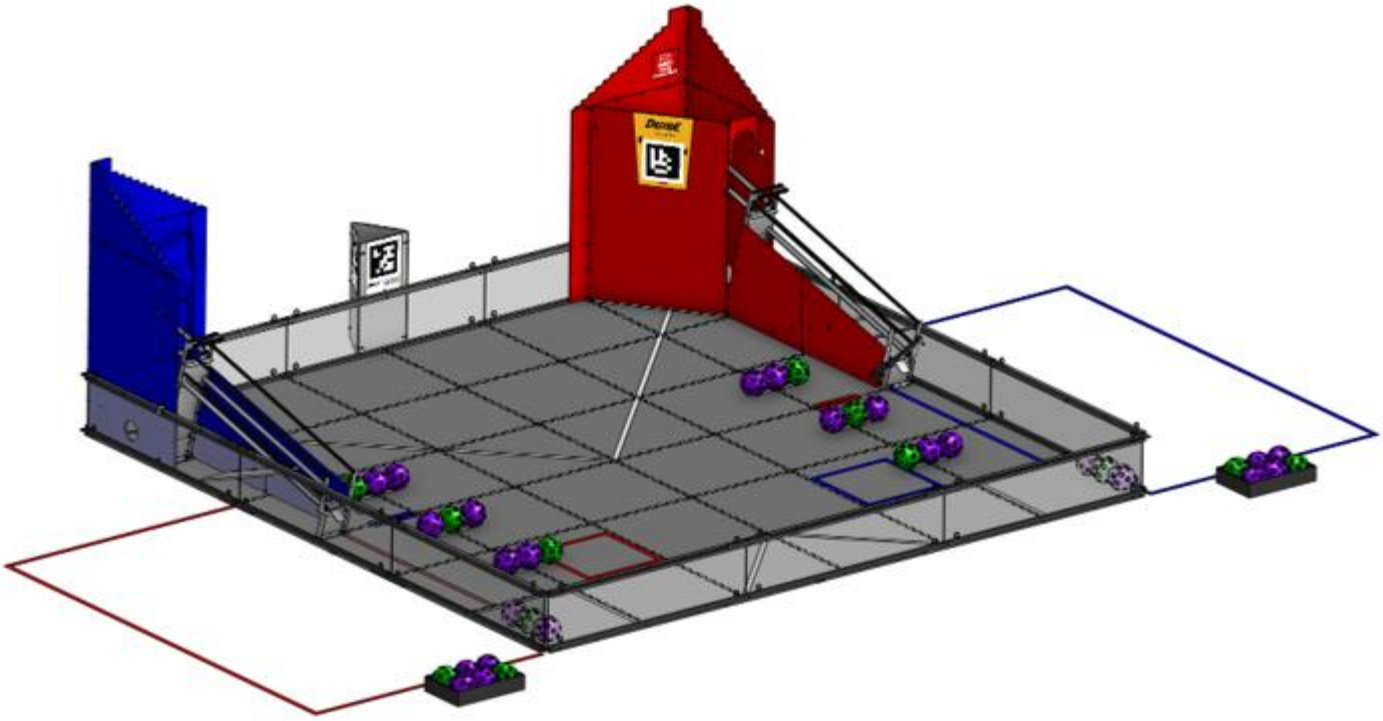
8 Game Overview



In DECODE™ presented by RTX 2 competing ALLIANCES of 2 teams each score purple and green ARTIFACTS in their GOAL, build PATTERNS, and race back to their BASE before time runs out.

Just before the match starts, the OBELISK is randomized to show one of 3 MOTIFS. The MOTIF for the MATCH defines what color PATTERN robots try to create on their RAMPS.

During the first 30 seconds of the MATCH, the ROBOTS operate autonomously. ROBOTS can use sensors to decode the randomized MATCH MOTIF. ROBOTS can earn points by scoring ARTIFACTS in their GOAL and building a PATTERN on their RAMP based on the MOTIF. ROBOTS also earn points for moving off the LAUNCH LINE.

During the remaining 2 minutes of the MATCH, human DRIVERS take control of their ROBOT. ROBOTS collect and continue to score ARTIFACTS in their GOAL to earn points. DRIVE TEAM members can retrieve ARTIFACTS from the ALLIANCE'S LOADING ZONE and help their ROBOTS by loading them with ARTIFACTS.

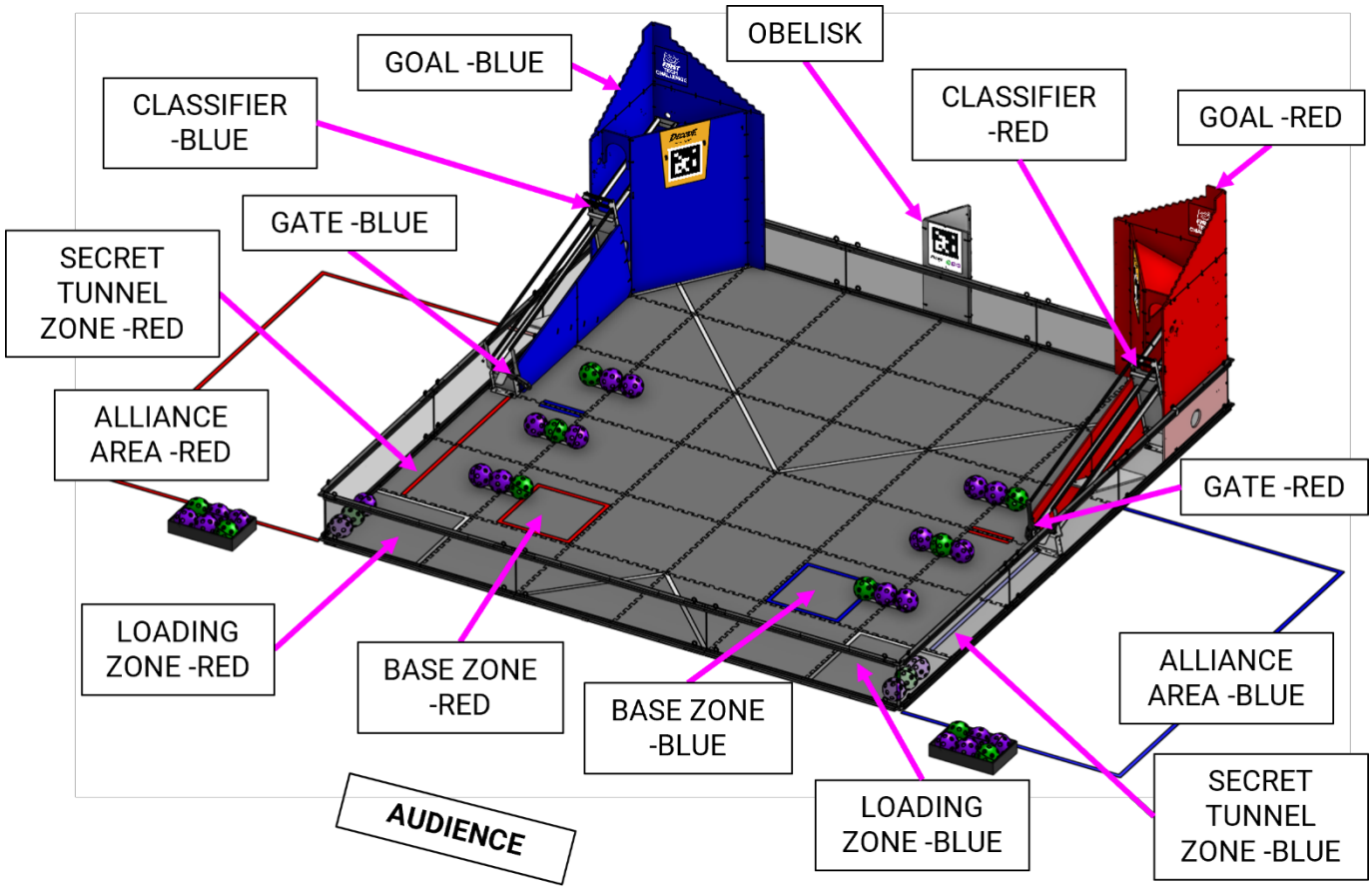
As time runs out, ALLIANCES can work together to return both of their ROBOTS to the BASE. ALLIANCES that build PATTERNS based on the MOTIF at the end of the MATCH earn additional points.

The ALLIANCE that earns the most points wins the MATCH and additional RANKING POINTS can be earned though completing other scoring achievements.

9 ARENA

The ARENA includes all elements of the game infrastructure that are required to play DECODE: the FIELD, SCORING ELEMENTS, queue area, team media area, and all equipment needed for event management.

Figure 9-1 DECODE (queue area, FIELD display, and optional media area not pictured)



9.1 Dimensions and Accuracy

The specifications for the DECODE FIELD can be retrieved from a few locations:

- The 3D CAD model is the official representation of the DECODE FIELD and how it is constructed. Measurements may be taken from this model with a general tolerance of +/- 1 in. (+/- 2.5 cm).
- Illustrations included in the Competition Manual are for a general visual understanding of the DECODE ARENA, and any dimensions included are nominal. Unless specifically noted, all these dimensions carry a tolerance of +/- 1 in. (+/- 2.5 cm).
- The Event FIELD Setup Guide includes instructions on how to build the FIELD, and along with showing the ways construction type will influence the field tolerances, it also includes many of the key dimensions which are listed in the Official FIELD Drawings.
- The FIELD Acceptance Checklist includes the controlled dimensions (with relevant tolerances) which will be regularly inspected by event staff.

- The FIELD Mitigation Guide provides FIELD STAFF recommended mitigation measures for issues with the field during an event.

The complete list of DECODE FIELD resources are posted on the Playing FIELD Resources page on the *FIRST* website.

> The ARENA is modular and is assembled, used, disassembled, and transported many times during the competition season. It undergoes wear and tear. The ARENA is designed to withstand rigorous play and frequent reassembly. Every effort is made to ensure that ARENAS are consistent from event to event.
>
> However, ARENAS are assembled in different venues by different event staff and volunteers, and some small variations occur. In addition, every region faces unique challenges which may impact the exact implementation of the ARENA, and as such the ARENA specifications are designed to accurately reflect the variations which may be present in official play, while still ensuring consistency of critical items. Contact your local support to request more information.
>
> Successful teams will design ROBOTS that are insensitive to these variations.

9.2 FIELD

Each FIELD for DECODE is an approximately 144 in. by 144 in. (365.75 cm by 365.75 cm) area bounded by the inside surface of the walls of the FIELD perimeter. The flooring surface of the FIELD is made of 36 interlocking soft foam TILES which are each approximately 24 in. by 24 in. by 0.59 in. (60.95 cm by 60.95 cm by 1.50 cm) nominally sized.

The FIELD is populated with and surrounded by the following FIELD elements:

- 1 CLASSIFIER per ALLIANCE which consists of a SQUARE, a RAMP, and a GATE
- 1 GOAL per ALLIANCE
- 1 OBELISK

Official events use the full DECODE FIELD manufactured and sold by AndyMark (am-5400_Full) or officially licensed equivalent.

The surface of the FIELD is *FIRST* Tech Challenge Field Soft Tiles (am-2499) or equivalent.

The primary version of the FIELD perimeter is the *FIRST* Tech Challenge Perimeter Kit (am-0481) sold by AndyMark. All illustrations in this manual show the am-0481 version of the FIELD design. Other versions of the FIELD perimeter of similar functionality may also be used in competitions.

Some events including the *FIRST* Championship (see section `15.2 Game Modification`) will place the FIELDS on platforms or risers such that the FIELD is raised while the ALLIANCE AREAS remain at ground level.

