2023-2024 FIRST® Tech Challenge
Game Manual Part 2 – Traditional Events
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Revision History

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1.0 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. 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.

2.0 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.

3.0 How to Use This Document

The Game Manual Part 2 – Traditional Events is a resource for all FIRST® Tech Challenge Teams for information specific to the 2023-2024 season’s game.

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 have read everything, you know everything.

Key words that have a specific meaning within this document are defined in the Game Definitions section and are indicated with the first letter capitalized, and the entire word in Italics.
4.0 The Game

4.1 Introduction
This document describes CENTERSTAGE™ presented by RTX, the FIRST® Tech Challenge game for the 2023-2024 season. We recommend viewing the game animation prior to reading this manual to gain a general understanding of the game. The animation is a brief summary of the game; it is not intended to provide the necessary information to fully understand the official game rules. Teams should refer to the Game Manual Part 1 – Traditional Events for information about the competition such as how rankings work (Ranking and TieBreaker Points), advancement, judged awards, Robot construction rules, and general competition rules.

4.2 Game Description
4.2.1 Field Illustration
The following illustrations identify the Game Elements and give a general visual understanding of the game. Teams should refer to andymark.com/FTC for the exact Game Element dimensions. The official Playing Field documents, including the official Field Setup and Assembly Guide, are available at https://www.firstinspires.org/resource-library/ftc/game-and-season-info.

Figure 4.2-1 – Isometric view of the Playing Field
4.2.2 Gameplay Overview

Welcome to CENTERSTAGE® presented by RTX. Matches are played on a Playing Field initially set up as illustrated in Figure 4.2-1. Two Alliances – one “red” and one “blue”, made up of two Teams each – compete in each Match. The object of the game is to earn as many points as possible by performing the achievements outlined below.

The Match starts with a 30-second Autonomous Period in which Robots operate using only pre-programmed instructions and sensor inputs. The following Robot actions earn points during the Autonomous Period:

1. Navigating to their Alliance Backstage.
2. Placing Pixels On their Alliance Backdrop or In their Alliance Backstage.
3. Identifying the Randomization Object on the randomly selected Spike Mark. Alliances can earn points by:
   a. Placing a purple Pixel On the randomly selected Spike Mark.
   b. Placing a yellow Pixel On their Alliance Backdrop in the location corresponding to the randomly selected Spike Mark.

Additional points are earned for these tasks when a Team uses their Team Prop in place of the tournament provided white Pixel.

The two-minute Driver-Controlled Period follows the Autonomous Period. Robots earn points by:

1. Placing Pixels On their Alliance Backdrop or In their Alliance Backstage.
2. Creating Mosaics.
3. Scoring Pixels that cross the Set Line on their Alliance Backdrop.

The final 30 seconds of the Driver-Controlled Period is called the End Game. In addition to the previously listed Driver-Controlled Period Scoring activities, Alliances earn points by:

1. Suspending Robots from their Alliance Rigging.
2. Parking Robots In their Alliance Backstage.

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3. Parking their Launched Drones In Landing Zone 1, 2, or 3.

4.2.3 Gameplay Technology
Each game comes with its own unique set of challenges. In CENTERSTAGE℠ there are multiple ways Teams can utilize technology to assist them in solving these challenges. Teams may use the built-in technology, or they can come up with their own solutions to solve the challenges.

This season, the challenges include:

1. Object Identification:
   a) Robots can use their on-board control system and sensors to identify Game Elements.
   b) Robots can use the built-in TensorFlow technology to decode the randomized Autonomous task.

2. Field Navigation: Built-in AprilTag technology helps the Robot identify and navigate to important locations on the Playing Field.

3. Situational Awareness: Sensors provide situational awareness during the Autonomous Period, automate operations, and provide feedback during the Driver-Controlled Period. Cameras, IMUs, motor encoders, distance, and color sensors are useful for solving gameplay tasks.

For resources on how to use the available technologies, please visit https://ftc-docs.firstinspires.org/control_hard_compon/rc_components/sensors/sensors.html.

4.3 Game Definitions
The following definitions and terms are used for CENTERSTAGE℠. Defined terms begin with a capital letter and are italicized throughout the manual (for example, Alliance). Game rules mean exactly and only what it plainly says. If a word isn’t given a game definition, then you should use its common conversational meaning.

Alliance – Each FIRST Tech Challenge Match consists of two, two-Team Alliances℠, designated as red or blue. The two Teams in one Alliance compete against the two Teams in the other Alliance to complete the game challenges and to earn the highest Score.

Alliance Neutral – Available to a Robot from any Alliance.

Alliance Specific – Associated with a specific Alliance (i.e., red or blue Alliance).

Alliance Station – The designated “red” or “blue” Alliance area next to the Playing Field where the Drive Team stands or moves within during a Match. Station One is the position in the Alliance Station that is closest to the audience.

AprilTag – A visual fiducial system, useful for a wide variety of tasks including augmented reality, robotics, and camera calibration¹. Three (3) AprilTags are affixed to each Backdrop to identify target locations for the Autonomous randomization task outlined in section 4.4.2. Two additional sets of AprilTags are placed at the audience side of the field for assistance with field localization. Information about AprilTags may be found here: https://ftc-docs.firstinspires.org/en/latest/apriltag-intro.

¹ See https://april.eecs.umich.edu/software/apriltag accessed on 5/18/2023.

Area – The space defined by the vertical projection of the outside edge of a region’s boundary (for example, gaffer tape, goal, Playing Field Wall). The boundary element (tape, wall, markings, etc.) is part of the Area for the purposes of determining Inside and Outside.
Autonomous Period – The initial thirty-second Match period in which the Robots operate and react only to sensor inputs and to commands pre-programmed by the Team onto the onboard Robot control system. Human control of the Robot is not permitted during this time.

Backdrop – A structure upon which Robots place Pixels to score points. There are two (2) Alliance Specific Backdrops, one (1) red and one (1) blue. See Appendix C-2 for specifications.

Backstage – The Alliance Specific Area beneath a Backdrop. The Backstage is defined by nominal 1-inch (24 mm) wide tape and is approximately 72-inches (183 cm) long by 23-inches (58.4 cm) deep. There are two (2) Alliance Specific Backstages, one (1) red and one (1) blue.

Block / Blocking – Preventing an opposing Alliance Robot from accessing an Area or Game Element for an extended period by obstructing ALL paths of travel to the object or Area. Active defense played by a Robot shadowing an opposing Alliance Robot that eliminates all paths of travel between the opposing Alliance Robot and an Area or Alliance Specific Game Element or all remaining Alliance Neutral Game Elements is considered Blocking, even though at a given moment there is an open path. See also the definition of Trap / Trapping.

Coach – A Student Team member or adult mentor designated as the Drive Team advisor during the Match and identified by wearing a Coach badge or identifying marker.

Competition Area – The Area where all the Playing Fields, scoring areas, Alliance Stations, scoring tables, on-deck queuing tables, event officials, and other competition items relating to Match play are located. The Team Pit area and practice Playing Fields are not part of the Competition Area.

Control / Controlling – An object is Controlled by a Robot if the object is following the movement of the Robot. Objects that are Controlled by a Robot are considered to be a part of the Robot. See also the definition of Possess / Possessing. Examples of interaction with Game Elements that are Controlled include, but are not limited to:

a) Carrying one or more Game Elements.

b) Herding of Game Elements. See also the definition of Herding in this section.

c) Propelled Game Elements are considered Controlled until they make contact with something other than the Playing Field Floor or come to rest. See also the definition of Propelled in this section. Inadvertent loss of Control of a Scoring Element is not considered Propelling.

Examples of interaction with Game Elements that are not Controlled include, but are not limited to:

d) Plowing of Game Elements is not considered Control. See also the definition of Plowing in this section.

e) Inadvertent contact with a Propelled Game Element as it bounces off the Playing Field or a Robot. See also the definition of inadvertent in this section.

Disable / Disabled – A Robot that is no longer active for the remainder of the Match due to a Robot failure or by the request of a referee. Only a Referee can declare a Robot Disabled. If a referee Disables a Robot during a Match, they may ask the Team to drive their Robot to a neutral position on the Playing Field, issue a stop command with the Driver Station, and place their Driver Station in a hands-off location on a competition provided structure or the Alliance Station floor.

Disqualified / Disqualification / Disqualify – A Team that is ineligible to compete in a Match. A Team that is Disqualified from a Match will not receive credit for the Match (that is, no Score, no Ranking and no TieBreaker points).
**Drive Team** – Up to four (4) representatives; two (2) Drivers, one (1) Human Player and one (1) Coach from the same Team. Only one (1) Human Player represents an entire Alliance in a Match.

**Driver** – A Student Team member responsible for operating and controlling the Robot and identified by wearing a competition supplied Driver badge or identifying marker.

**Driver-Controlled Period** – The two-minute Match time in which the Drivers operate the Robots.

**Driver Station** – Hardware and FIRST supplied software used by a Drive Team to control their Robot during a Match. A detailed description of the Driver Station rules is listed in Game Manual Part 1 – Traditional Events.

**Drone** – A paper airplane Scoring Element built and supplied by a Team. The Drone must be constructed using materials and methods described in Game Manual Part 1 – Traditional events and have passed inspection.

**End Game** – The last thirty (30) seconds of the two-minute Driver-Controlled Period.

**End of the Period/Match** – The moment when the Match timer reaches 2:00 for the Autonomous Period or 0:00 for the Driver-Control Period and which coincides with the start of the sound that designates the End of the Period.

**Game Element** – Any item Robots interact with to play the game. Game Elements for this year’s game include Pixels, Backdrops, Trusses, Stage Door, Riggings, Team Prop, and Drone.

**Grasp** – Securely holding an object.

**Herding** – Pushing or moving one or more Scoring Elements to a desired location or direction that gains a strategic advantage beyond moving the Robot around the Playing Field. See also the related definition of Plowing in this section.

**Human Player** – A Student Team member responsible for handling Scoring Elements and identified by wearing a competition supplied Human Player badge or identifying marker.

**Human Player Station** – The designated red or blue Area adjacent to the Playing Field where the Human Players are located during a Match.

**In (Inside) / Completely In (Completely Inside)** – An object that has crossed into the upwards vertical extension (i.e., at a right angle to the Playing Field Floor) of a defined Area’s boundary is Inside the Area. An object that is entirely within the upwards vertical extension of a defined Area’s boundary is Completely Inside the Area. The boundary element (tape, wall, markings, etc.) is part of the Area for the purposes of determining Inside and Outside, unless otherwise specified.

**Inadvertent** – An unintended side effect of a Robot action. Unforced or unexpected Robot actions based on software commands are not considered to be Inadvertent.

**Inconsequential** – An outcome that does not influence Scoring or gameplay.

**Interference** – Interaction between opposing Alliance Robots that amplifies the difficulty of a Scoring activity. Actions that constitute Interference should not be considered illegal except as specified by a game rule.

