		Energy used by the Robot, (i.e., stored at the start of a Match), shall come only from approved sources.	<RG06>
		Robot is not capable of launching its own components.	<RG07>
✓	✓	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> <RM06>
✓	✓	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 REV Expansion Hub or REV Control Hub.	<RE03> <RE05>a(i&ii)
		Where present, fuses must not be replaced with fuses of higher rating than originally installed or according to manufacturer's specifications. Fuses are single use only.	<RE04>
		Allowed electronic devices are powered by power ports on the REV Expansion Hub or REV Control Hub except as noted in <RE05>a&b, <RE13>, and <RE14>.	<RE05>a
		The REV Expansion Hub and/or REV Control Hub is powered by the Robot main battery.	<RE05>a(i&ii)
		REV SPARK Mini Motor Controllers and REV Servo Power Modules are powered by the Robot main battery or a REV Control or Expansion Hub XT30 port.	<RE05>a(ii)
		Allowed sensors may only receive power from the REV Expansion Hub or REV Control 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) <RE13>
		Video recording devices, if used, are powered by an internal battery and their wireless communication capability is turned off.	<RE05>a(v) <RE14>
		The smartphone Robot Controller Android device (if used) is powered by its internal battery or by the built-in charging feature of the REV Expansion Hub.	<RE05>b
		Exactly one Robot Controller (a) smartphone Android Device + REV Expansion Hub or b) REV Control Hub) is required. One additional REV Expansion Hub is allowed.	<RE06> <RE08>
		The only allowed Motor and Servo Controllers are: REV Expansion Hub, REV Control Hub, REV Servo Power Module, REV Spark Mini Motor Controller, and VEX Motor Controller 29.	<RE09>
		Robot contains no more than eight (8) DC motors of the allowed models.	<RE10>
		Robot contains no more than twelve (12) servos. They must be compatible with the attached REV Expansion Hub, REV Control Hub, REV Servo Power Module, or VEX Motor Controller 29 and not exceed the manufacturer specifications for the controller.	<RE11>
		Robot contains only allowed sensors and they are connected only to the REV Expansion Hub or the REV Control Hub.	<RE12>
		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.	<RE15>f
		Power, motor control, servo and sensor wires are the correct size.	<RE15>i
		If electronics are grounded to the <i>Robot</i> frame, the only approved method is the REV Robotics Resistive Grounding Strap. If needed, the REV Robotics Anderson Powerpole to XT30 adapter may connect to the Resistive Grounding Strap. No other grounding straps or cables are allowed.	<RE15>k
		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.	<RE16>
✓	✓	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.]	<I07>
✓	✓	Team Scoring Element Inspection	Rule #
		The <i>Team Scoring Element</i> is subject to the <i>Robot Mechanical Parts and Materials Rules</i> in section 7.3.2.	<TE01>
		Maximum size of the <i>Team Scoring Element</i> is 4 inches (10.16 cm) by 4 inches (10.16 cm) by 8 inches (20.32 cm). The minimum size of the <i>Team Scoring Element</i> is 3 inches (7.62 cm) by 3 inches (7.62 cm) by 4 inches (10.16 cm).	<TE02>
		Team Scoring Element must be labeled with their Team number (numerals only, for example, "12345").	<TE03>
		Team Scoring Element does not use or resemble any current season's COTS scoring elements.	<TE04> <TE05>

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

Robot Inspector