The FIELD variant used at an event will be determined by the local Program Delivery Partner and all competition FIELDS at the same event must comply with Section `9.1 Dimensions and Accuracy` and be consistent with each other per `T204`.

9.3 Areas, Zones, & Markings

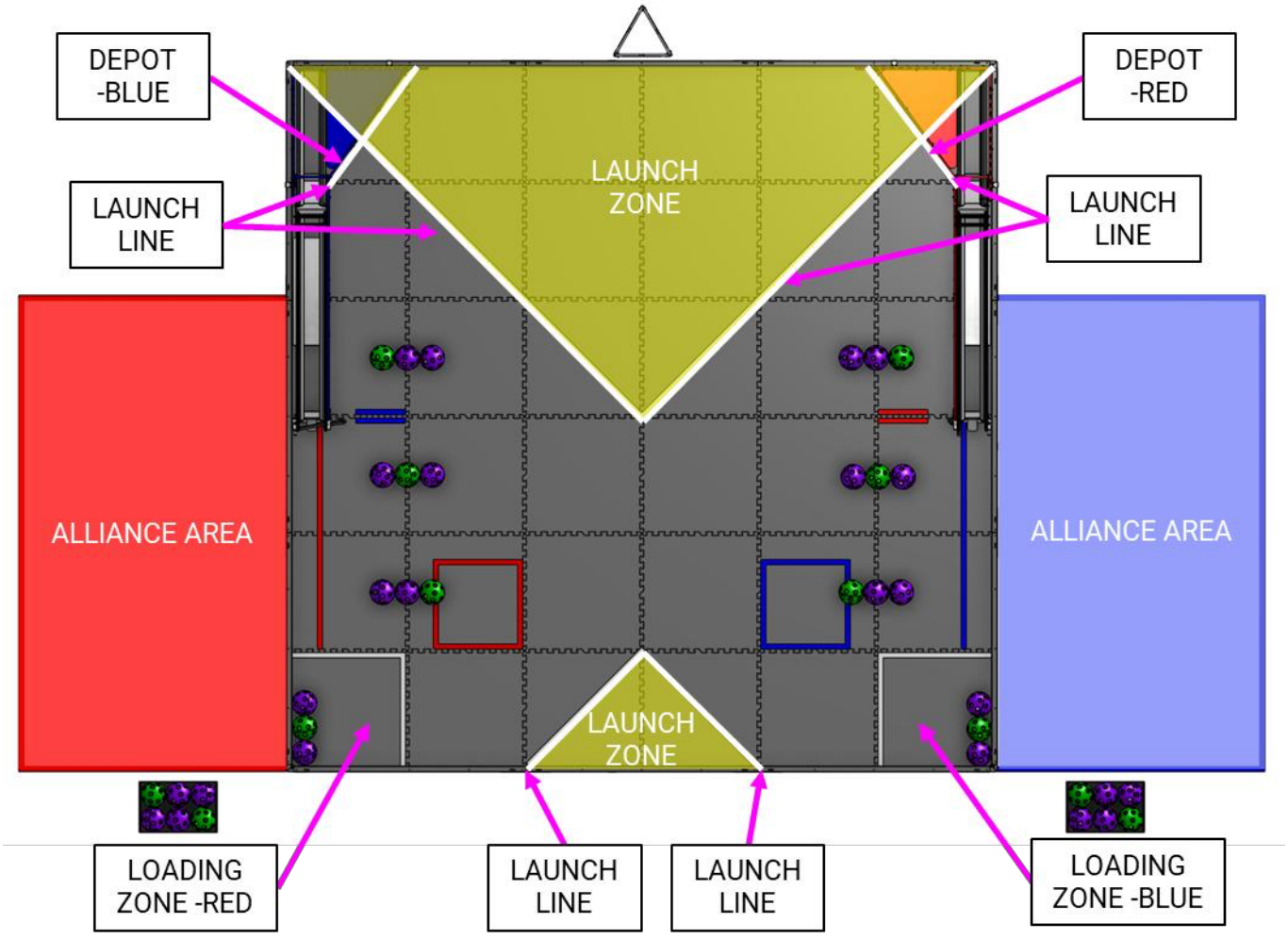
FIELD areas, zones, and markings of consequence are described below. The term “zone” is used to identify spaces within the FIELD, while the term “area” is used to describe spaces outside of the FIELD. Unless otherwise specified, the tape used to mark lines and zones throughout the FIELD is 1 in. (2.50 cm) wide 3M™ Premium Matte Cloth (Gaffers) Tape (GT1), ProGaff® Premium Professional Grade Gaffer Tape, or comparable gaffers tape in red, electric blue, and white. Areas outside the FIELD may be marked with other types or widths of tape, depending on the event.

The tape used to mark lines and zones throughout the FIELD is shown as continuous strips in all official specifications. However, events do not need to install the tape as a continuous strip:

- After applying the tape, event staff may cut the tape at the tile seams so the TILES may be removed without replacing the tape.
- Events may also apply the tape in multiple segments with gaps at the tile junctions.

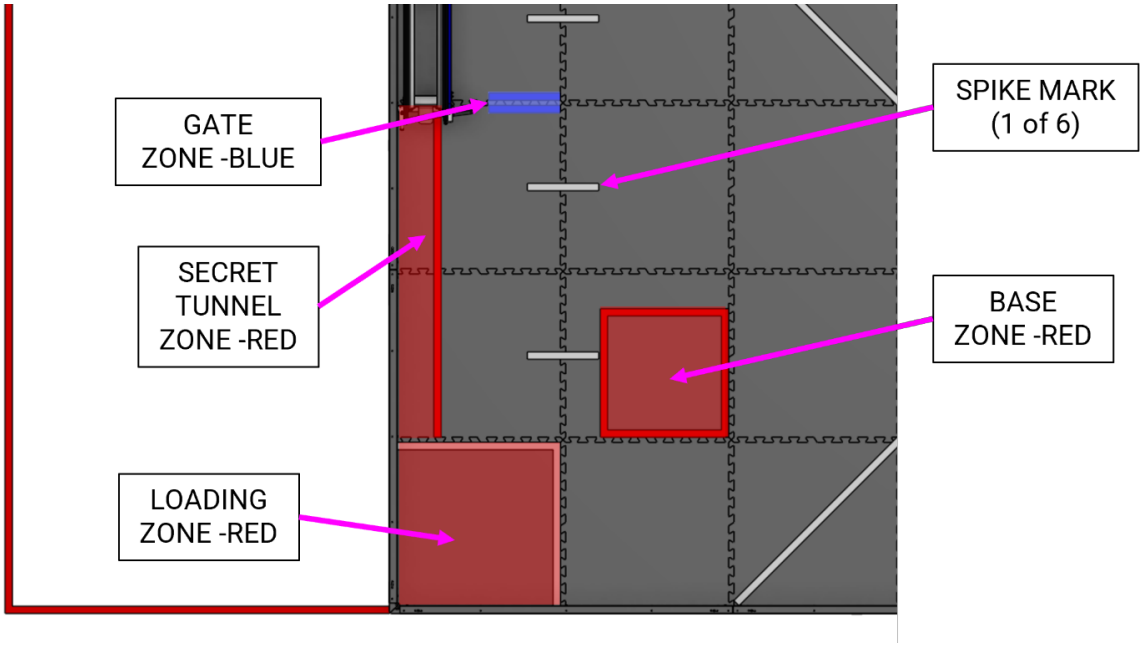
REFEREES are instructed to treat these line segments as a continuous line segment, ignoring gaps, when applying game rules.

Figure 9-2 ALLIANCE AREA, LAUNCH LINES, and LAUNCH ZONE



- ALLIANCE AREA: a 96 in. (243.85 cm) wide by 54 in. (137.15 cm) deep by infinitely tall volume formed by placing ALLIANCE colored tape onto the flooring surface outside of the FIELD. The ALLIANCE AREA includes the taped lines (Figure 9-2).
- DEPOT: the white tape approximately 30 in. (76.20 cm) long which spans the entire length of the GOAL front face and is located at the base of the GOAL. The DEPOT tape is a LAUNCH LINE (Figure 9-2).
- LAUNCH LINE: the white tape which bounds 2 triangular LAUNCH ZONES, as well as 2 segments of white tape located at the base of the GOAL.(Figure 9-2).
- LAUNCH ZONE: infinitely tall triangular volumes bounded by LAUNCH LINES and the FIELD perimeter. There are 2 LAUNCH ZONES: the LAUNCH ZONE on the audience side of the FIELD spans a section 2 TILES wide and 1 TILE deep and the LAUNCH ZONE on the GOAL side of the FIELD spans a section 6 TILES wide by 3 TILES deep. The LAUNCH ZONES include the tape that defines the LAUNCH LINES (Figure 9-2).

Figure 9-3: SECRET TUNNEL, GATE ZONE, LOADING ZONE, and SPIKE MARKS (shown with ARTIFACTS removed)



- BASE ZONE: an 18 in. +/- 0.125 in. (45.70 cm +/- 0.30 cm) wide by 18 in. +/- 0.125 in. (45.70 cm +/- 0.30 cm) deep infinitely tall volume bounded by ALLIANCE colored tape. The BASE ZONE is an ALLIANCE specific zone belonging to the matching color ALLIANCE. The BASE ZONE includes the tape lines (Figure 9-3).
- GATE ZONE: a 2.75 in. (7.00 cm) wide by 10 in. (25.40 cm) long infinitely tall volume bounded by 2 parallel 10 in. (25.40 cm) long ALLIANCE colored tape segments adjacent to each GATE. The GATE ZONE includes the tape lines (Figure 9-3).
- LOADING ZONE: an approximately 23 in. (58.40 cm) wide by 23 in. (58.40 cm) deep infinitely tall volume bounded by white tape and the adjoining FIELD perimeters. The LOADING ZONE includes the tape lines (Figure 9-3). The LOADING ZONE is an ALLIANCE specific zone belonging to the ALLIANCE with the adjacent ALLIANCE AREA.

- SECRET TUNNEL ZONE: an approximately 46.5 in. (118.10 cm) long by approximately 6.125 in. (15.55 cm) wide infinitely tall volume bounded by ALLIANCE colored tape, the GOAL assembly, the LOADING ZONE, and the adjoining FIELD perimeter. The SECRET TUNNEL ZONE includes the ALLIANCE colored tape lines and excludes the white tape (Figure 9-3). The SECRET TUNNEL ZONE is an ALLIANCE specific zone belonging to the matching color ALLIANCE.
- SPIKE MARK: 1 of 6 white tape marks 10 in. (25.40 cm) long used to identify the placement of 3 ARTIFACTS before the MATCH (Figure 9-3).

9.4 TILE Coordinates

TILE coordinates are used to assist with FIELD setup. Figure 9-4 defines the intersections of each of the TILES on the FIELD where the TILE tabs interlock. Figure 9-5 defines the grid coordinate system for each of the TILES.