**Landing Zone** – Alliance Neutral Areas outside the Playing Field Perimeter on the audience side of the Playing Field Wall. There are three (3) Landing Zones:
a) **Landing Zone 1** – A 144-inch (3.66 m) wide x 24-inch (610 mm) deep Area immediately adjacent to the audience side Playing Field Wall.

b) **Landing Zone 2** – A 144-inch (3.66 m) wide x 24-inch (610 mm) deep Area immediately adjacent to Landing Zone 1.

c) **Landing Zone 3** – A 144-inch (3.66 m) wide x 24-inch (610 mm) deep Area immediately adjacent to Landing Zone 2.

The first white tape line from the Playing Field Wall is part of Landing Zone 1, the second white tape line is part of Landing Zone 2, and the third white line is part of Landing Zone 3. (see Appendix C-9).

Recognize that Landing Zone surfaces and marking materials may vary from event to event. Potential surfaces include hardwood floors, carpeting, gym tarp, cement, tiles, mats, etc. Potential marking materials include tape, paint, etc. Teams should plan for these variances when competing at different events.

**Launch / Launching** – Propelling Game Elements through the air or water above the Playing Field Floor.

**Match** – A head-to-head competition between two Alliances. Matches are made up of several periods totaling two minutes and thirty seconds (2:30). There is a thirty (30) second Autonomous Period, followed by a two (2) minute Driver-Controlled Period. The last thirty (30) seconds of the Driver-Controlled Period is called the End Game. There is an eight-second transition between the Autonomous Period and the Driver-Controlled Period for Teams to pick up the controllers and switch programs.

**Mosaic** – A cluster of three (3) non-white Pixels Scored On a Backdrop. See Appendix F, figures F-2 and F-3 for examples.

1. A Mosaic consists of three (3) non-white Pixels, either all the same color (all green, all purple or all yellow) or each Pixel a different color (one (1) green, one (1) purple, and one (1) yellow).

2. A completed Mosaic cannot be in contact with another non-white Pixel.

3. Each Pixel in a Mosaic must be in contact with the other two (2) Pixels of that Mosaic.

**Navigating** – A Scoring task where a Robot is Parked In or Completely In a specified Area.

**Off / Completely Off** – Not physically in contact with or Supported by an object, surface, etc. Objects that are Off are also considered Completely Off.

**On / Completely On** – An object that is physically in contact with and at least partially Supported by an object, surface, etc. is considered On. An object that is entirely Supported by an object, surface, etc. is Completely On.

**Out / Outside** – An object that does not extend into any part of a defined Area is Outside the Area.

**Park / Parked** – The condition where a Robot or Drone is motionless.

**Penalty** – The consequence imposed for a rule or procedure violation that is identified by a referee. When a Penalty occurs, points will be added to the non-offending Alliance’s Score. Penalties are further defined as Minor Penalties and Major Penalties.

Penalties may also escalate to the issuing of a Yellow Card or Red Card as a result of a continued occurrence of a rule violation and upon discretion of the Referee.

**Yellow Cards and Red Cards** – In addition to rule violations explicitly listed in section 4.5, Yellow Cards and Red Cards are used in the FIRST Tech Challenge to manage Team and Robot behavior that does not align with the mission of FIRST. Yellow and Red Cards are not limited to just the Gracious Professionalism® - “Doing your best work while treating others with respect and kindness - It’s what makes FIRST, first.”
**Competition Area.** Teams that display egregious behavior in the pit area, judging rooms, stands, or any other location of the competition can be issued a Yellow or Red Card for egregious behavior.

Illegal behaviors that are repeated (3 or more times), or egregious behaviors by a Robot or Team member at the competition can result in a Yellow and/or Red Card. Yellow Cards are additive, meaning that a second Yellow Card is automatically converted to a Red Card. A Team is issued a Red Card for any subsequent incident in which they receive an additional Yellow Card, for example, earning a second Yellow Card during a single Match.

Yellow and Red Cards may be issued on or off the competition field. For details, please make sure to read the Competition Rules outlined in section 3.5 of the Game Manual Part 1 – Traditional Events.

**Pin / Pinning** – Preventing the movement around the Playing Field in all directions of an opposing Alliance Robot while it is in contact with the Playing Field Wall, one or more Game Elements, or another Robot.

**Pixel** – A hexagonal shaped Scoring Element, 3-inches (76.2 mm) across by 0.5-inches (12.7 mm) thick. There are sixty-four (64) white Pixels, ten (10) yellow Pixels, ten (10) green Pixels, and ten (10) purple Pixels.

**Pixel Storage** – The designated Alliance Specific area outside of the Playing Field Wall directly adjacent to the Wing (see Figure 4.2-2) where Pixels are stored to be introduced by the Human Player. There are two (2) Alliance Specific Pixel Storage areas, one (1) red and one (1) blue.

**Playing Field** – The part of the Competition Area that includes the 12 ft. x 12 ft. (3.66 m x 3.66 m) field, the Landing Zones, and all the Game Elements described in the official field documents. From the audience viewpoint, the Red Alliance Station is on the right side of the Playing Field.

**Playing Field Damage** – A physical change to a Game Element or Playing Field that affects gameplay.

**Playing Field Floor** – The top surface of the Tiles that make up the base of the Playing Field.

**Playing Field Perimeter** – The boundary defined by the outside edge of the extrusion that holds the Playing Field Wall panels.

**Playing Field Wall** – An approximate 12-inches (30.5 cm) tall, 12 ft. (3.66 m) long by 12 ft. (3.66 m) wide wall surrounding the Playing Field Floor. The height of the Playing Field Wall and inside dimensions will vary depending on which manufacturer’s Playing Field Wall is being used at the event. Robots should be built to interact with all legal Playing Field Walls.

**Plowing** – Inadvertent contact with Game Elements while in the path of the Robot moving about the Playing Field that provides no additional advantages beyond field mobility. See also the definition of Herding in this section.

**Possess / Possessing** – An object is Possessed by a Robot if, as the Robot moves or changes orientation (for example, moves forward, turns, backs up, spins in place), the object remains in approximately the same position relative to the Robot. Objects Possessed by a Robot are considered to be Controlled, and they are part of the Robot. See also Control/Controlling.

**Pre-Load** – A Game Element that a Drive Team positions during pre-Match setup so that it touches a Robot or is Possessed by a Robot at the start of the Autonomous Period.
Propel / Propelling – Giving Game Elements enough force such that they move independent of contact with the Robot or Human Player. Movement solely due to gravity is not Propelling. Launching, Rolling, and Sliding are forms of Propelling.

Queuing Area – The location in the Competition Area where Drive Teams, Robots, and optional Robot transportation carts are staged until directed by competition personnel to set up their Robots on a competition Playing Field.

Randomization Object – A white Pixel or Team Prop that is placed in one of three randomly chosen locations. There are four (4) Randomization Objects, one (1) placed opposite each Robot.

Randomization Task – An Autonomous Period Scoring achievement designated by the target Randomization Object.

Rigging – Part of the Truss from which Robots Suspend. There are four (4) Alliance Specific Riggings, two (2) red and two (2) blue.

Robot – Any mechanism that has passed Robot inspection and a Drive Team places on the Playing Field prior to the start of a Match. A detailed definition of Robot is in the Robot rules section in the Game Manual Part 1 – Traditional Events.

Rolling – Propelling Game Elements along the Playing Field Floor.

Score / Scoring – Robots earn points for their Alliance by interacting with Scoring Elements and Navigating to specific Areas of the Playing Field.

The specific method for each Scoring achievement is stated in the achievement’s description in Section 4.4. Individual Scoring achievements are determined by one of three methods:

1. **Scored as Completed**: The achievement is considered Scored the moment it is successfully completed, i.e., all criteria are met.

2. **Scored at End of the Period**: The achievement’s Scoring status is determined based on the Robot or Scoring Element's position at the End of the Period (Autonomous or Driver-Controlled).

3. **Scored at Rest**: The achievement is considered Scored based on the position of the Robot or Scoring Element when the entire field has come to rest after the Period (Autonomous or Driver-Controlled) ends.

Use of the real-time scoring system display is intended to help the audience and Teams keep up with the action on the Playing Field and give a general sense of the Match Score. Those watching should keep in mind that the Scoring for the Match is not official until the referees finalize the Score after the End of the Match.

Scoring Elements – Objects that Robots manipulate to earn points for their Alliance. The Scoring Elements for CENTERSTAGE™ are Pixels and Drones.

Set Bonus – Scoring achieved by Robots when they place Pixels that cross the bottom edge of a Set Line on the Backdrop.

Set Line – A line on the Backdrop that indicates a height achievement. There are three (3) Set Lines on each Backdrop.

Slide / Sliding – Propelling Game Elements along the Playing Field Floor.

Gracious Professionalism® - “Doing your best work while treating others with respect and kindness - It’s what makes FIRST, first.”
**Spike Mark** – A one (1) inch by twelve (12) inch long tape line. There are three (3) Spike Marks in each of the Tiles B2, B4, E2, and E4. They are positioned on the left, center, and right of the Tiles from the corresponding Alliance Station perspective. The Spike Marks identify locations for the Autonomous Randomization Task outlined in section 4.4.2.

**Stage Door** – A horizontally hinged, height restricting barrier that spans the gap between the Trusses. Robots can manipulate to allow their passage from one side of the Playing Field to another. The Stage Door opens towards the rear of the Playing Field (see Appendix C for a drawing of the Stage Door’s range of motion).

**Student** – A person who has not completed high-school, secondary school, or the comparable level as of September 1st prior to the season Kickoff.

**Support / Supported / Completely Supported** – An object (i.e., Robot, Scoring Element, Game Element, etc.) is Supported by another object if the second object is bearing at least some of the weight of the first object. If the second object is bearing all the weight of the first object, it is Completely Supported by the second object.

**Suspend / Suspended** – A Robot is Suspended when it is Completely Supported by the Rigging and is not in contact with any other Game Element, Robot, or the Playing Field Floor. Incidental contact with Scoring Elements, the Truss, another Robot or the Stage Door is allowed (for example, Possession of Scoring Elements is allowed). Teams are encouraged to make these actions obvious and unambiguous.

**Team** – Mentors, supporters, and Students affiliated with an entity registered with FIRST and for the competition.

**Team Prop** – A Team designed and supplied Game Element used during the Autonomous Period. The Team Prop must meet the specifications described in Game Manual Part 1 – Traditional Events.

**Tile** – An approximate 24-inch x 24-inch (610 mm x 610 mm) foam rubber mat. The Playing Field Floor has thirty-six (36) Tiles. Tile size may vary depending on which manufacturer’s Tile is used at the event. Robots should be built to interact with all legal Tiles. Tile size variation may affect locations of Game Elements and gap sizes between the Tile and Playing Field Walls.

**Trap / Trapping** – Preventing an opposing Alliance Robot from escaping a constrained Area of the Playing Field for an extended period of time by obstructing all paths of travel from the object or Area. See also the definition of Block / Blocking in this section.

**Truss** – A structure that contains two (2) Alliance-specific Riggings. There are two (2) Alliance Specific Trusses on the Playing Field, one (1) red and one (1) blue. The Stage Door connects the two Trusses.