Figure 9-4: TILE tab-line locations

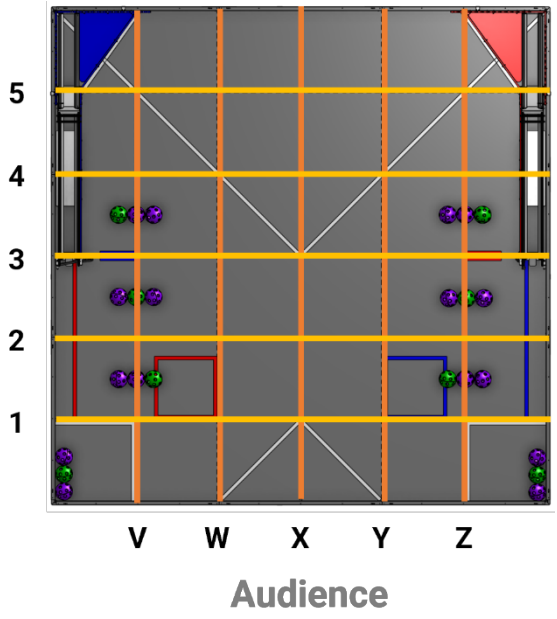
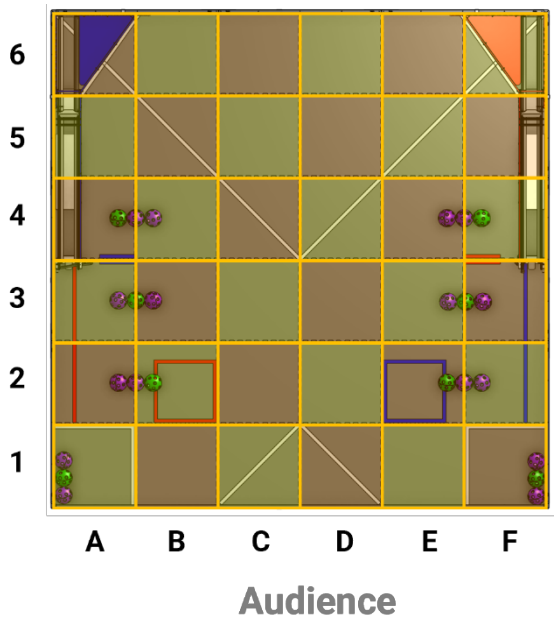


Figure 9-5: TILE locations

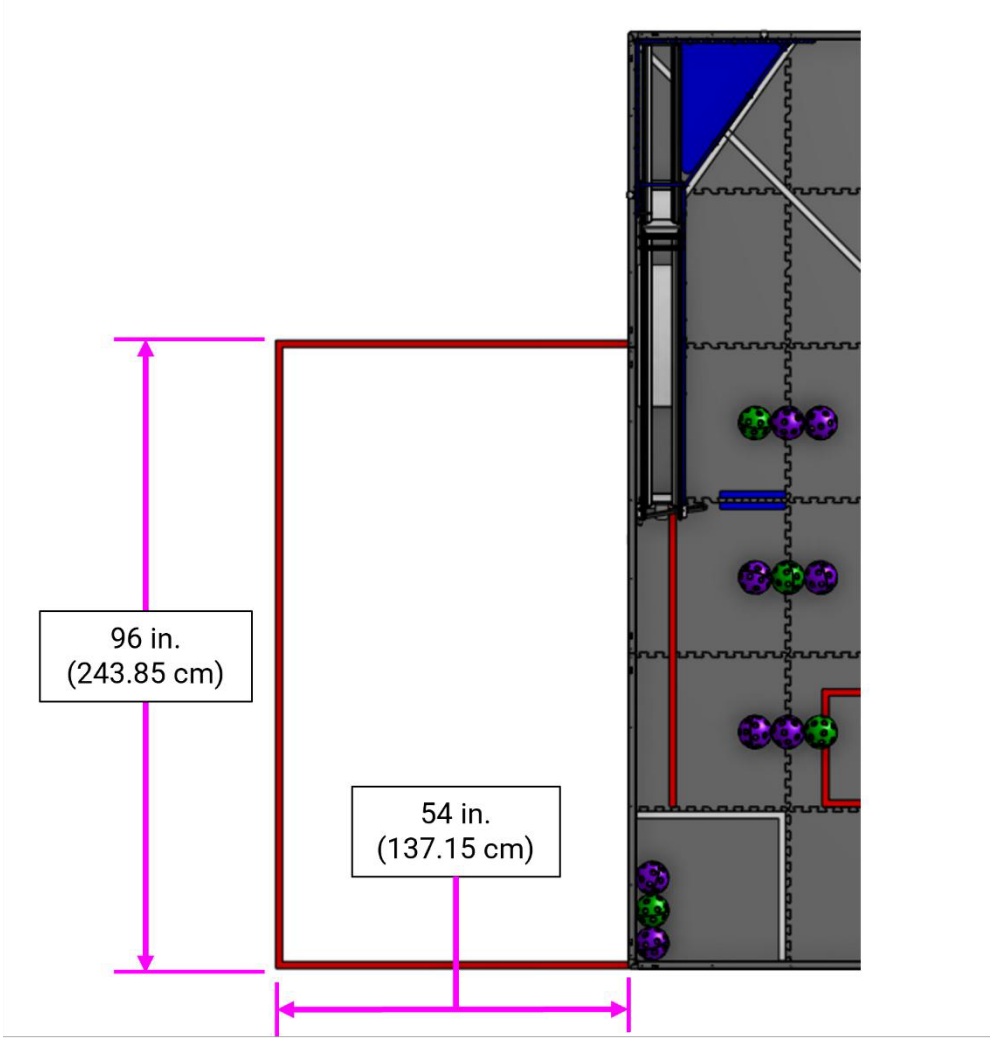


9.5 ALLIANCE AREA

An ALLIANCE AREA is the designated red or blue ALLIANCE AREA adjacent to the FIELD where the DRIVE TEAMS stage themselves during a MATCH. The FIELD is oriented such that the red ALLIANCE AREA is located on the left from the primary audience viewing direction.

Short tables, stands, or stools may be provided by the event which will sit near the FIELD perimeter inside the ALLIANCE AREA. These tables are provided for teams to place their OPERATOR CONSOLES. If provided by the event, these tables may not be removed or rearranged by the teams without permission from the Head REFEREE, FIELD Supervisor, or FTA.

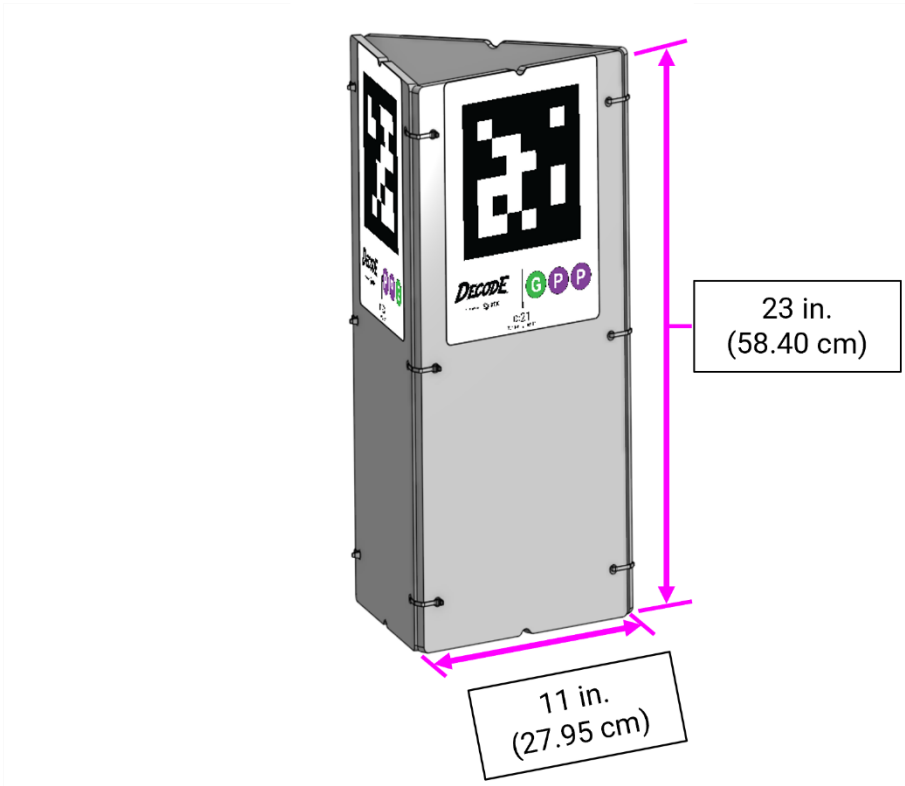
Figure 9-6: ALLIANCE AREA



9.6 OBELISK

The OBELISK is an equilateral triangular prism (we know, real obelisks have 4 sides) which is positioned with 1 of the rectangular faces centered on the GOAL-side of the FIELD, just outside of the FIELD perimeter. The OBELISK is 23 in. (58.40 cm) tall and each rectangular face is 11 in. (27.95 cm) wide (Figure 9-7).

Figure 9-7: OBELISK dimensions



Each of the 3 rectangular faces of the OBELISK has an AprilTag (see section 9.10 AprilTags) which corresponds to a different MOTIF. A MOTIF is a series of ARTIFACT colors, comprised of 2 purple (P) and 1 green (G), in a unique order. There are 3 MOTIFS in DECODE (GPP, PGP, PPG).

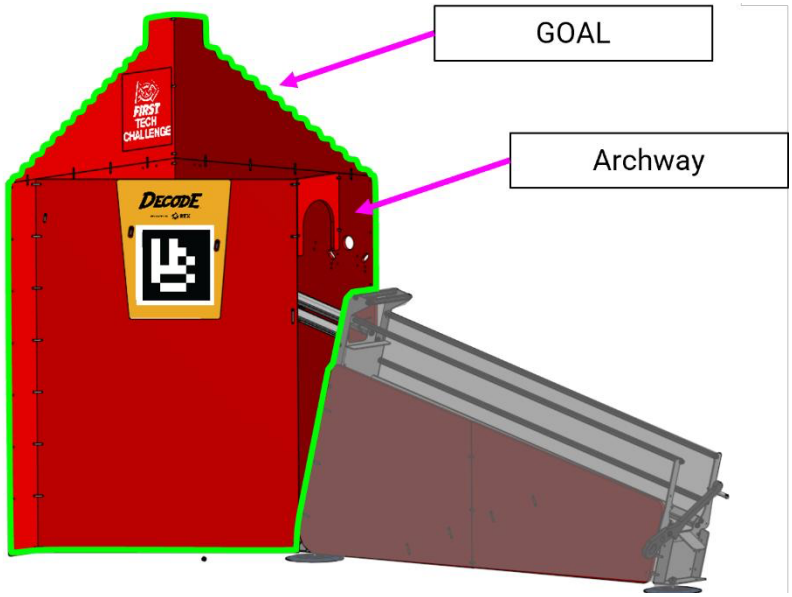
The OBELISK orientation is randomized by the FIELD STAFF using the event management software after DRIVE TEAMS have set-up for the MATCH (G304). The event management software will determine which face of the OBELISK should face towards the FIELD and the FIELD STAFF will put it in place. The location of the OBELISK will be approximately centered along the outside edge of the FIELD perimeter with the face containing the AprilTag approximately parallel to and contacting the FIELD perimeter wall.

> The location of the OBELISK is not intended to be deterministic relative to the field coordinate system and should not be used for navigation.

9.7 GOAL

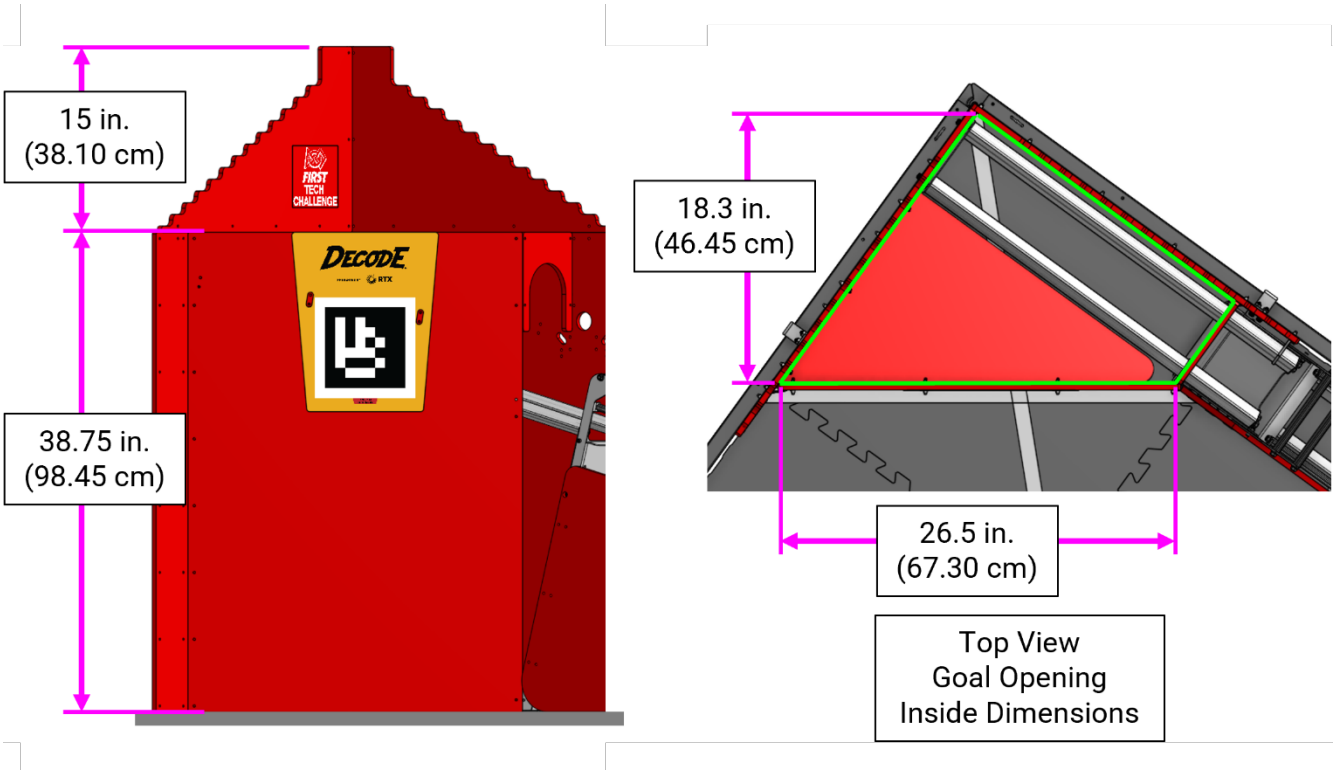
The GOAL is an approximately 27 in. (68.60 cm) by 27 in. (68.60 cm) by 54 in. (137.15 cm) tall structure primarily composed of 0.39 in. (1.00 cm) thick polypropylene corrugated plastic sheet. The GOAL is a 3-sided structure with a horizontal triangular shaped opening at the top. On the side where the CLASSIFIER connects to the GOAL there is an exit archway (Figure 9-8).

Figure 9-8: GOAL with Archway exit



The opening of the GOAL is approximately 26.5 in. (67.30 cm) wide and 18.3 in. (46.45 cm) deep. The top lip of the GOAL is 38.75 in. (98.45 cm) from the surface of the TILE. The maximum height of the backboard with the *FIRST* Tech Challenge logo is 15 in. (38.10 cm) from the open top of the GOAL (Figure 9-9).

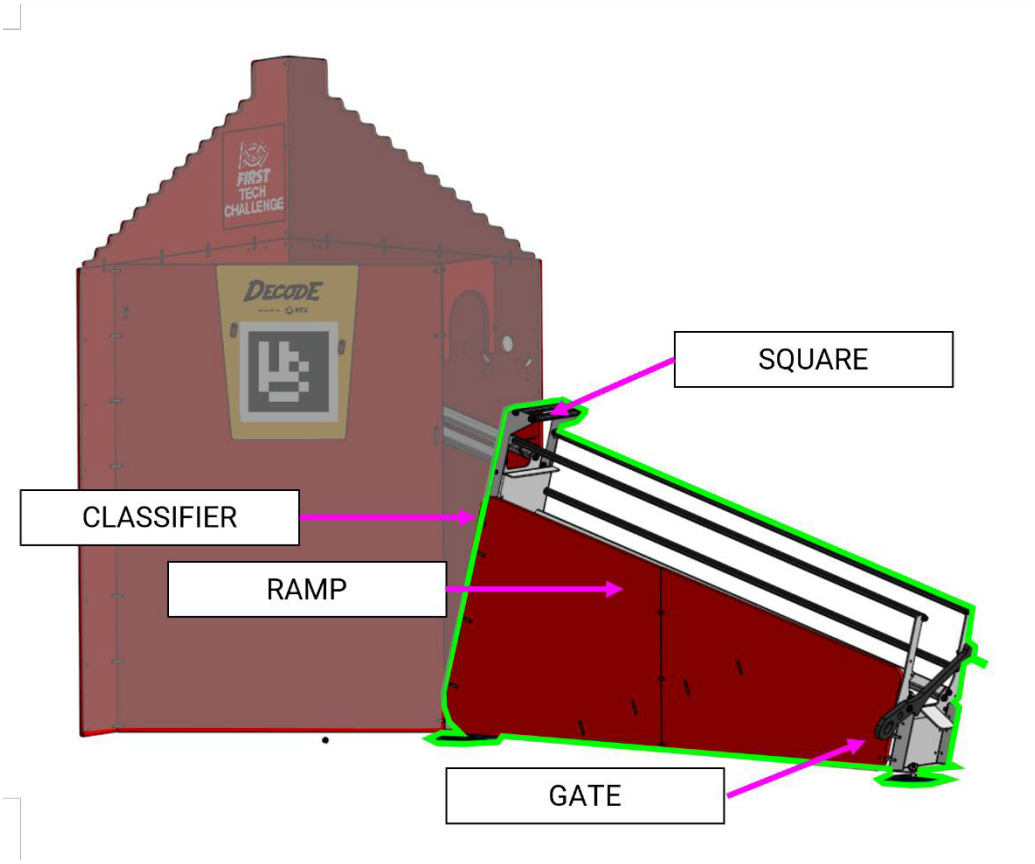
Figure 9-9: GOAL Dimensions



9.8 CLASSIFIER

The CLASSIFIER is a structure attached to the GOAL which has 3 main components: the SQUARE, RAMP, and GATE (Figure 9-10).

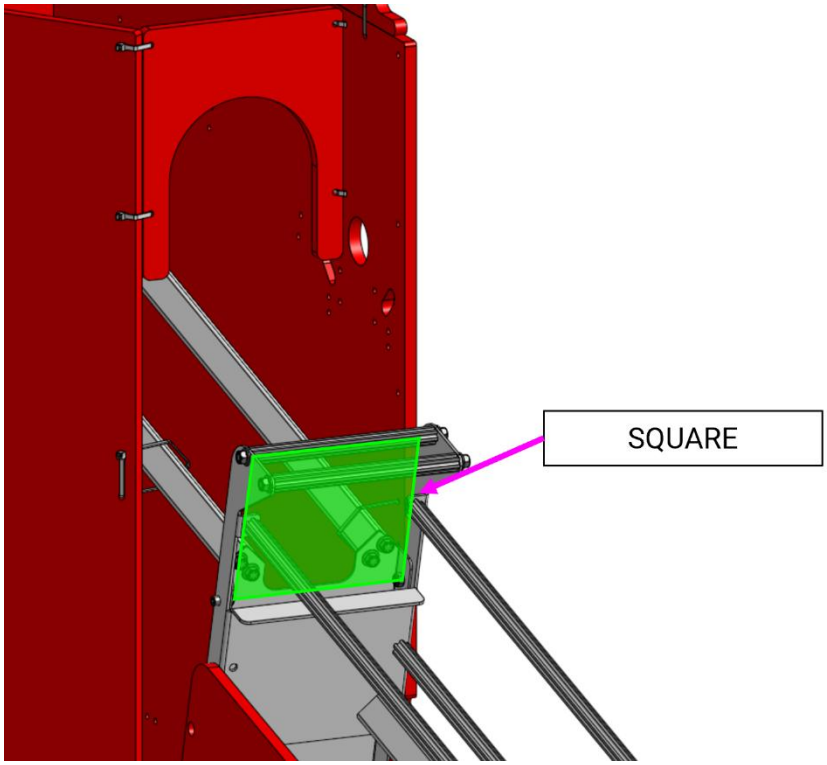
Figure 9-10: CLASSIFIER with no SCORING ELEMENTS



9.8.1 SQUARE

The SQUARE (Figure 9-11) is a location at the top of the RAMP at which ARTIFACT scoring is assessed as per 10.5 Scoring.

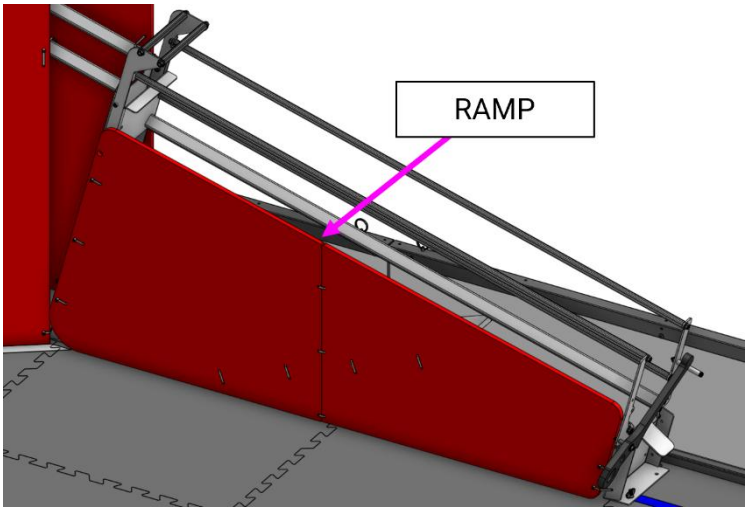
Figure 9-11: SQUARE on the RAMP



9.8.2 RAMP

The RAMP is a structure made of primarily aluminum extrusion. The RAMP can fit up to 9 CLASSIFIED ARTIFACTS before newly entered ARTIFACTS will OVERFLOW.

Figure 9-12: RAMP with no SCORING ELEMENTS



In most cases exactly 9 ARTIFACTS will fit on the RAMP as CLASSIFIED before newly entered ARTIFACTS will OVERFLOW, but sometimes ARTIFACTS LAUNCHED into the GOAL at a high velocity or with significant spin may skip over the 9th open CLASSIFIER slot and count as OVERFLOW. This is a normal FIELD operation and not an ARENA FAULT.