**Warning** – An alert given by a referee to an individual or group. Warnings are applied to the entire Team, and they have no effect on an Alliance’s Score. Warnings are used as a way to point out rule violations while not issuing formal Penalties. Repeated Warnings throughout a Competition may escalate to Penalties and/or Yellow/Red Cards.

**Wing** - Taped off locations on the Playing Field Floor where a Human Player places Pixels and Drones. There are two (2) Alliance Specific Wings, one (1) red and one (1) blue.
4.4 Gameplay
Prior to the start of the Match, Drive Teams perform some basic Robot setup steps that are described in section 4.4.1. Matches are made up of several periods totaling two minutes and thirty seconds (2:30). There is a thirty (30) second Autonomous Period, followed by a two (2) minute Driver-Controlled Period. The last thirty (30) seconds of the Driver-Controlled Period is called the End Game. There is an eight-second transition between the Autonomous Period and the Driver-Controlled Period for Teams to pick up the controllers and switch programs. When the Match is over and referees signal, Drive Teams collect their Robots and Team Supplied Game Elements, return Possessed tournament provided Game Elements to the Playing Field, and exit the Competition Area.

4.4.1 Pre-Match
1. Field personnel set up the Playing Field as depicted in Figure 4.2-1.
   a) Pixel placement
      i. On-Field:
         a) Six (6) stacks of five (5) white Pixels
      b) Pixel Storage: there are two Pixel Storage locations, one (1) for the red Alliance and one (1) for the blue Alliance. Each Pixel Storage contains the following:
         i. Three (3) stacks of five (5) white Pixels
         ii. One (1) stack of five (5) purple Pixels
         iii. One (1) stack of five (5) yellow Pixels
         iv. One (1) stack of five (5) green Pixels
   c) Randomization Task
      i. Four (4) white Pixels, one (1) for each set of Spike Marks. The Pixels will start centered on top of the center Spike Marks.
2. Drive Teams set up their Robots on the Playing Field with the following constraints:
   a) Starting Location
      i. Drive Teams, with the agreement of their Alliance partners, select their Robots’ starting locations.
      ii. Blue Alliance Robots must start Completely In Tile A2 or A4, red Alliance Robots must start Completely In Tile F2 or F4. See Appendix B for Tile nomenclature.
      iii. Drive Teams must place their Robot, in any orientation, touching the Playing Field Wall adjacent to their Alliance Station.
   b) Pre-Loaded Pixels – The Drive Team may Pre-Load exactly one (1) yellow Pixel and/or one (1) purple Pixel. If used, Pre-Loaded Pixels are taken from Pixel Storage. When loaded, the Pre-Loaded Pixels must be Outside all Scoring Areas.
   c) Drones - Drive Teams may either Pre-Load exactly one (1) Drone or place one (1) Drone into the Pixel storage area.
   d) Team Prop – Drive Teams intending to use their Team Prop must place it centered on top of the center Spike Mark closest to their Robot. If a Team Prop is used, the white Pixel is placed into that Alliance’s Pixel Storage.

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e) **Op Mode** –
   i. *Drive Teams* use their *Driver Station* to select an *Autonomous* op mode. If the *Team* does not have an *Autonomous* op mode, steps ii and f) below can be skipped.
   
   ii. Press the *Driver Station* “Init” button.

f) **Autonomous Timer** – The thirty-second timer must remain enabled.

g) **Robot Motion** - *Robot* must be motionless prior to the start of the *Match*.

h) **Driver Station** - *Drive Teams* may not touch their *Driver Stations* or controllers until the *Autonomous Period* has ended, except to start their *Autonomous* program (if applicable) with a single touch to the *Driver Station* Android device screen.

4. Once the referees signal that set-up is complete:

   a) *Drive Teams* may no longer touch their *Robots* until the conclusion of the *Match*.

   b) *Drive Teams* may not touch their *Driver Stations* or controllers until the *Autonomous Period* has ended. Exceptions to this include using the *Driver Station* to start their *Autonomous* program or to *Disable* their *Robot* as instructed by a referee.

   c) The Scoring System will choose one of the *Spike Marks* (left, center, right) as the target for the *Randomization Tasks*. Field personnel will move the *Randomization Object* to the chosen *Spike Mark* as specified in Appendix E.

4.4.2 **Autonomous Period**

The *Match* starts with a thirty (30) second *Autonomous Period* where *Robots* are operated only via pre-programmed instructions. *Teams* are not allowed to control *Robot* behavior with the *Driver Station* or any other actions during the *Autonomous Period*. The *Driver Station* is placed in a hands-off location during the *Autonomous Period* so that it is evident that there is no human control of *Robots*. The only exception is to allow *Drive Teams* to start their *Robot* with the “start” command issued on the *Driver Station* touch screen. *Teams* must use the built-in thirty-second timer.

Following a countdown by field personnel, the *Autonomous Period* begins. *Drive Teams* may issue *Robot* start commands with their *Driver Station* Android device to run the *Autonomous Op Mode* that was selected during *Pre-Match* setup. Failure to adhere to this procedure may subject the *Team* to a *Penalty* as specified in the game rules in section 4.5.2. *Drive Teams* are not required to start executing an Op Mode during the *Autonomous Period*.

*Autonomous* points are **Scored at Rest** for the following achievements:

1. **Navigating** – *Robots* that *Park In the Backstage* for the corresponding *Alliance* earn five (5) points for each *Robot*.

2. **Randomization Tasks** – There are two distinct tasks based on the *Spike Mark* location that was designated during *Randomization*. A *Robot* may only use its own *Pre-Loaded Pixels* to earn *Randomization Task* points.

   a) A purple *Pixel* placed *On* the *Robot’s designated Spike Mark* in the *Tile* immediately adjacent to the starting location, earns points depending on the *Randomization Object* used:
      i. Ten (10) points for using the white *Pixel*; or
      ii. Twenty (20) points if *Team Prop* is used.
b) A yellow Pixel on the Backdrop in the location corresponding to the designated Spike Mark earns points depending on the Randomization Object used:
   i. Ten (10) points for using the white Pixel; or
   ii. Twenty (20) points if Team Prop is used.

3. **Pixels** – Robots placing Pixels earn points as follows:
   a) All Pixels On the recessed Scoring area of their Alliance Backdrop earn five (5) points per Pixel.
   b) Pixels In their Alliance Backstage earn three (3) points per Pixel.

   Pixels that are Scored in the Autonomous Period will earn additional points at the end of the Driver-Controlled Period if they remain in place.

### 4.4.3 Driver-Controlled Period

Directly following the end of the Autonomous Period, Drive Teams have five (5) seconds plus a “3-2-1-go” countdown to prepare their Driver Stations for the start of the 120 second Driver-Controlled Period. On the countdown word “go,” the Driver-Controlled Period starts, and Drive Teams press their Driver Station start button to resume playing the Match.

**Driver-Controlled tasks are Scored at Rest** for the following achievements:

1. **Pixel** – Robots placing Pixels earn points as follows:
   a) Pixels On the recessed Scoring area of their Alliance Backdrop earn three (3) points per Pixel.
   b) Pixels In their Alliance Backstage earn one (1) point per Pixel.

2. **Artist Bonus** – Mosaics earn ten (10) points per Mosaic.

3. **Set Bonus** – Alliances earn ten (10) points when Scored Pixels On a Backdrop extend In a horizontal Set Line. Vertically crossing In each Set Line earns one (1) Set Bonus, regardless of the number of Pixels that cross it. The maximum Set Bonus for an Alliance is thirty (30) points.

### 4.4.4 End Game

The last thirty seconds of the Driver-Controlled Period is called the End Game. Driver-Controlled Period Scoring can still take place during the End Game. End Game achievements, other than Navigating, begun before the start of End Game are worth zero (0) points.

1. **Robot Location** – There are two mutually exclusive location-based Scoring opportunities. A Robot may only earn points for one of these tasks. Teams are encouraged to make these actions obvious and unambiguous. Robot Location is Scored at End of the Period.
   a) **Suspended from the Rigging** - A Robot Suspended by a corresponding Alliance’s Rigging earns twenty (20) points. Only one (1) Robot per Rigging counts as Scored.
   b) **Parked In the Backstage** – Robots that Park In the Backstage for the corresponding Alliance earn five (5) points for each Robot.

2. **Drone Launching** – Launched Drones that end up Parked In a Landing Zone earn points as shown below. Launched Drones must pass over the Truss and/or Stage Door for each scoring attempt to earn points. Drone Launching is Scored at Rest.
   a) Landing Zone 1 earns thirty (30) points.
   b) Landing Zone 2 earns twenty (20) points.
   c) Landing Zone 3 earns ten (10) points.

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4.4.5 Post Match
By the conclusion of the stop Match sound, Drive Teams must press the stop button on their Driver Stations. Field Personnel will then finalize the Score. Referees will signal for the Drive Teams to enter the Playing Field and retrieve their Robots and Drones. Drive Teams should return any tournament provided Game Elements that are Possessed by the Robot to the Playing Field. The Playing Field reset crew will set up the Playing Field for the next Match.

4.4.6 Penalties
Penalty points are added to the non-offending Alliance’s Score at the End of the Match. Minor Penalties give the non-offending Alliance ten (10) points per occurrence. Major Penalties give the non-offending Alliance thirty (30) points per occurrence. Warnings have no effect on an Alliance’s Score.

4.4.7 Flowchart of Match Play
The following figure shows the typical flow of the Match and the actions taken on the Driver Station Android device.

4.5 Rules of Gameplay
Gameplay is restricted by the Safety rules (<S#>), the General rules (<G#>), and the Game-Specific rules (<GS#>). Violation of rules may lead to Warnings, Penalties, Yellow Cards, Red Cards, a Disabled Robot, or Disqualification of the offending Team or Alliance from either a Match or the competition. Rules apply to all periods of play unless otherwise specified. If rules are in conflict, Safety rules take precedence over all rules and Game-Specific rules take precedence over General rules. The official FIRST Tech Challenge Question & Answer Forum rulings take precedence over all information in the game manuals.

4.5.1 Safety Rules
<S01> Unsafe Robot or Playing Field Damage – If at any time the Robot operation is deemed unsafe or has damaged the Playing Field or another Robot, by the determination of the referees, the offending Robot may be Disabled, and the Team may be issued a Yellow Card. Re-inspection of the Robot is required before it may play another Match. Damage that requires significant repair and/or delays subsequent Match play is likely to escalate to a Red Card.
<S02> **Robot Extension Outside the Playing Field Perimeter** – If any portion of the Robot contacts anything Outside the Playing Field Perimeter, the Team will be issued a **Yellow Card** and the Robot may be **Disabled** immediately for the remainder of the Match, unless allowed by Game-Specific rule(s) listed in section 4.5.3. See the game definitions in section 4.3 for a complete description of the Playing Field Perimeter.