Figure 9-13: RAMP partially full of SCORING ELEMENTS

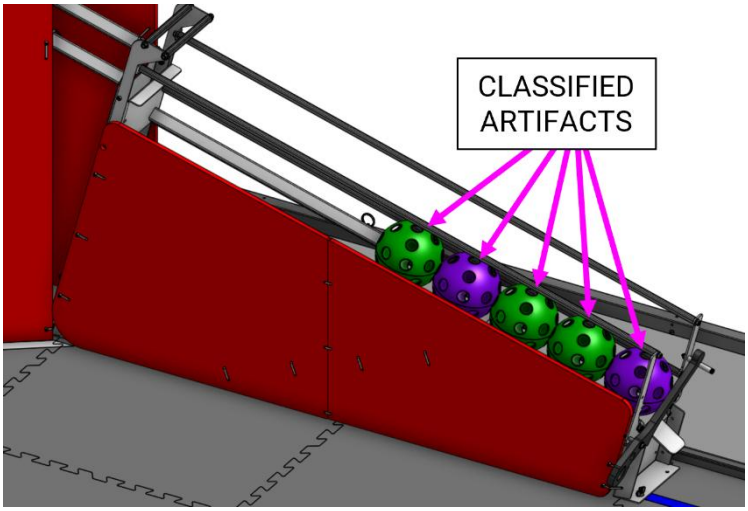
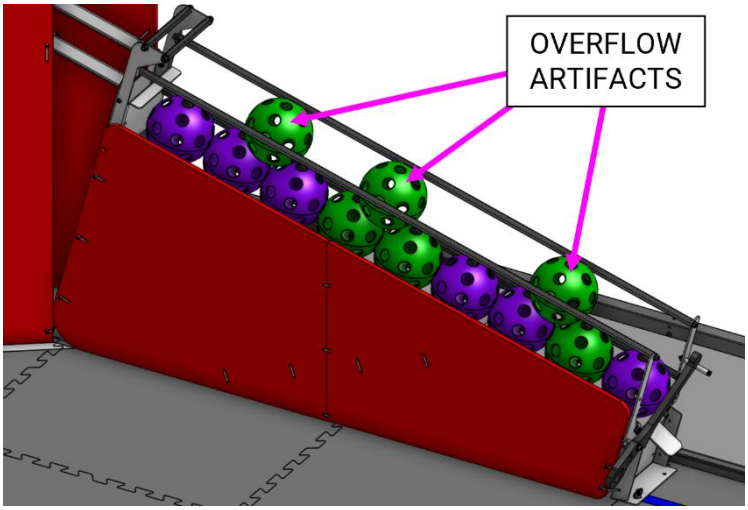


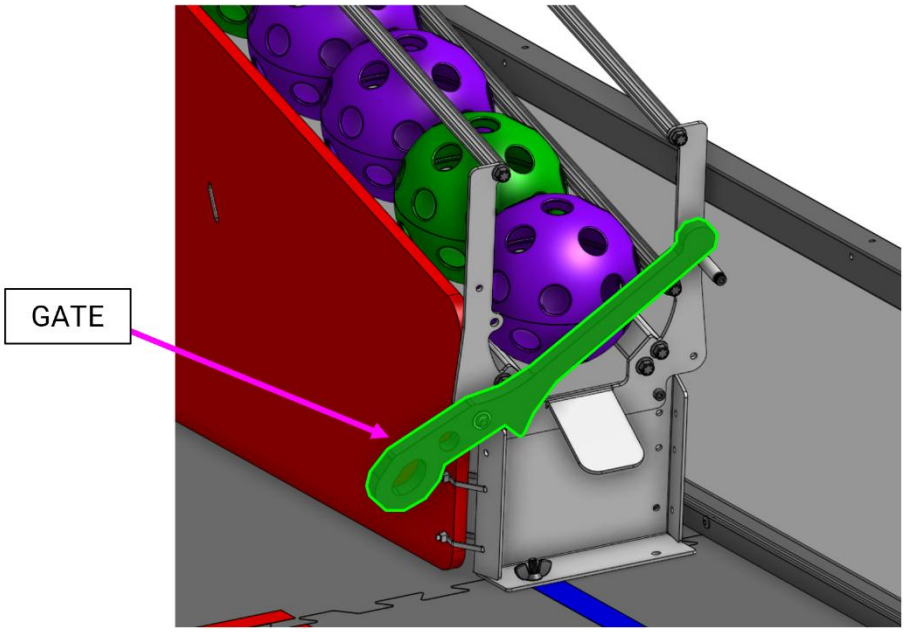
Figure 9-14: RAMP full of SCORING ELEMENTS with OVERFLOW



9.8.3 GATE

The GATE is an ALLIANCE specific FIELD element that prevents CLASSIFIED ARTIFACTS from exiting the RAMP into the opposing ALLIANCE'S SECRET TUNNEL ZONE (Figure 9-15). OVERFLOW ARTIFACTS can pass over the top of the GATE to exit the RAMP into the opposing ALLIANCE'S SECRET TUNNEL ZONE. The GATE is closed by gravity and after opening it may or may not stay open to clear all CLASSIFIED ARTIFACTS.

Figure 9-15: GATE



The GATE is a ROBOT-activated, push to open mechanism which will release ARTIFACTS which are CLASSIFIED on the RAMP (Figure 9-16).

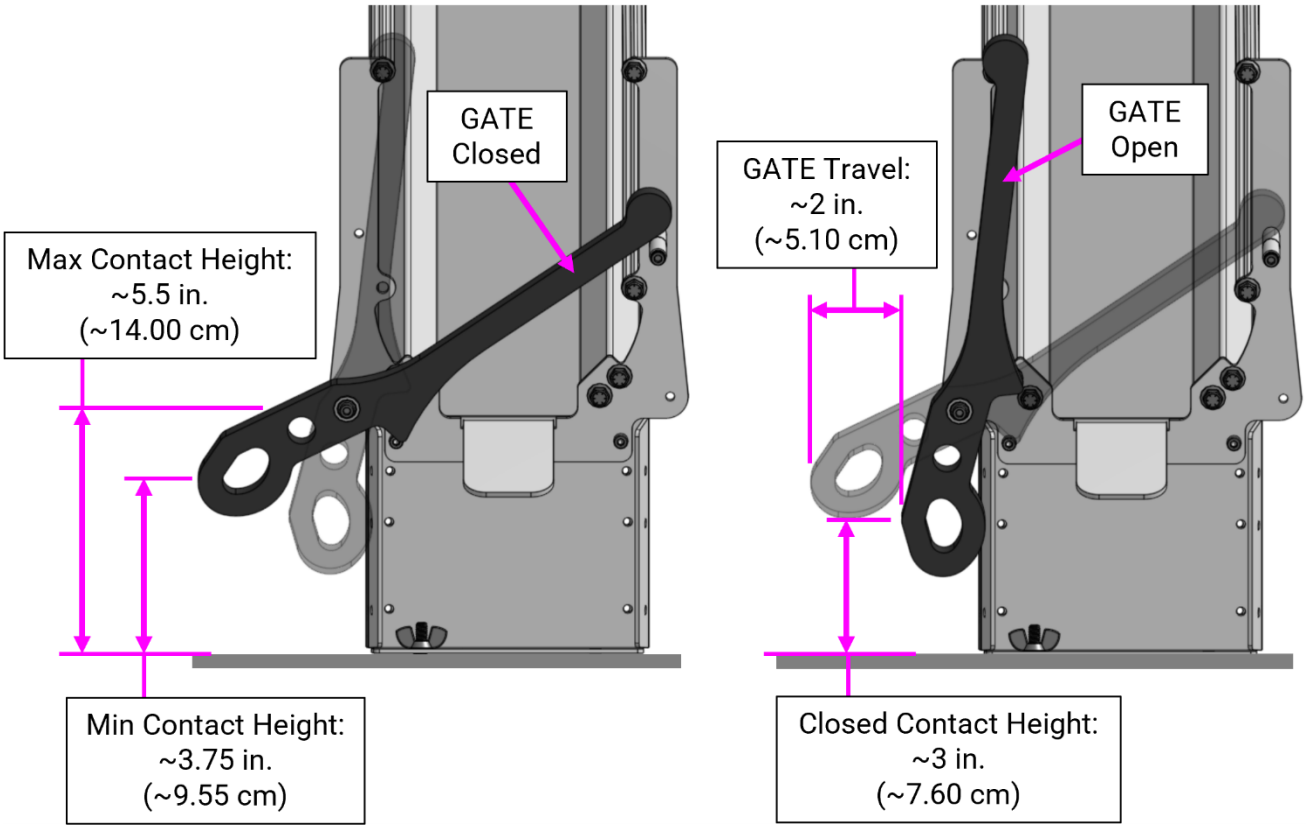
> The GATE will take variable amounts of time to close. The GATE closing before all CLASSIFIED ARTIFACTS exit the RAMP is not considered an ARENA FAULT, and teams should be prepared to hold the GATE open to fully clear the RAMP. The GATE not closing immediately when released by the ROBOT (but closing eventually) is not considered an ARENA FAULT. During a MATCH, FIELD STAFF may follow steps in the Field Mitigation Guide to mitigate some FIELD issues during a MATCH. Refer to the Field Mitigation Guide for more guidance on how FIELD STAFF will respond to inconsistent FIELD behavior.

When closed, the height of the contact area of the GATE above the surface of the TILE ranges from approximately 3.75 in. (9.55 cm) to 5.5 in. (14.00 cm) and when open the contact point is approximately 3 in. (7.60 cm) above the TILES (Figure 9-16). The total horizontal displacement required to move the GATE from closed to open is approximately 2 in. (5.10 cm).

> TEAMS are encouraged to design their ROBOTS with a large vertical surface which ensures consistent contact with the GATE arm. It is particularly important that this panel extends up to the high end of the interface range approximately 5.5 in. (14.00 cm) above the TILE surface. This ensures the ROBOT cannot end

up “under” the GATE arm and will help prevent ROBOTS from inadvertently damaging the FIELD.

Figure 9-16: GATE Actuation: Open & Closed



9.9 SCORING ELEMENTS

SCORING ELEMENTS are ALLIANCE neutral ARTIFACTS. ARTIFACTS are 5 in. (12.70 cm) nominal Gopher ResisDent™ polypropylene balls in purple (am-3376a_purple) and green (am-3376a_green). There are 24 purple (P) ARTIFACTS and 12 green (G) ARTIFACTS total in a DECODE MATCH.

ARTIFACTS are not perfectly spherical and may vary in size. Teams should plan for this variation when designing their ROBOTS. Based on the specifications provided by the manufacturer, ARTFACTS are specified to be 4.9 in +/- 0.25 in. (12.45 cm +/- 0.65 cm) in diameter at the mold seam.

Figure 9-17: SCORING ELEMENTS (ARTIFACTS)

9.10 AprilTags

AprilTags for DECODE are 8.125 in. (~20.65 cm) square targets from the 36h11 tag family (Figure 9-18).

AprilTags are placed on the front face of the GOAL to help aid in ROBOT navigation and targeting. The red ALLIANCE GOAL has ID 24, and the blue ALLIANCE GOAL has tag ID 20. Each marker has an identifying “TAG ID” text label (Figure 9-19).

AprilTags with the ID 21, 22, 23 are located on each rectangular face of the OBELISK, which is placed outside of the FIELD and can be used to identify the MOTIF for the MATCH.

The OBELISK AprilTag is not recommended for ROBOT navigational use as the exact placement location may vary from MATCH to MATCH.