The intent of this rule is not to Penalize an Alliance for Inadvertent, safe Robot extension Outside the Playing Field Perimeter. Intentional Robot extension Outside the Playing Field is not permitted.

<S03> **Safety Gear** – All members of the Drive Team are required to wear approved eye protection and shoes with closed toed and a closed back. If any member of the Drive Team is not wearing these safety items, the referee will issue a **Warning** to the Team member(s) and if the situation is not remedied within thirty (30) seconds, the offending member(s) of the Drive Team must leave the Competition Area for the remainder of the Match and may not be replaced by another Team member. Failure to comply with a request to leave the Competition Area violates rule <G30>. Repeated Team violations during the competition will escalate to an entire Team Warning. Following the Team Warning, subsequent violations by any member of the Team will result in a Minor Penalty for the Alliance.

<S04> **Competition Area Safety** – When a competition has venue-specific safety rules for the Competition Area, all members of a Team are required to abide by those rules. Initial violations will result in a verbal Warning. Subsequent violations at a competition will result in a Yellow Card.

### 4.5.2 General Game Rules

<G01> **Autonomous to Driver-Controlled Period Transition** – At the conclusion of the Autonomous Period, Robots will remain in a hands-off state. Field personnel will not enter the field and will not touch Robots on the field during the Autonomous to Driver-Controlled transition. The scoring system display will provide visual and audio cues for Drive Teams to pick up their Driver Stations. Drive Teams will have five (5) seconds to pick up and prepare their Driver Station. After five (5) seconds, there will be a “3-2-1 go” countdown and the Driver-Controlled Period of the Match will begin.

<G02> **Score Certification at the End of the Match** – Scores will be tracked by field personnel throughout the Autonomous and Driver-Controlled Periods of the Match. At the End of the Match, the final Score will be certified as quickly as possible. A change in state of a Game Element or Robot at the End of the Match after its final Score is recorded will not change an already-recorded Score. Scoring Elements will not be recounted after the End of the Match unless otherwise specified by a Game-Specific rule.

<G03> **Forcing an Opponent to Break a Rule** – The actions of an Alliance or their Robots shall not cause an opposing Alliance or Robot to break a rule and thus incur Penalties. Any forced rule violations committed by the affected Alliance shall be excused, and no Penalties will be assigned to the affected Alliance.

<G04> **Robot Manipulation of Scoring Elements** – Scoring Elements that are Controlled or Possessed by a Robot are part of the Robot except when determining the location of the Robot or otherwise specified by a Game-Specific rule.

For Example: If a Robot Possesses a Scoring Element, and only that Scoring Element breaks the plane of a Scoring Area, the Robot does not receive points for being In that Area.

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<G05> **Robot or Scoring Elements In Two or More Scoring Areas** – Robots or Scoring Elements that are eligible for two or more Scoring achievements earn points only for the highest value achievement. If the achievement values are equal, only one achievement counts as Scored.

<G06> **Scoring Elements in Contact with Robots** – Scoring Elements in a Scoring Area that are in contact with or Controlled by a Robot on the corresponding Alliance for the Scoring Area have zero Score value.

<G07> **Disabled Robot Eligibility** – If a referee Disables a Robot, it will not be eligible to Score or earn points for the remainder of the Match. A Disabled Robot (whether referee induced or Robot failure) does not earn Penalties after being declared Disabled unless otherwise specified by a Game-Specific rule.

<G08> **Playing Field Tolerances** – Competition provided Playing Field and Game Elements will start each Match with tolerances that may vary by +/-1.0 inch (25.4 mm). Teams must design their Robots accordingly.

Playing Field and Game Elements are expected to be manufactured, assembled, and set up using a high standard for dimensional and location accuracy. The intent of the generous +/- 1.0 inch tolerance is to accommodate unintentional size and location variations that may occur. The tolerance is not an excuse for intentional or imprecise accuracy in construction or setup.

<G09> **Match Replay** – Matches are replayed at the discretion of the head referee only for a failure of a non-Team supplied Game Element or verified Wi-Fi interference that was likely to have impacted which Alliance won the Match.

Unexpected Robot behavior will not result in a Match replay. Team-induced failures, such as low battery conditions, processor sleep time-outs, Robot mechanical, electrical, software, or communication failures, etc. are NOT valid justifications for a replaying of a Match.

<G10> **Inadvertent and Inconsequential** – Robot actions that violate a rule may be ruled at the referee’s discretion to be Inconsequential and Inadvertent and will not be Penalized.

<G11> **Illegal Match Communication** – Electronic communication (cell phone, two-way radio, Wi-Fi, Bluetooth, etc.) by Drive Team members after an Alliance has been called from the queue to the Playing Field for its Match is not allowed. The first instance of violating this rule will result in a Warning, with any following instances during the competition resulting in a Minor Penalty. Items that may be mistaken by a casual observer as being in violation of this rule should not be brought to the Playing Field. The Driver Station is exempt from this rule but must be used only for operating the Robot.

<G12> **Playing Field Access** – Team members must not enter the Playing Field for any reason other than to place/retrieve their Robots. While placing Robots, Teams may not measure, test, or adjust Game Elements Inside or Outside of the Playing Field unless allowed by Section 4.4.1. When retrieving Robots, Teams may not verify the Scoring of Game Elements.

The consequences for violating this rule are:

a) **Minor Penalty** for violations during Match setup or following the End of the Match.

b) **Major Penalty** for violations that delay the start of the Match.
c) Violations of this rule outside of normal Match play will result in a **Yellow Card**.

If a **Team** feels the **Playing Field** is not set up correctly, **Teams** should notify a referee or **FIRST** technical advisor prior to the start of the **Match**.

**<G13> Pre-Match Robot Placement** – At the beginning of a **Match**, each **Alliance Robot** must be set up on the **Playing Field** according to section 4.4.1 Pre-Match.

a) During the Qualification **Matches**, the blue **Alliance Robots** are set up on the **Playing Field** first, unless the red **Alliance** waives their right to set up on the **Playing Field** second.

b) During the Elimination **Matches**, the 3\textsuperscript{rd} and 4\textsuperscript{th} seeded **Alliance Robots** are set up on the **Playing Field** first, unless the higher seeded **Alliance** waives their right to set up on the **Playing Field** second. **Alliance** color doesn’t change the seeding of a **Team** during the Elimination **Matches**. If the 4\textsuperscript{th} seed defeats the 1\textsuperscript{st} seed in the Semi-Finals, they will still have to place their **Robot** on the field first in the finals because their seeding will be lower than the 2\textsuperscript{nd} or 3\textsuperscript{rd} seed.

c) During Elimination **Matches**, three **Team Alliances** may only place two **Robots** that are intended to compete in that **Match**. After the **Robots** are placed, the **Alliance** cannot swap in the 3\textsuperscript{rd} **Alliance’s Robot** for a **Robot** already placed.

d) **Teams** may implicitly waive their right to place their **Robots** on the **Playing Field** last by placing their **Robots** on the **Playing Field** before or with the opposing **Alliance**. There is no need to tell the referees; **Teams** waive their right by the act of placing their **Robots** on the **Playing Field**.

e) **Teams** that unnecessarily delay the beginning of a **Match** and/or field reset will incur a **Minor Penalty** for each offense. Significant delays may escalate to a **Major Penalty** at the discretion of the head referee.

**Drive Teams** are expected to stage their **Robots** for a **Match**, and remove it from the **Playing Field** afterwards, safely and swiftly. **Drive Team** efforts that either intentionally or unintentionally delay the start of a **Match** or the **Playing Field** reset are not allowed. Examples include, but are not limited to:

- Late arrival to the **Playing Field**.
- **Robot** maintenance once on the **Playing Field**.

If the field is waiting for the **Team**, they would be subject to this **Penalty**.

**<G14> Robot Starting Volume** – Before the start of a **Match**, each **Robot** in its starting location must not exceed a volume of 18 inches (457.2 mm) by 18 inches (457.2 mm) by 18 inches (457.2 mm). Flexible materials (i.e., zip tie, surgical tube, string, etc.) may extend up to 0.25 inches (0.635 cm) beyond the 18-inch (45.72 cm) size constraint. A Pre-Loaded Scoring Element may extend Outside the 18-inch (457.2 mm) cube volume constraint. Once a violation has been identified, if the **Team** cannot fix the violation within thirty (30) seconds, the offending **Robot** will be removed from the **Playing Field**. **Robots** removed from the field are not subject to a delay of game (<G13>e) **Penalty**. The **Team** remains eligible to earn Ranking and TieBreaker Points if a member of the **Drive Team** is in their **Alliance Station** during the **Match**.

After the start of a **Match**, the **Robot** may extend in any direction unless otherwise specified by the Game-Specific rules detailed in section 4.5.3.
**<G15> Robot Setup Alignment** – Teams may align their Robots during Pre-Match setup if they do so with legal components that are part of the Robot and can be reset to be within the 18-inch (457.2 mm) cube starting volume constraint. Robot setup alignment devices that extend outside the 18-inch starting volume constraint cannot be powered. A single member of the Drive Team may also align the Robot by sight if they are next to the Robot and their action does not delay the start of a Match. A Minor Penalty will be assessed to the Alliance for violation of this rule.

**<G16> Alliance and Human Player Stations** – During a Match, the Drive Team must remain In their Alliance or Human Player Station.

a) Drive Teams may be anywhere in their respective Alliance or Human Player Station.

b) The first instance of leaving the Alliance or Human Player Station will result in a Warning, with any following instances during the Match resulting in a Minor Penalty. Leaving the Alliance or Human Player Station for safety reasons will not result in a Warning or Penalty.

c) Opposing Alliance’s Drive Team members cannot distract/interfere with each other or the off-field Scoring Elements (if present in the current season’s challenge). Violations of this rule will result in an immediate Major Penalty and a possible Yellow Card.

d) After Robots are set up on the Playing Field, and before the Match starts, Drive Teams must stand Inside their respective Alliance or Human Player Station. Once the Match starts, the members of the Drive Teams may stand, sit, or kneel for the remainder of the Match. Violations of this rule (for example, lying down in the Alliance Station) will result in a Minor Penalty. Repeated violations of this rule will be handled per rule <G30>.

The intent of this rule is to prevent Drive Team members from leaving their assigned Station during a Match to gain a competitive advantage. For example, moving to another part of the Field for better viewing, reaching into the Field, etc. Simply breaking the plane of the Station during normal Match play is not a Penalty.

**<G17> Post-Match Removal of Robots** – Robots must be designed to permit easy removal of Game Elements from the Robot after the Match. Robots should also be able to be removed from the Playing Field without unnecessary delay or damaging the Playing Field. A Minor Penalty will be assessed for violations of this rule.

The intent of this rule is to have timely removal of Robots from the Playing Field following a Match. Drive Teams are expected to stage their Robots for a Match, and remove them from the Playing Field afterwards, safely, and swiftly. Drive Team efforts that either intentionally or unintentionally delay the start of a Match or the Playing Field reset are not allowed. Examples include, but are not limited to:

a) Failing to exit the Playing Field once instructed by a referee.

b) Failing to remove Driver Stations in a timely manner.