Figure 9-18: AprilTag Locations on the DECODE FIELD

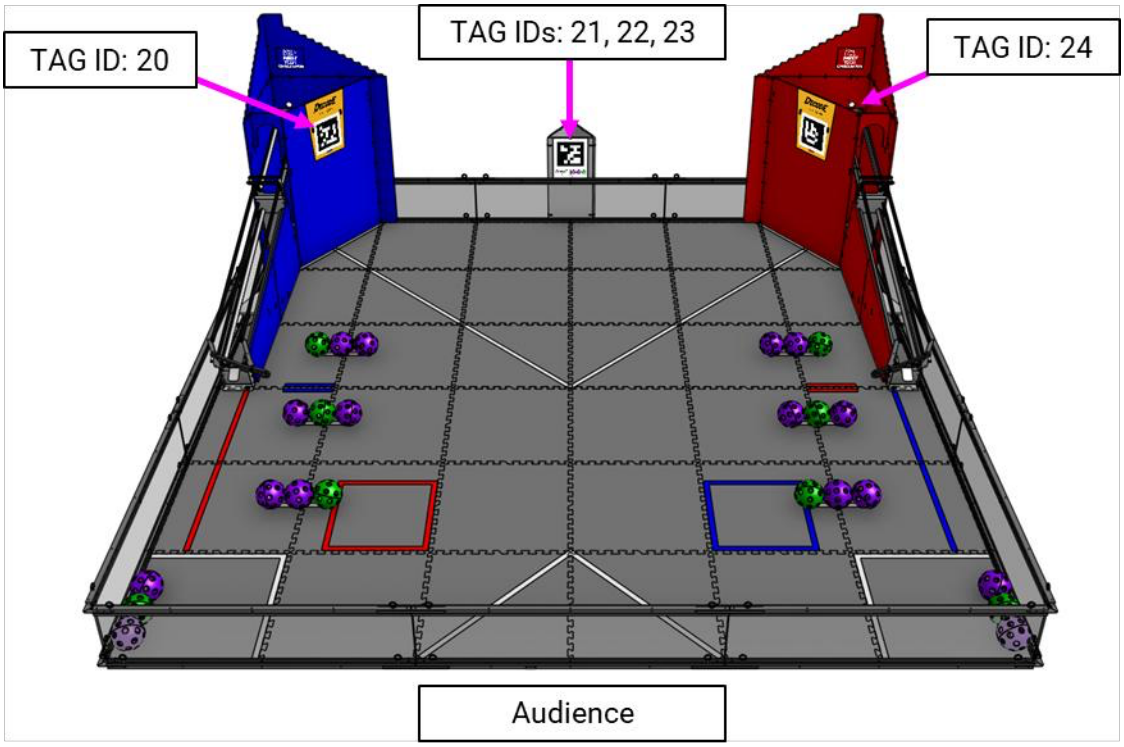
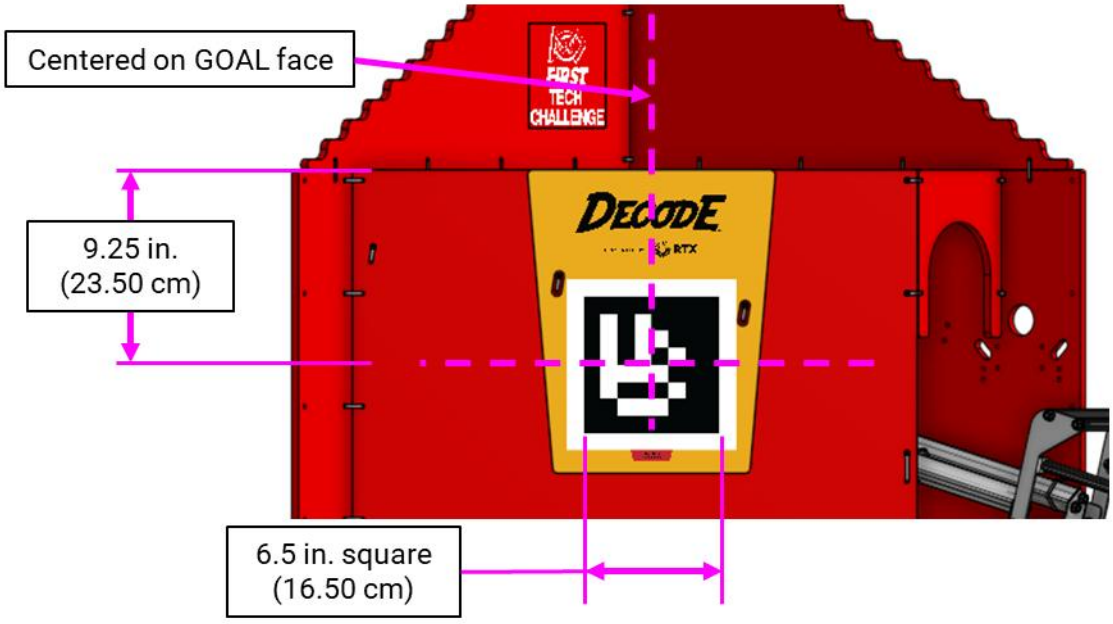


Figure 9-19: AprilTag location on the GOAL



Do not print the images from this manual for practice purposes, they are examples only and are not the same size as those used in the ARENA. Please refer to the Playing Field Resources page for printable versions of these images, including instructions on how to place the images correctly around the FIELD.

9.11 FIELD STAFF

FIELD STAFF are volunteers present in and around the ARENA that are responsible for making sure the MATCHES are cycled through efficiently, fairly, safely, and with a spirit of cooperation, *Gracious Professionalism*®, and generosity of spirit. FIELD STAFF roles are filled by volunteers from the community who prepare for the event with thorough training and certification. There are 3 FIELD-side key volunteer roles with whom teams should be familiar with and are encouraged to use as resources to make their event experience valuable.

- Head REFEREE – trains, directs, and supervises REFEREES. They oversee all scoring processes and procedures in collaboration with other FIELD STAFF. They interact with STUDENTS, volunteers, and event staff. The Head REFEREE has final authority for decisions regarding MATCH scores, FOULS, and YELLOW and RED CARD assignments.
- *FIRST* Technical Advisor (FTA) - ensures events run smoothly, safely, and in accordance with *FIRST* requirements. The FTA collaborates with *FIRST* staff, event staff, and other event volunteers in many different areas at events. The FTA focuses on all technical things related to the FIELD, ROBOTS, and game, and acts as a team advocate for all teams competing at the event.
- FIELD Supervisor - (may be the same as the FTA or Head REFEREE at smaller events) directs activity on the FIELD to ensure efficient execution of the MATCHES, pacing of the event, and smooth flow of MATCH play. FIELD Supervisors are responsible for ensuring the FIELD is intact and lead FIELD reset teams, who are responsible for resetting the FIELD after each MATCH in preparation for the subsequent MATCH.

For additional details about each of these roles, as well as other *FIRST* Tech Challenge volunteer roles, please refer to our volunteer resources.

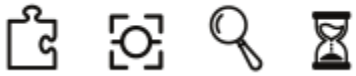
9.12 Event Management System

The *FIRST* event management system is the software responsible for managing the MATCH scores and other event inputs. The system encompasses all FIELD electronics, including computers, displays, REFEREE and other volunteer electronic devices, wireless access point, ethernet cables, etc.

The *FIRST* event management system alerts participants to milestones in the MATCH using audio cues detailed in Table 9-1. Please note that audio cues are intended as a courtesy to participants and not intended as official MATCH markers. If there is a discrepancy between an audio cue and the visual FIELD timers, the visual FIELD timers are the authority.

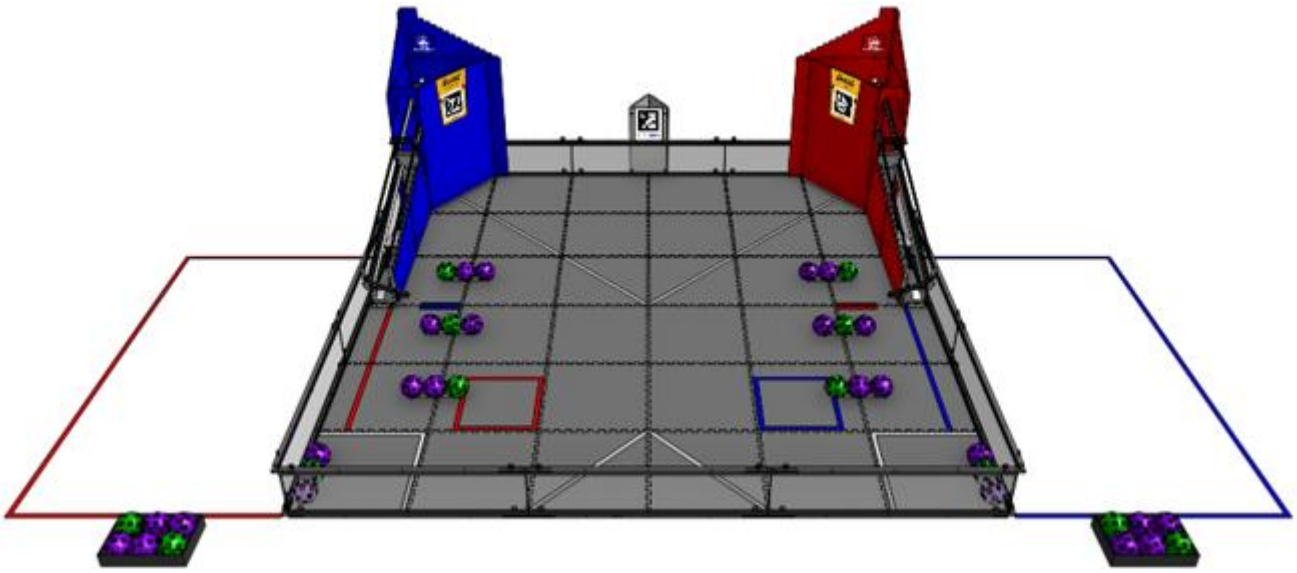
Table 9-1 Audio cues

Event	Timer Value	Audio Cue
MATCH start	2:30	“Cavalry Charge”
AUTO ends	2:00	“Buzzer x 3”
AUTO to TELEOP Transition	0:07 to 0:01	“Drivers, pick up your controllers, 3-2-1”
TELEOP begins	2:00	“3 Bells”
Final 20 seconds	0:20	“Train Whistle”
MATCH end	0:00	“3-second Buzzer”
MATCH stopped	N/A	“Foghorn”



10 Game Details

Figure 10-1: FIELD for DECODE



In DECODE, 2 ALLIANCES (an ALLIANCE is a cooperative of 2 *FIRST* Tech Challenge teams) play MATCHES, set up and implemented per the details described below.

10.1 MATCH Overview

MATCHES run on a typical 5- to 12-minute cycle time per FIELD, which consists of pre-MATCH setup, a 30-second AUTO period, an 8-second transition period between AUTO and TELEOP, and a 2-minute TELEOP period, followed by the post-MATCH reset.

During the MATCH, ROBOTS collect ARTIFACTS and score them into their GOAL to CLASSIFY and create the randomly selected MOTIF. ROBOTS can then open their GATE to continue CLASSIFYING additional ARTIFACTS. ARTIFACTS which do not drop into the RAMP will count as OVERFLOW.

ROBOTS conclude the MATCH by returning to their BASE.

10.2 DRIVE TEAM

A DRIVE TEAM is a set of up to 4 people from the same *FIRST* Tech Challenge team responsible for team performance for a specific MATCH. There are 3 specific roles on a DRIVE TEAM which ALLIANCES can use to assist ROBOTS, and no more than 1 member of the DRIVE TEAM is allowed to be a non-STUDENT.

> The intent of the definition of DRIVE TEAM and DRIVE TEAM related rules is that, barring extenuating circumstances, the DRIVE TEAM consists of people who arrived at the event affiliated with that team and are responsible for their team's and ROBOT'S performance at the event (this means a person may be affiliated with more than 1 team).

The intent is not to allow teams to “adopt” members of other teams for strategic advantage for the loaning team, borrowing team, and/or their ALLIANCE (e.g., an ALLIANCE Lead believes 1 of their DRIVERS has more experience than a DRIVER of their ALLIANCE partner, and the teams agree the partner team will “adopt” that DRIVER and make them a member of their DRIVE TEAM for Playoffs).