**<G18> Starting Gameplay Early** – Robots that start playing the game (Autonomous or Driver-Controlled Period) prior to the start of a Match Period receive a Minor Penalty. Referees have the option of issuing a Major Penalty in place of the Minor Penalty if the early start results in a competitive advantage for the offending Alliance.
<G19> Late Start of the Autonomous Period – A Drive Team that starts their Robot’s Autonomous Op Mode late will receive a Minor Penalty. Any delay in Robot movement must be done by its programming. Referees have the option of issuing a Major Penalty in place of the Minor Penalty if the late start results in a competitive advantage for the offending Alliance.

<G20> Robot Actions at End of the Period –

a) Robots must Park at the end of the Autonomous and Driver-Controlled Periods. Robots that are not Parked at the conclusion of the “game sound” receive a Minor Penalty and the Robot’s following actions do not count towards their Alliance’s Score. Drive Teams should make their best effort to stop gameplay immediately when the End of the Period game sound begins. Referees have the option of issuing a Major Penalty in place of the Minor Penalty if the late stop results in a competitive advantage (other than Scoring) for the offending Alliance.

b) Scoring achievements that were started (unless disallowed by Game-Specific rules) before the End of the Period are eligible to be counted as Scored.

c) Robot Scoring achievements that occur after the announced End of the Autonomous Period and before the start of the Driver-Controlled Period do not count towards the Score for the Autonomous or Driver-Controlled Periods.

<G21> Robot Control During Autonomous Period – During the Autonomous Period, Drive Teams may not directly or indirectly control or interact with Robots or Driver Stations. Early stopping of the Robot while running its Autonomous code is not allowed, except in cases of personal or equipment safety, and any achievements earned due to early stoppage will not Score points. A Major Penalty will be assessed for violating this rule. Teams that stop their Robots during the Autonomous Period are allowed to participate in the Driver-Controlled Period provided it can be done safely.

<G22> Drive Team Contact with the Playing Field or Robot – During a Match, the Drive Team is prohibited from making contact with the Playing Field, any Robot, or any Game Element unless allowed by Game-Specific rules. The first instance of contact will result in a Warning, with any following instances during the competition resulting in a Minor Penalty. Contact that affects Scoring and/or gameplay will result in issuance of a Yellow Card at the discretion of the referees. Contact with the Playing Field, a Game Element, or a Robot for safety reasons will not result in a Warning or Penalty.

For example, a Game Element is Launched from a Robot on the Playing Field and it Inadvertently hits a Team member in the Alliance Station and is deflected back onto the field. The Team would not receive a <G22> Penalty because the Team member was protecting themselves (safety). However, if that same Game Element is caught and/or directed to a specific location on the Playing Field, the Team may be issued a <G22> Penalty.

<G23> Drive Team Coach Driver Station Control – During the Driver-Controlled Period, Robots must be remotely operated only by the Drivers using the Gamepads connected to the Team’s Driver Station and/or by software running on the on-board Robot control system. The first instance of the Coach operating a Gamepad will result in a Warning, with any following instances during the competition resulting in a Major Penalty. During the Driver-Controlled Period, Drive Team Coaches and/or Drivers are allowed to hold the Team’s Driver Station Android device and interact with it to select an Op Mode, view information displayed on the screen, and initialize, start, stop, and reset the Robot.

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<G24> **Robots Deliberately Detaching Parts** – Robots may not deliberately detach parts during a Match or leave mechanisms on the **Playing Field** unless permitted by a Game-Specific rule. **Possessed or Controlled Scoring Elements** are not considered to be a part of the **Robot** for the purpose of this rule. The consequence of deliberately detaching a part is a **Minor Penalty** if it does not **Block** an opposing **Alliance Robot**, **Alliance Specific Scoring Element** or **Scoring Area**. If a deliberately detached component or mechanism affects gameplay by any **Robot**, the offending **Robot** will receive a **Major Penalty** and will be issued a **Yellow Card**. **Robot** parts that are released but remain connected by a tether are considered detached for the purposes of this rule.

Tethered components that move independently of the main **Robot** are considered a detached component and are illegal.

<G25> **Robots Grasping Game Elements** – Robots may not **Grasp** and/or **attach** to any **Game Element**, **Robot**, or structure other than **Scoring Elements**, unless specifically allowed by Game-Specific rule(s) listed in section 4.5.3. The first instance will result in a **Warning** with any following violations during the competition resulting in a **Major Penalty**.

<G26> ** Destruction, Damage, Tipping, etc.** – **Robot** actions aimed at the destruction, damage, tipping over, or entanglement of **Robots** or **Game Elements** are not in the spirit of the **FIRST Tech Challenge** and are not allowed unless permitted by Game-Specific rules. However, **FIRST Tech Challenge** games are highly interactive. **Robot**-to-**Robot** contact and defensive gameplay should be expected. **Robot** interactions that result in tipping, entanglement, or impair the functions of an opposing **Alliance’s Robot** may result in a **Major Penalty** and/or a **Yellow card**.

<G27> **Removing Game Elements from the Playing Field** – **Robots** may not deliberately remove **Game Elements** from the **Playing Field** during a **Match** unless specifically allowed by Game-Specific rule(s) listed in section 4.5.3. **Game Elements** that **Inadvertently fall Outside** the **Playing Field** will be returned to the **Playing Field** by field personnel at the earliest safe and convenient opportunity at a non-**Scoring** location approximately where it left the field. **Game Elements** removed from the **Playing Field** in an attempt to **Score** are also not subject to this **Penalty**. Teams deliberately removing **Game Elements** from the **Playing Field** will incur a **Minor Penalty** per **Game Element** removed from the **Playing Field**. Game-Specific rules listed in section 4.5.3 that address the removal of specified **Scoring Elements** from the **Playing Field** take precedence over this general game rule.

<G28> **Pinning, Trapping, or Blocking Robots** – A **Robot** may not cause an opposing **Alliance Robot** to become **Pinned**, **Trapped**, or **Blocked**.

Once a referee determines this rule is being violated, a **Minor Penalty** will be assessed for every 5 seconds the violation continues.

A **Robot** is in violation until it has moved at least 3 feet (0.9 m), approximately 1.5 **Tiles**, from the **Pinned**, **Trapped**, or **Blocked Robot**.

During the **Autonomous Period**, **Robots** will not incur this **Penalty** unless it is determined by the referee to be part of a deliberate strategy, which will then be penalized as described above. If the violation happens during the **Autonomous Period**, the first action done by the offending **Robot** during the **Driver-Controlled Period** must be to move away from the **Pinned**, **Trapped**, or **Blocked Robot** or a **Minor Penalty** will be assessed immediately.
and again for every five-seconds that they are in violation. Game-Specific rule(s) listed in section 4.5.3 that further define Pinning, Trapping, or Blocking take precedence over this general game rule.

The intent of this rule is that Drive Teams begin to immediately move their Robots away and have a five second grace period to move the required distance. The grace period is not permission to intentionally Block/Pin/Trap for up to five seconds.

<G29> Illegal Usage of Game Elements – Robots may not deliberately use Game Elements to ease or amplify the difficulty of any Scoring or game activity. A Major Penalty will be assessed for violations of this rule. Continued violations of this rule will quickly escalate to a Yellow Card at the discretion of the Head Referee.

<G30> Egregious Behavior – Egregious Robot or Team member behavior is not in the spirit of Gracious Professionalism and will not be tolerated at a FIRST Tech Challenge event. Egregious behavior includes, but is not limited to, repeated and/or flagrant violation of rules, unsafe behavior or actions, or uncivil behavior towards volunteers, Drive Team, competition personnel, or event attendees. In most cases, as determined by the referees, the offending team will result in a Major Penalty and issuance of a Yellow Card and/or Red Card. Subsequent violations may result in Team disqualification from the competition.

Continued and repeated violations will be brought to FIRST Headquarters’ attention. FIRST Headquarters will work with event staff to determine if further escalations are necessary, which can include removal from award consideration and removal from the event.

In cases where the egregious behavior is deemed to be unsafe, such as physical contact or threatening behaviors to other event attendees, event staff will work with FIRST Headquarters to determine if the behavior warrants immediate removal of the team from the event.

4.5.3 Game-Specific Rules

<GS01> General Rule Exceptions – The following instances of gameplay are Game-specific exceptions to General Game Rules in section 4.5.2:

a) Robot contact with a Pixel in a Backstage is allowed as an exception to rule <G06> if the Pixel is not Possessed by the Robot.

b) Robots are allowed to Grasp the Rigging as an exception to rule <G25>.

c) A Robot may Launch their Drone to the Outside of the Playing Field as an exception to rule <G27>.

d) Rule <GS06>.f modifies the application of rule <G28>.

e) Rule <GS07> constraints are an exception to rule <G07>.

f) Consequences for violating rule <GS07>.a apply a stricter penalty than outlined in rule <G25>.

g) Rule <GS08>.c is an exception to rule <G07>.

h) The rule <GS09> consequence for a Disabled Robot In a Wing is an exception to rule <G07>.

<GS02> Drive Teams Touching Robots or Driver Stations after Randomization – Drive Teams are not allowed to touch or interact with their Robots or Driver Stations once field personnel have begun the Playing Field randomization process. If this occurs, a Minor Penalty will be assessed to the Alliance. The offending Robot is not eligible to earn points for the Randomization Tasks in the Autonomous Period. The non-offending Alliance partner Robot remains eligible for the Randomization Tasks Scoring achievement.

<GS03> Autonomous Interference – During the Autonomous Period a Major Penalty is assessed for the following actions:

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a) **Interfering** with an opposing **Alliance Robot In** the opposing **Alliance’s half of the Playing Field.** Tiles A, B, C constitute the blue side of the **Playing Field,** Tiles D, E, F constitute the red side of the **Playing Field.** The tabs joining Tiles C and D are neutral.

b) **Interfering** with the opposing **Alliance’s Randomization Task setup or Randomization Task Scoring.**

c) **Robots** moving the pre-placed white **Pixel** stacks in the opposing **Alliance half of the Playing Field** that impacts or impedes the opposing **Alliance’s Autonomous Period Scoring actions.**

The intent of this rule is to protect **Robot actions performed while Completely In their Alliance’s side of the Playing Field.** Navigating into the opposing **Alliance’s side of the Playing Field** is a risky gameplay strategy.

<GS04> **Descoring** – **Robots** may not descore **Pixels** or affect scoring achievements from the opposing **Alliance’s Backdrop or Backstage.**

a) A **Minor Penalty** will be assessed for each **Pixel** that is descored.

b) An additional **Minor Penalty** is assessed for each affected completed **Mosaic** and/or **Set Line Bonus** scoring achievement.

Examples:

1. A **Robot** descores a **Pixel** from the opposing **Alliance’s Backdrop.** The opposing **Alliance’s Mosaic** or **Set Line points** are unaffected. The offending **Robot** that descored the **Pixel** receives one **Minor Penalty.**

2. A **Robot** descores a **Pixel** from the opposing **Alliance’s Backdrop.** The opposing **Alliance’s Mosaic score** is affected by the descore. The offending **Robot** that descored the **Pixel** receives two **Minor Penalties.**

3. A **Robot** repositions a **Pixel** on the opposing **Alliances Backdrop.** This causes the affected **Alliance** to lose points for an already achieved **Set Line bonus.** The offending **Robot** receives one **Minor Penalty.**

<GS05> **Robot Control/Possession Limits for Scoring Elements** –

a) **Robots** may **Control** or **Possess** a maximum of two (2) **Pixels** and one (1) **Drone** at a time. **Controlling or Possessing** more than the allowed quantity of **Scoring Elements** is an immediate **Minor Penalty** for each **Scoring Element** above the limit plus an additional **Minor Penalty per Scoring Element** in excess of the limit for each 5-second interval that the situation continues.

b) **Scoring a Pixel** while in **Control or Possession** of more than the allowed quantity of **Scoring Elements** will result in a **Minor Penalty per Element Scored.**

c) **Control/Possession limit exceptions:**

   i. Knocking over a stack of unscored **Pixels** is allowed.

   ii. **Inadvertent** and **Inconsequential** movement of a pre-set stack of unscored **Pixels is allowed.** Moving the stack **Completely Off** the tape is considered consequential.

   iii. **Plowing** through any quantity of **Scoring Elements** is allowed.
iv. *Pixels In the Backstage* that are directly *Supported* by the *Playing Field Floor* or *Supported* by a *Pixel* that is directly *Supported* by the *Playing Field Floor*, are exempt from the *Control/Possession* limit. The intent of this rule is to prevent penalizing a *Robot* maneuvering *In the Backstage*.

v. *Pixels On the Backdrop* are exempt from the *Control/Possession* limit.

<GS06> **Truss Constraints** –

a) *Robots* may only *Grasp* one of either *Rigging* of their corresponding *Alliance Specific Trusses*. Contact with the other parts of the *Truss* is allowed for stabilization of the *Robot* while *Suspended*. The intent is that the *Rigging* is the primary support for the *Robot*. Violation of this rule results in zero *Score* value for the *Suspend* task.

b) *Robots* may not *Grasp* or *Suspend* from any other part of the *Truss* structure. Violation of this rule results in a *Minor Penalty* per occurrence.

c) There is a limit of one (1) *Supported Robot* per *Rigging*. Additional *Robots* *Supported* by a *Rigging* or by a *Robot* *Supported* by that *Rigging* earn a *Major Penalty*.

d) A *Robot* may not impede or obstruct an opposing *Alliance Robot* from *Suspending* during the *End Game Period*. Each violation of this rule results in an immediate *Major Penalty* and additional *Blocking Penalties* per rule <G28>.

e) Contact with a *Suspended* opposing *Alliance Robot* will not invalidate the *Suspend*. The action will also result in a *Minor Penalty* per occurrence for contacting the *Suspended Robot*.

f) During the *End Game*, the height restricted paths leading to the *Rigging* are not an open path of travel when applying rule <G28>.

<GS07> **Stage Door Constraints** – *Stage Door* constraints apply to both operational and *Disabled Robots*.

a) *Robots* may not *Grasp* the *Stage Door*. Violation of this rule results in a *Major Penalty*.

b) Preventing the *Stage Door* from operating normally while an opposing *Alliance Robot* attempts to travel through the *Stage Door* is not allowed. Violation of this rule results in a *Major Penalty*. For example:

i. *Robots* may not limit the upward motion of the *Stage Door*.

c) Transit constraints: Violations of this rule are addressed per rule <G28>. Repeated violations will quickly escalate to a *Yellow Card* at the discretion of the Head Referee.

i. Disrupting the transit of an opposing *Alliance Robot* through the *Stage Door* is not allowed.

ii. *Robots* passing through the *Stage Door* from the audience side of the *Playing Field* to the back have transit priority. *Robots* traveling from the back of the *Playing Field* to the audience side of the *Playing Field* must yield a free path of travel.

The *Stage Door* is wide enough for two *Robots* to pass through at the same time without disruptions. *Robots* that allow a free path of travel to faster *Robots* are less likely to incur transit constraint *Penalties*.

<GS08> **Backdrop and Backstage Constraints** –

a) A *Robot* may not impede or obstruct an opposing *Alliance Robot* that is *In the Backstage* from *Scoring* a *Pixel*. Each violation of this rule results in an immediate *Minor Penalty*.

b) *Robots* may not *Block* access to the opposing *Alliance’s Backstage* or *Backdrop*. Once a referee determines this rule is being violated, a *Major Penalty* will be applied. A *Minor Penalty* will be added for

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every 5 seconds the violation continues. A Robot is in violation until it has moved at least 3 feet (0.9 m), approximately 1.5 Tiles, from the affected Robot(s).

c) A Disabled Robot In the opposing Alliance’s Backstage remains eligible for all Penalties associated with <GS08>. This is an explicit exception to rule <G07>.

d) Robots located In Tile rows 1, 2, or 3 may not Score into the Backstage or Backdrop. Each violation will receive a Minor Penalty.

<GS09> Wing Constraints –

a) A Robot may not impede or obstruct an opposing Alliance Robot that is In the corresponding Alliance’s Wing. Each violation of this rule results in an immediate Minor Penalty.

b) Robots may not be In or Block access to the opposing Alliance’s Wing. Once a referee determines this rule is being violated, a Major Penalty will be applied. A Minor Penalty will be added for every 5 seconds the violation continues. A Robot is in violation until it has moved at least 3 feet (0.9 m), approximately 1.5 Tiles, from the Blocked Wing.

c) A Disabled Robot In a Wing is not considered a safety hazard, therefore Scoring Elements may continue to be placed. However, a Disabled Robot In the opposing Alliance’s Wing remains eligible for all Penalties associated with <GS09> including escalation to Yellow Cards. This is an explicit exception to rule <G07>.

d) There can be a maximum of six (6) Pixels In the Wing at any one time. A Minor Penalty will be assessed for each additional Pixel beyond the maximum. Pixels in the Possession of a Robot do not count towards this limit.

<GS10> Pixel Constraints – Pixels may not be Propelled. Each violation of this rule results in a Minor Penalty.

<GS11> Drone Constraints –

a) Drones are pre-loaded onto the Robots during Pre-Match setup as described in section 4.4.1 or introduced into the Playing Field during the Driver Controlled Period via the Wing.

b) A Robot may not Possess a Drone provided by another Team. A Major Penalty will be assessed for violating this rule.

c) Drones Launched before the End Game have zero (0) Score value.

d) Drones may be Launched from Suspended Robots.

e) For each scoring attempt (Launch, fly, land), a Launched Drone must pass over a Rigging or top pole of the Stage Door before it is eligible to Score points.

f) To Score a Drone, the Drone must be in a legal configuration. Altering a Drone after inspection or during Match play to better the chance of Scoring is not in the spirit of this rule and will not be considered a Scored Drone.

g) Drone Interference:
   i. A Robot may not affect the flight of an opposing Alliance’s Drone that is flying at a height above the height of the Playing Field Wall, approximately 11.5 inches (295 mm). The Drone that is affected will be awarded Landing Zone 1 points.

   ii. Contact between two or more Drones in flight or In a Landing Zone is not penalized.
iii. Drive Teams may not directly or indirectly affect the flight of a Drone. Affecting an opposing Alliance Drone will result in that Drone earning Landing Zone 1 points. Affecting their own Drone’s flight results in no points for that Drone.

iv. A Drone that contacts field personnel In a Landing Zone is awarded Landing Zone 1 Score value regardless of the final Parking location.

v. A Drone that contacts field personnel that are Outside a Landing Zone or any object Outside the Playing Field has zero Score value regardless of the final Parking location.

h) Drones must be Parked Completely Outside the Playing Field Perimeter to be eligible to Score points.

<GS12> Human Player Constraints – Each violation of this rule results in a Minor Penalty.

a) Drones and Pixels In the Pixel Storage Area may not be handled until after the Match has begun with the exception of the Pre-Load Scoring Elements.

b) Drones and Pixels may be placed or dropped only In the Wing and only during the Driver-Controlled Period. Drones and Pixels can be in any orientation and may be in contact with other Drones or Pixels In the Wing.

c) Human Players may place a maximum of two (2) Pixels or one (1) Drone In a Wing at a time.

d) Once a Pixel or Drone has been placed in the Wing, a Human Player may not pick it up or reposition it.

e) Human Players may not Propel Pixels or Drones Out of the Wing.

f) The Human Player may enter the area between the Human Player Station and the adjacent Playing Field Wall while placing a Pixel or Drone In the Wing, provided that it is done safely.

g) The Human Player may not use tools or devices (including another Pixel) to manipulate a Pixel or Drone. Accommodations and exceptions for Human Players with disabilities or extenuating circumstances will be made at the discretion of the Tournament Director.

h) For safety reasons, a Human Player cannot break the vertical plane of the Playing Field Perimeter or hand-deliver a Pixel or Drone to the Playing Field when there is a Robot In the Wing. A Disabled Robot In an Alliance Wing is not considered a safety hazard to the Human Player, therefore Drones and Pixels may continue to be placed.

i) A Robot cannot enter the Wing while a Human Player is In the Wing.

<GS13> Truss/Stage Door Safety – Drive Teams may never step/jump over any section of the Truss and/or Stage Door. The first instance will result in a Warning to the Team. Subsequent violations at a competition will result in a Yellow Card. Further violations beyond will be addressed per <G30>.

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4.6 Scoring Summary
The following table shows the possible Scoring achievements and their point values. The table is a quick reference guide and not a substitute for a thorough understanding of the game manual. All achievements are Scored at Rest, except for Robot location during End Game, which is scored at End of the Period.

<table>
<thead>
<tr>
<th>Scoring Achievement</th>
<th>Autonomous Points</th>
<th>Driver-Controlled Points</th>
<th>End Game Points</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigating: Robot Parked In Backstage</td>
<td>5</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Placement: Pixel placed On their Alliance’s Backdrop</td>
<td>5</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Placement: Pixels placed In their Alliance’s Backstage</td>
<td>3</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Randomization: Purple Pixel placed on the designated Spike Mark using white Pixel</td>
<td>10</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Randomization: Yellow Pixel placed On their Alliance’s designated Backdrop location using white Pixel</td>
<td>10</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Randomization: Purple Pixel placed On the designated Spike Mark using Team Prop</td>
<td>20</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Randomization: Yellow Pixel placed On their Alliance’s designated Backdrop location using Team Prop</td>
<td>20</td>
<td></td>
<td></td>
<td>4.4.2</td>
</tr>
<tr>
<td>Placement: Pixels placed In their Alliance’s Backstage</td>
<td></td>
<td>1</td>
<td></td>
<td>4.4.3</td>
</tr>
<tr>
<td>Placement: Pixels placed On their Alliance’s Backdrop</td>
<td></td>
<td>3</td>
<td></td>
<td>4.4.3</td>
</tr>
<tr>
<td>Artist Bonus: Completed Mosaic</td>
<td></td>
<td>10</td>
<td></td>
<td>4.4.3</td>
</tr>
<tr>
<td>Set Bonus: Scored Pixel extend In a Backdrop Set Line</td>
<td></td>
<td>10</td>
<td></td>
<td>4.4.3</td>
</tr>
<tr>
<td>Robot Location: Robot Suspended from Rigging</td>
<td></td>
<td></td>
<td>20</td>
<td>4.4.4</td>
</tr>
<tr>
<td>Robot Location: Robot Parked In the Backstage</td>
<td></td>
<td></td>
<td>5</td>
<td>4.4.4</td>
</tr>
<tr>
<td>Drone Launch</td>
<td></td>
<td></td>
<td></td>
<td>4.4.4</td>
</tr>
<tr>
<td>Zone 1</td>
<td></td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Zone 2</td>
<td></td>
<td></td>
<td>20</td>
<td></td>
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<tr>
<td>Zone 3</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
### 4.7 Rule Summary

The following table shows the possible rule violations and their consequences. The table is a quick reference guide and not a substitute for a thorough understanding of the complete rule descriptions in section 4.5.