The definition is not stricter for 2 main reasons. First, to avoid additional bureaucratic burden on teams and event volunteers (e.g., requiring that teams submit official rosters that Queuing must check before allowing a DRIVE TEAM into the ARENA). Second, to provide space for exceptional circumstances that give teams the opportunity to display *Gracious Professionalism* (e.g., a bus is delayed, a DRIVE COACH has no DRIVERS, and their pit neighbors agree to help by loaning DRIVERS as temporary members of the team until their bus arrives).

Table 10-1: DRIVE TEAM roles

Role	Description	Max./ DRIVE TEAM	Criteria
DRIVE COACH	a guide or advisor	1	any team member and may be an adult, must wear “DRIVE COACH” badge
DRIVER	an operator and controller of the ROBOT	3	STUDENT, must wear a “DRIVE TEAM” badge
HUMAN PLAYER	a SCORING ELEMENT manager		

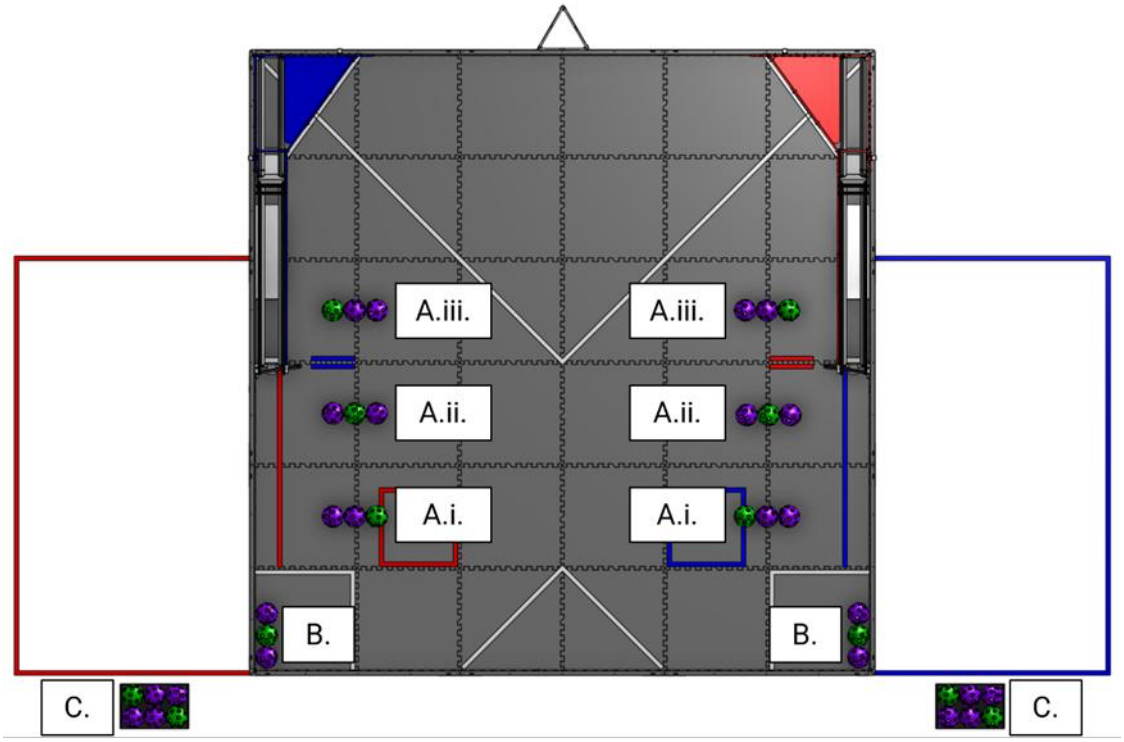
A STUDENT is a person who has not completed high-school, secondary school, or the comparable level in their home region as of September 1st of the current season.

10.3 Setup

Before each MATCH begins, FIELD STAFF stage SCORING ELEMENTS as described in section 10.3.1 SCORING ELEMENTS DRIVE TEAMS stage their ROBOTS (as described in section 10.3.4 ROBOTS) and OPERATOR CONSOLES (as described in section 10.3.3 OPERATOR CONSOLES). Then, DRIVE TEAMS take their places as described in section 10.3.2 DRIVE TEAMS

10.3.1 SCORING ELEMENTS

Figure 10-2: SCORING ELEMENTS staging positions



24 purple (P) and 12 green (G) ARTIFACTS and are staged on the FIELD as follows, with the MOTIFS starting from the middle of the FIELD and continuing toward the FIELD perimeter:

A. 3 ARTIFACTS on each SPIKE MARK arranged as follows:
   i. Near (audience side): GPP
   ii. Middle: PGP
   iii. Far (GOAL side): PPG
B. 3 ARTIFACTS (2P, 1G) in each LOADING ZONE biased against the FIELD perimeter adjacent to the ALLIANCE AREA and closest to the corner arranged PGP.
C. 6 ARTIFACTS (4P, 2G) in each ALLIANCE AREA (may be organized in provided ARTIFACT tray or similar container) with no set order

Each ROBOT may be pre-loaded with up to 3 ARTIFACTS from their own ALLIANCE AREA pre-staged ARTIFACTS in C such that each ARTIFACT is in direct contact with the ROBOT.

> As described in 15.2 Game Modification, the number, type, and distribution of SCORING ELEMENTS may be adjusted for the *FIRST* Championship and *FIRST* Premier Events. For the *FIRST* Championship, any game modifications will be published on or before the last regularly scheduled Team Update as described in section 1.8 Team Updates. For *FIRST* Premier Events, game modifications will be posted by the event organizers prior to the event.

10.3.2 DRIVE TEAMS

DRIVE TEAMS prepare for a MATCH by staging in the ALLIANCE AREA after the DRIVE TEAM from the previous MATCH has left. DRIVE TEAM starting conditions are listed below, and a DRIVE TEAM obstructing or delaying any of the conditions is at risk of violating G301.

A. only DRIVE TEAM members assigned to the upcoming MATCH are present.
B. only DRIVE TEAM members whose ROBOTS have passed initial, complete Inspection are present.
C. DRIVE TEAM members are staged in their designated ALLIANCE AREA. If members of the ALLIANCE cannot agree where their DRIVE TEAM members will be staged, the team listed on the MATCH schedule as “Red 1” or “Blue 1” will stage closest to the audience.
D. DRIVE TEAM members clearly display their designated DRIVE TEAM badges above their waists.
E. if a Playoff MATCH, the ALLIANCE CAPTAIN clearly displays their designated ALLIANCE CAPTAIN identifier (e.g., hat or armband).

10.3.3 OPERATOR CONSOLES

DRIVE TEAMS set up their OPERATOR CONSOLES as soon as they are staged in their ALLIANCE AREA. OPERATOR CONSOLES must be compliant with all relevant rules, specifically those in section 12.9 OPERATOR CONSOLE. A DRIVE TEAM obstructing or delaying OPERATOR CONSOLE set up is at risk of violating G301.

A. DRIVE TEAMS intending to run an OpMode during AUTO must select an OpMode within their DRIVER STATION app with the 30 second timer enabled.
B. Otherwise, DRIVE TEAMS must select a TELEOP OpMode within the DRIVER STATION app.
C. The selected OpMode must be initialized by pressing the “INIT” button on the DRIVER STATION app.

10.3.4 ROBOTS

DRIVE TEAMS stage their ROBOT in accordance with G304. A DRIVE TEAM obstructing or delaying ROBOT setup requirements is at risk of violating G301.

If order of placement matters to either or both ALLIANCES, the ALLIANCE notifies the Head REFEREE or their designee before setting up for that MATCH, and the Head REFEREE instructs ALLIANCES to alternate placement of ROBOTS. REFEREE instructions are that ROBOTS are placed in the following order:

1. first red ROBOT
2. first blue ROBOT
3. second red ROBOT
4. second blue ROBOT

In Qualification MATCHES the ROBOT assigned to Red 1 or Blue 1 places first within their ALLIANCE. In Playoff MATCHES the ALLIANCE lead decides which ROBOT places first within their ALLIANCE.

10.4 MATCH Periods

The first period of each MATCH is 30 seconds (0:30) long and called the Autonomous Period (AUTO). During AUTO, ROBOTS operate without any DRIVER control or input. There is an 8-second delay between AUTO and TELEOP for scoring purposes as described in Section 10.5 Scoring.

The second period of each MATCH is 2 minutes (2:00) long and called the teleoperated period (TELEOP). During TELEOP, DRIVERS remotely operate ROBOTS to score points. See Table 9-1 for detailed MATCH timing.

10.5 Scoring

ALLIANCES are rewarded for accomplishing various actions throughout a MATCH, including LEAVING their LAUNCH LINE, scoring CLASSIFIED or OVERFLOW ARTIFACTS, scoring ARTIFACTS in the DEPOT, achieving a PATTERN of ARTIFACTS, returning to their BASE, and winning or tying MATCHES.

ALLIANCES are rewarded for their performance during MATCHES via MATCH points and RANKING POINTS (RP), which increase the measure used to rank teams per section 13.6.3 Qualification Ranking.

All achievements are updated by FIELD STAFF throughout the MATCH. Scoring achievements are assessed as follows:

A. Assessment of ARTIFACTS as either CLASSIFIED or OVERFLOW occurs throughout the MATCH and continues until all ARTIFACTS have come to rest following the conclusion of the MATCH. ARTIFACTS scored after the end of AUTO are assessed as part of TELEOP.
B. Assessment of AUTO PATTERN scoring occurs at the end of AUTO.
C. Assessment of TELEOP PATTERN scoring occurs when all ROBOTS and ARTIFACTS have come to rest following the conclusion of the MATCH.
D. Assessment of DEPOT scoring occurs at the end of TELEOP when all ROBOTS and ARTIFACTS have come to rest following the conclusion of the MATCH.
E. Assessment of LEAVE scoring occurs at the end of AUTO.
F. Assessment of BASE scoring occurs at the end of the TELEOP.

LEAVING the LAUNCH LINE, ARTIFACT scoring, and return to BASE points are all evaluated and scored by human volunteers. Teams are encouraged to make sure that it is obvious and unambiguous that the criteria are met.

Achievements scored before the MATCH starts, during the AUTO-to-TELEOP transition, and after the MATCH ends at 0:00 are subject to penalties.

10.5.1 ARTIFACT Scoring Criteria

To qualify for CLASSIFIED or OVERFLOW points, an ARTIFACT must enter the GOAL through the open top, exit under the archway, and pass through the diverting SQUARE. The determination of whether an ARTIFACT is CLASSIFIED or OVERFLOW is made as the ARTIFACT passes through the diverting SQUARE as follows:

- An ARTIFACT that passes through the SQUARE and transitions directly to the RAMP is considered CLASSIFIED.
- An ARTIFACT that passes through the SQUARE but does not meet CLASSIFIED criteria is considered OVERFLOW.

ARTIFACTS that do not meet all the criteria for ARTIFACT scoring (e.g., did not enter the GOAL through the open top, did not exit under the archway, or did not

pass through the diverting SQUARE) do not score as either CLASSIFIED or OVERFLOW.

ARTIFACTS that are CLASSIFIED move directly to the RAMP, meaning they:

– do not roll over or otherwise bypass any ARTIFACTS on the RAMP.