<table>
<thead>
<tr>
<th>Rule #</th>
<th>Rule</th>
<th>Consequence</th>
<th>Warning Disable</th>
<th>Minor Penalty</th>
<th>Major Penalty</th>
<th>Card Issued</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Safety Rules</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;S01&gt;</td>
<td>Unsafe Robot or Damage to the Playing Field.</td>
<td>Disable if unsafe operation is likely to persist. Optional Yellow Card.</td>
<td>D*</td>
<td></td>
<td></td>
<td>YC* RC*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Significant damage and/or delays may escalate to Red Card.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;S02&gt;</td>
<td>Contact Outside the Playing Field.</td>
<td>Immediate Yellow Card and Optional Disable unless allowed by rule.</td>
<td>D*</td>
<td></td>
<td></td>
<td>YC</td>
</tr>
<tr>
<td>&lt;S03&gt;</td>
<td>Drive Team missing safety gear.</td>
<td>Warning and if not resolved within 30 seconds, the offending member(s) of the Drive Team must leave the Competition Area and may not be replaced.</td>
<td>W</td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;S04&gt;</td>
<td>Competition Area entry or exit rule violated.</td>
<td>Warning and subsequent violations result in a Yellow Card.</td>
<td>W</td>
<td></td>
<td></td>
<td>YC*</td>
</tr>
<tr>
<td></td>
<td><strong>General Rules – Further definitions, no Penalties earned</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;G01&gt;</td>
<td>Autonomous to Driver-Controlled Period transition.</td>
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<tr>
<td>&lt;G02&gt;</td>
<td>Certifying the Score at End of the Match.</td>
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</tr>
<tr>
<td>&lt;G03&gt;</td>
<td>Forcing an opponent to break a rule.</td>
<td>Penalty points not given to Robot or Alliance forced to break a rule.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;G04&gt;</td>
<td>Scoring Elements Controlled or Possessed are part of the Robot except for Robot location.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;G05&gt;</td>
<td>Robot or Scoring Element in two or more Scoring Areas.</td>
<td>Robot or Scoring Element eligible for two or more Scoring achievements earn points only for highest achievement value.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G06&gt;</td>
<td>Scoring Elements in contact with Robots.</td>
<td>Points are not earned for any Scoring Elements in a Scoring Area in contact with Robots of the corresponding Alliance except as outlined in GS rules.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G07&gt;</td>
<td>Disabled Robot eligibility.</td>
<td>Disabled Robots do not earn points. Penalties do not apply to Disabled Robots except as outlined in GS rules.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G08&gt;</td>
<td>Playing Field Tolerances.</td>
<td></td>
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</tr>
<tr>
<td>&lt;G09&gt;</td>
<td>Match Replay.</td>
<td></td>
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</table>

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<thead>
<tr>
<th>Rule #</th>
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<th>Consequence</th>
<th>Warning</th>
<th>Minor Penalty</th>
<th>Major Penalty</th>
<th>Card Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;G10&gt;</td>
<td><em>Inadvertent and Inconsequential.</em></td>
<td><em>Inadvertent and Inconsequential</em> rule violations are not * Penalized* at head referee discretion.</td>
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<tr>
<td></td>
<td><strong>General Rules – Pre-Match and Post-Match Penalties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G11&gt;</td>
<td>Drive Team using disallowed electronic communication.</td>
<td>Warning followed by a Minor Penalty.</td>
<td>W</td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G12&gt;</td>
<td>Measure, test, or adjust Game Elements. Playing Field inspection to determine Score.</td>
<td>Minor Penalty for pre-Match or post-Match violations. Major Penalty if delay start of Match. Yellow Card if outside of normal Match play.</td>
<td>1x</td>
<td>1x</td>
<td></td>
<td>YC</td>
</tr>
<tr>
<td>&lt;G13&gt;e</td>
<td>Pre-Match Robot placement.</td>
<td>Minor Penalty if Teams delay the start of a Match. Major Penalty for a significant delay.</td>
<td>1x</td>
<td>1x*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G14&gt;</td>
<td>Robot starting volume.</td>
<td>Robot is removed from the Playing Field if not resolved within 30 seconds.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G15&gt;</td>
<td>Robot setup alignment devices/Match delay.</td>
<td>Minor Penalty for each offense.</td>
<td>1x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G16&gt;b</td>
<td>Drive Team member(s) leaving the Alliance Station.</td>
<td>Warning for the first instance with any following instances resulting in a Minor Penalty.</td>
<td>W</td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G16&gt;c</td>
<td>Drive Teams distracting and/or interfering with each other or the off-Field Scoring Elements.</td>
<td>Immediate Major Penalty and a possible Yellow Card.</td>
<td></td>
<td></td>
<td>1x</td>
<td>YC*</td>
</tr>
<tr>
<td>&lt;G16&gt;d</td>
<td>Drive Teams may only sit, stand, or kneel in Driver Station.</td>
<td>Minor Penalty for each offense. Continued violations considered Egregious.</td>
<td>1x</td>
<td>1x*</td>
<td></td>
<td>YC* RC* DQ*</td>
</tr>
<tr>
<td>&lt;G17&gt;</td>
<td>Post-Match removal of Robots causes a delay or damage to the Playing Field.</td>
<td>A Minor Penalty will be assessed.</td>
<td>1x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>General Rules – Gameplay Penalties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G18&gt;</td>
<td>Starting Gameplay early.</td>
<td>Minor Penalty with the option of a Major Penalty if the early start results in a competitive advantage for the offending Alliance.</td>
<td></td>
<td>1x</td>
<td>1x*</td>
<td></td>
</tr>
<tr>
<td>&lt;G19&gt;</td>
<td>Late start of the Autonomous Period.</td>
<td>Minor Penalty with the option of a Major Penalty if the late start results in a competitive advantage for the offending Alliance.</td>
<td></td>
<td>1x</td>
<td>1x*</td>
<td></td>
</tr>
<tr>
<td>Rule #</td>
<td>Rule</td>
<td>Consequence</td>
<td>Warning Disable</td>
<td>Minor Penalty</td>
<td>Major Penalty</td>
<td>Card Issued</td>
</tr>
<tr>
<td>--------</td>
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</tr>
<tr>
<td>&lt;G20&gt;</td>
<td>Robot is not Parked at the end of period.</td>
<td>Minor Penalty and the actions of the Robot that occur after the end of gameplay do not count towards their Alliance’s Score. Major Penalty if the late stop results in a competitive advantage for the offending Alliance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G21&gt;</td>
<td>Robot control during Autonomous Period / early stopping of the Autonomous code.</td>
<td>Major Penalty. Achievements earned during that time result in zero Score.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G22&gt;</td>
<td>Drive Team contact with the Playing Field, Game Element, or Robot.</td>
<td>Warning for the first instance with any following instances resulting in a Minor Penalty. Optional Yellow Card if contact affects Scoring and/or gameplay.</td>
<td>W 1x</td>
<td></td>
<td>YC*</td>
<td></td>
</tr>
<tr>
<td>&lt;G23&gt;</td>
<td>Drive Team Coach Driver Station control.</td>
<td>Warning for the first instance with any following instances resulting in a Major Penalty.</td>
<td>W</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;G24&gt;</td>
<td>Robots deliberately detaching parts.</td>
<td>Minor Penalty. Major Penalty and a Yellow Card if it affects Scoring and/or gameplay.</td>
<td></td>
<td>1x 1x</td>
<td>YC</td>
<td></td>
</tr>
<tr>
<td>&lt;G25&gt;</td>
<td>Robots illegally Grasping Game Elements.</td>
<td>Warning for the first instance with any following instances resulting in a Major Penalty except as outlined in GS rules.</td>
<td>W</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;G26&gt;</td>
<td>Destruction, damage, tipping, etc.</td>
<td>Deliberate or chronic violations of this rule will receive a Major Penalty and a Yellow Card.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G27&gt;</td>
<td>Deliberately removing Game Elements from the Playing Field.</td>
<td>Minor Penalty per Game Element deliberately removed from the Playing Field except as outlined in GS rules.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G28&gt;</td>
<td>Pinning, Trapping, or Blocking.</td>
<td>Once rule is violated, a Minor Penalty is assessed for every five seconds the Robot violates this rule.</td>
<td></td>
<td></td>
<td>1x+</td>
<td></td>
</tr>
<tr>
<td>&lt;G29&gt;</td>
<td>Illegal Use of Game Elements to ease or amplify Scoring.</td>
<td>Major Penalty will be assessed with any following instances resulting in a Yellow Card.</td>
<td></td>
<td></td>
<td>1x YC</td>
<td></td>
</tr>
<tr>
<td>&lt;G30&gt;</td>
<td>Egregious behavior.</td>
<td>Major Penalty plus a Yellow and/or Red Card. Possible Match Disqualification. Subsequent violations may result in Team Disqualification for the competition.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Game-Specific Rules – Gameplay Penalties**

<p>| GS01 | General Game rule exceptions. | | |
| GS02 | Drive Teams touching Robot or Driver Station after Randomization. | Minor Penalty and Robot not eligible for Autonomous tasks. | 1x |</p>
<table>
<thead>
<tr>
<th>Rule #</th>
<th>Rule</th>
<th>Consequence</th>
<th>Warning Disable</th>
<th>Minor Penalty</th>
<th>Major Penalty</th>
<th>Card Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;GS03&gt;a</td>
<td>Interfering with opposing Alliance Robot in the opposing Alliance’s half of the Playing Field.</td>
<td>Major Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS03&gt;b</td>
<td>Interfering with Randomization Task setup or Scoring.</td>
<td>Major Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS03&gt;c</td>
<td>Moving pre-placed white Pixel stacks in opposing Alliance’s half of the Playing Field.</td>
<td>Major Penalty when Pixels impact or impede opposing Alliance’s Autonomous Period Scoring actions.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS04&gt;a</td>
<td>Descoring.</td>
<td>Minor Penalty for each Pixel descored.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS04&gt;b</td>
<td>Descoring Pixels from Backdrop.</td>
<td>Additional Minor Penalty assessed for each affected completed Mosaic and/or Set Line.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS05&gt;a</td>
<td>Control of more Scoring Elements than allowed.</td>
<td>Minor Penalty for each Scoring Element above the limit plus additional Minor Penalty per Scoring Element above the limit every 5 sec.</td>
<td></td>
<td></td>
<td>1x+</td>
<td></td>
</tr>
<tr>
<td>&lt;GS05&gt;b</td>
<td>Scoring a Pixel while Controlling more Scoring Elements than allowed.</td>
<td>Minor Penalty for each Pixel Scored while in possession of more than the allowed Scoring Elements.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS06&gt;a</td>
<td>Robots may only Grasp one Rigging for the corresponding Alliance.</td>
<td>Zero Score value for the Suspend task.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS06&gt;b</td>
<td>Robots may not Grasp or Suspend from any other part of the Truss structure.</td>
<td>Minor Penalty per occurrence.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS06&gt;c</td>
<td>Limit of one Supported Robot per Rigging.</td>
<td>Major Penalty for the second Robot.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS06&gt;d</td>
<td>Impeding or obstructing an opposing Alliance from Suspend during End Game.</td>
<td>Immediate Major Penalty. Additional Minor Penalty for every 5 seconds the violation continues.</td>
<td></td>
<td></td>
<td>1x+</td>
<td>1x</td>
</tr>
<tr>
<td>&lt;GS06&gt;e</td>
<td>Contact with opposing Alliance Suspended Robot.</td>
<td>Minor Penalty per occurrence to offending Alliance.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS07&gt;a</td>
<td>Grasping the Stage Door.</td>
<td>Major Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS07&gt;b</td>
<td>Preventing Stage Door from normal operations.</td>
<td>Major Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS07&gt;c.i</td>
<td>Disrupting transit of opposing Alliance Robot through Stage Door.</td>
<td>Minor Penalty is assessed for every five seconds the Robot violates this rule.</td>
<td></td>
<td></td>
<td>1x+</td>
<td>YC*</td>
</tr>
<tr>
<td>Rule #</td>
<td>Rule</td>
<td>Consequence</td>
<td>Warning Disable</td>
<td>Minor Penalty</td>
<td>Major Penalty</td>
<td>Card Issued</td>
</tr>
<tr>
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<td>----------------------------------------------------------------------------</td>
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<td>---------------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>&lt;GS07&gt;c.ii</td>
<td>Robots passing through Stage Door from audience side have transit priority.</td>
<td>Minor Penalty is assessed for every five seconds the Robot violates this rule.</td>
<td></td>
<td>1x+</td>
<td></td>
<td>YC*</td>
</tr>
<tr>
<td>&lt;GS08&gt;a</td>
<td>Robot impeding/blocking opposing Alliance In Backstage/Backdrop.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS08&gt;b</td>
<td>Block access to opposing Alliance Backstage/Backdrop.</td>
<td>Major Penalty plus an additional Minor Penalty for every five seconds the Robot continues to violate this rule.</td>
<td></td>
<td>1x+</td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;GS08&gt;d</td>
<td>Robots Scoring Pixels from Tile rows 1, 2, 3.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS09&gt;a</td>
<td>Robot impeding/blocking Robot In its Alliance Wing.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS09&gt;b</td>
<td>Robot In or Blocking access to opposing Alliance Wing.</td>
<td>Major Penalty plus an additional Minor Penalty for every five seconds the Robot continues to violate this rule.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS09&gt;d</td>
<td>Exceeding allowed quantity of Pixels in Wing.</td>
<td>Minor Penalty for each Pixel over the maximum of 6 Pixels in Wing.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS10&gt;</td>
<td>Propelling Pixels.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS11&gt;b</td>
<td>Robot Possess another Team’s Drone.</td>
<td>Major Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS11&gt;g.i</td>
<td>Affecting the flight of an opposing Alliance's Drone above Playing Field Wall.</td>
<td>No Penalty points assessed. Opposing Alliance Drone receives points for Landing Zone 1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS11&gt;g.iii</td>
<td>Drive Team affects the flight of a Drone.</td>
<td>Affected opposing Alliance Drone receives Landing Zone 1 points.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS11&gt;h</td>
<td>Drones Parked</td>
<td>Drones must Park Completely Outside of the Playing Field Perimeter to Score.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS12&gt;a</td>
<td>Scoring Elements in Pixel Storage may not be handled until start of Match.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS12&gt;b</td>
<td>Human Players may only place Pixels or Drones in Wing during Driver-Controlled Period.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS12&gt;c</td>
<td>Placing more than 2 Pixels or more than 1 Drone in the Wing at a time.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td>1x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Rule #

<table>
<thead>
<tr>
<th>Rule</th>
<th>Consequence</th>
<th>Warning Disable</th>
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</tr>
</thead>
<tbody>
<tr>
<td>&lt;GS12&gt;d</td>
<td>Repositioning already placed <em>Scoring Elements</em> in Wing.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;GS12&gt;e</td>
<td><strong>Propelling Pixels or Drones Out of the Wing.</strong></td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;GS12&gt;g</td>
<td>Using tools to place <em>Pixels or Drones</em>.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;GS12&gt;h</td>
<td>Human Player cannot break the vertical plane of the Playing Field Perimeter while a Robot is in the Wing.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;GS12&gt;i</td>
<td>Robot enters Wing while Human Player is In the Wing.</td>
<td>Minor Penalty for each offense.</td>
<td></td>
<td></td>
<td>1x</td>
</tr>
<tr>
<td>&lt;GS13&gt;</td>
<td>Drive Teams stepping/jumping over Truss or Stage Door.</td>
<td>First instance results in a <strong>Warning</strong>. Subsequent violations will result in a <strong>Yellow Card</strong>. Repeated violations may be considered <strong>Egregious</strong>.</td>
<td>W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table Key

| W: Warning | 1x: Penalty at single cost |
| D: Robot Disabled | 1x+: Penalty at single cost every 5 seconds |
| YC: Yellow Card issued | 2x: Penalty at double cost |
| RC: Red Card issued | * Indicates optional |
| DQ: Disqualification | |
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

FIRST Headquarters Pre-Event Support
Phone: 603-666-3906
Mon – Fri
8:30am – 5:00pm
Email: Firsttechchallenge@firstinspires.org

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!

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Appendix B – *Playing Field Locations*

B-1 *Tile Locations*
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Appendix C – Playing Field Details

**Important Note:** The measurements in this section are nominal and may vary based on manufacturing and assembly tolerances (including *Tile* and *Playing Field Wall* variances). For critical measurements and *Game Element* placement for field setup and assembly, please reference the AndyMark Field Setup and Assembly Guide. To view individual *Game Element* component measurements, please reference the field CAD file located on AndyMark’s website.

Dimensions are for reference only. Actual position of the tape and *Backdrop* are dependent on the *Tile* position and will be detailed in the Setup guide.

---

C-1 *Backstage* and *Backdrop* locations

C-2 *Backdrop* dimensions

*The *Pixel* height dimensions are measured vertically off the *Tile* surface.*

Dimensions are for reference only; actual dimensions may vary slightly from field to field.
The dimensions are measured vertically off the *Tile* surface. Dimensions are for reference only. Actual dimensions may vary slightly.

**C-3 Backdrop dimensions**

**C-4 Truss and Rigging**
C-5 Truss and Stage Door spacing

Dimensions are for reference only; actual dimensions may vary slightly from field to field.

C-6 Truss and Rigging

Dimensions are for reference only; actual dimensions may vary slightly from field to field.
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~1 inch wide by 12” long tape strips.

The strips are aligned to the *Tile*, against the root of the tabs.

The center strip is centered on the *Tile*

There is a black mark in the center of each strip to indicate the starting position of the *Pixel* or *Team Prop*.

**C-7 Spike Marks, typical**

1” wide tape runs from corner to corner (not including the tabs)

**C-8 Wing typical**
C-9 Landing Zones

C-10 Pre-Match setup of on-field Pixels
C-11 Pre-Match setup of on-field Pixels – locations
C-12 Location of Wall AprilTags

~4” from the centerline to the top of the Tile

~11 1/2” from the tab root to the center mark on the AprilTag

Red side

Blue side

4” from the centerline to the top of the Tile

~11 1/2” from tab root to the center marks on the AprilTag
three (3) stacks of five (5) white Pixels
one (1) stack of five (5) purple Pixels
one (1) stack of five (5) yellow Pixels
one (1) stack of five (5) green Pixels

*Note: locations of the stacks are approximate*

**C-13 Pre-Match setup of Pixel Storage**
Appendix D – Scoring Element

D-1 Pixel
Appendix E – Randomization

E-1 – Randomization Objects – pre-randomization starting positions – red Alliance

E-2 – Randomization Objects – pre-randomization starting position - blue Alliance
Randomization Object - left side scoring locations

E-3 – left side Scoring

Randomization Object - center scoring locations

E-4 – center Scoring
**Randomization Object** - right side scoring locations

**E-5 – right Scoring**

During the Autonomous period, the yellow *Pixel* only has to touch the correct surface (in this example it is the Left randomized position)

This is a legally scored *Pixel* and earns the autonomous points

**E-6 – *Pixel* position**
E-7 – Scoring Examples

Purple Pixel earns Randomization Bonus

E-8 – Scoring Examples

Purple Pixel does not earn Randomization Bonus

E-9 – Scoring Examples

Yellow Pixel does not earn Randomization Bonus
Appendix F – **Scoring Examples**

**F-1 Pixel Scoring**

Pixel is not in the recessed area, it does not score.

Pixel is not flat against the back but it still scores.

**F-2 Mosaics**

**Legal Mosaics:**

A, B, C  Mosaic consists of three (3) non-white Pixels, all the same color (all green, all purple or all yellow) and in contact with the other two (2) Pixels of that Mosaic.

D  Mosaic consists of three (3) non-white Pixels, all different colors (one (1) green, one (1) purple and one (1) yellow) and in contact with the other two (2) Pixels of that Mosaic.

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Not legal Mosaics:

A. A Mosaic must consist of three (3) non-white Pixels, either all the same color (all green, all purple or all yellow) or each Pixel a different color (one (1) green, one (1) purple, and one (1) yellow).

B. A Mosaic cannot be in contact with another non-white Pixel.

C. Each Pixel in a Mosaic must be in contact with the other two (2) Pixels of that Mosaic.

F-3 Not Mosaics

F-4 Set Bonus
F-5 Landing Zone Scoring
Appendix G – AprilTags

G-1 AprilTags for Backdrop

You do not need to print these images if you are purchasing a full field kit from AndyMark. The AprilTags for the Backdrop are included in the full and partial field kits.

Do not print the images from this manual for practice purposes, as they are not to the same scale as Teams will see in actual competition. Please refer to the FIRST Tech Challenge Game and Season page for printable versions of these images.
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