ARTIFACTS that are OVERFLOW:

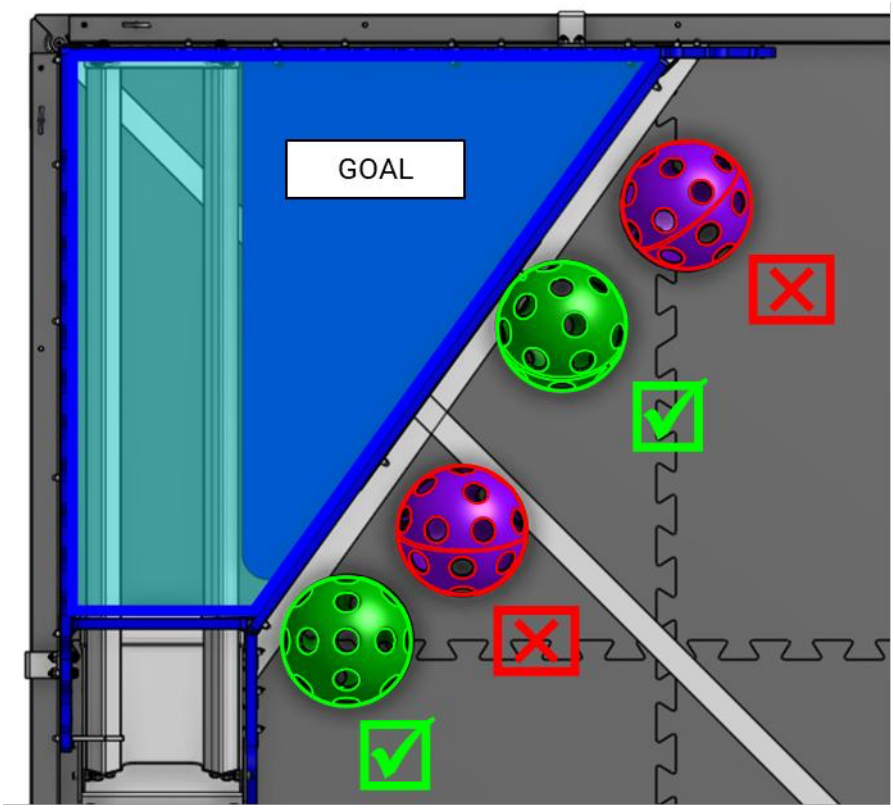
– pass through the SQUARE and may roll over one or more ARTIFACTS that are on the RAMP.

To qualify for DEPOT points, ARTIFACTS must be over the DEPOT.

- DEPOTS are ALLIANCE specific and are tied to the GOAL they are adjacent to.
- DEPOT points are assessed after the MATCH without regard to which ALLIANCE placed the ARTIFACTS in the DEPOT.
- DEPOTS are not protected zones, and either ALLIANCE can remove ARTIFACTS from either DEPOT during the MATCH.

An ARTIFACT over a DEPOT that is in contact with or in CONTROL of a ROBOT from either ALLIANCE will still qualify for DEPOT points for the ALLIANCE that owns the DEPOT.

Figure 10-3: Example DEPOT scoring



10.5.2 PATTERN Scoring Criteria

At the end of AUTO and TELEOP, ARTIFACTS that are directly on the RAMP score for PATTERN points if the color of the ARTIFACT in order matches the MOTIF color for that index, and the ARTIFACTS are retained by the GATE.

The randomization of the OBELISK prior to the start of the MATCH selects the MOTIF which is repeated 3 times to define the PATTERN colors for each of the 9 indices on the RAMP (Figure 10-4). PATTERN points are scored based on the color of the ARTIFACT on the RAMP matching the individual index color defined by the MOTIF (Figure 10-5).

Figure 10-4: MOTIFS as defined by the OBELISK

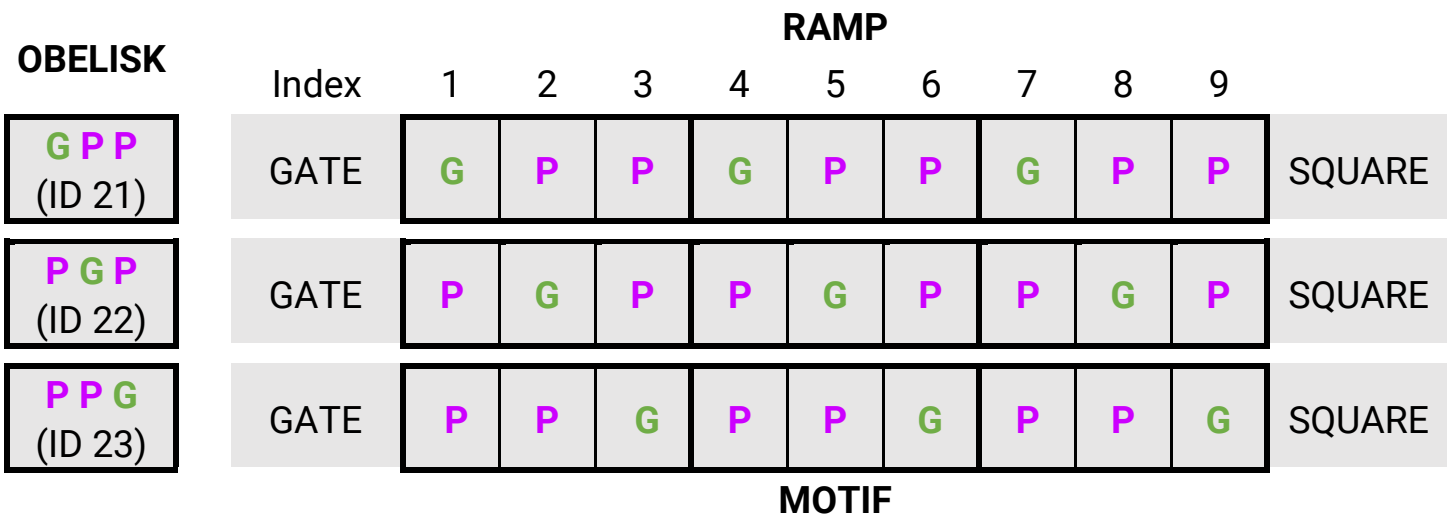
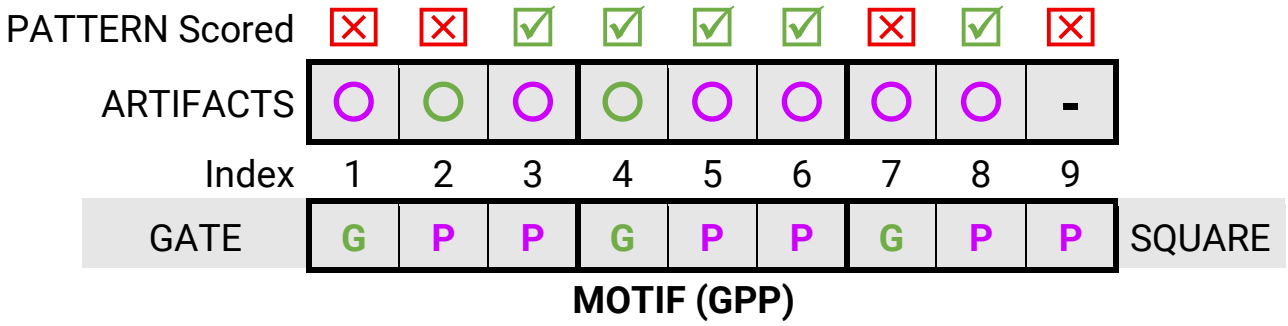


Figure 10-5: Example PATTERN scoring with GPP scoring



10.5.3 ROBOT Scoring Criteria

To qualify for LEAVE points, a ROBOT must move such that it is no longer over any LAUNCH LINE at the end of AUTO.

To qualify for BASE points, a ROBOT must be either fully returned or partially returned by meeting the following conditions:

- A ROBOT fully returned to BASE must only be supported, either directly or transitively, by the TILE in the BASE ZONE.
- A ROBOT partially returned to BASE must be partially supported, either directly or transitively, by the TILE in the BASE ZONE.

> The TILE in the BASE ZONE is the flooring surface bounded by the outside edge of the tape defining the BASE ZONE.
>
> Support comes, either directly or transitively through other items on the FIELD (e.g., SCORING ELEMENTS, another ROBOT), through the TILE in the BASE ZONE.
>
> If all of the support of the ROBOT in the BASE ZONE is from the TILE in the BASE ZONE, the ROBOT is fully returned to BASE.
>
> If some of the support of the ROBOT in the BASE ZONE is from the TILE in the BASE ZONE and some is from TILES outside the BASE ZONE, the ROBOT is partially returned to BASE.
>
> If none of the support of the ROBOT in the BASE ZONE is from the TILE in the BASE ZONE, the ROBOT is not considered returned to BASE.

10.5.4 Point Values

Table 10-2: DECODE point values

		MATCH points		RANKING POINTS
		AUTO	TELEOP	
LEAVE		3		
ARTIFACT	CLASSIFIED	3	3	
	OVERFLOW	1	1	
	DEPOT		1	
PATTERN	ARTIFACT matches MOTIF	2	2	
BASE	Partially returned to BASE		5	
	Fully returned to BASE		10	
	Additional Bonus: 2 ROBOTS fully returned to BASE.		10	
MOVEMENT RP – Combined LEAVE + BASE points earned at or above threshold				1
GOAL RP – The number of ARTIFACTS scored through the SQUARE at or above threshold				1
PATTERN RP – PATTERN points earned at or above threshold				1
WIN	Completing a MATCH with more MATCH points than your opponent			3
TIE	Completing a MATCH with the same MATCH points as your opponent			1

Table 10-3: DECODE RP thresholds

RP Type	*FIRST* Championship	Regional Championships	All Other Events*
MOVEMENT RP	TBA	21	16
GOAL RP	TBA	42	36
PATTERN RP	TBA	22	18

RP thresholds for Regional Championships and *FIRST* Championship will be announced in Team Updates.

*Premier Events will be able to set their own thresholds to best reflect the experience they want to provide teams.

10.6 Violations

FIRST Tech Challenge uses 3 words in the context of how durations and actions are assessed with regards to evaluation of rules and assignment of violations. These words provide general guidance to describe benchmarks. It is not the intent for REFEREES to provide a count during the time periods.

- MOMENTARY describes durations that are fewer than approximately 3 seconds.
- CONTINUOUS describes durations that are more than approximately 10 seconds.
- REPEATED describes actions that happen more than once within a MATCH.

Unless otherwise noted, all penalties are assigned for each instance of a rule violation, and a single action may violate multiple rules. A description of the penalties is listed in Table 10-4. All rules throughout the Game Rules section are called as perceived by a REFEREE.

Table 10-4: Rule violations

Penalty	Description
MINOR FOUL	a credit of 5 points towards the opponent's MATCH point total
MAJOR FOUL	a credit of 15 points towards the opponent's MATCH point total
YELLOW CARD	a warning issued by the Head REFEREE for egregious ROBOT or team member behavior or rule violations. A subsequent YELLOW CARD within the same tournament phase results in a RED CARD
RED CARD	a penalty issued by the Head REFEREE for egregious ROBOT or team member behavior or rule violations which results in a team being DISQUALIFIED for the MATCH.
DISABLED	The REFEREE instructs the team to stop the ROBOT which will deactivate all outputs, rendering the ROBOT inoperable for the remainder of the MATCH.
DISQUALIFIED	the state of a team in which they receive 0 MATCH points and 0 RANKING POINTS in a Qualification MATCH or causes their ALLIANCE to receive 0 MATCH points in a Playoff MATCH.
VERBAL WARNING	a warning issued by event staff or the Head REFEREE
ALLIANCE is ineligible for RP	An ALLIANCE is ineligible for the specified RP for that MATCH. This overrides any RP awarded through normal MATCH play or other rule violations.

10.6.1 YELLOW and RED CARDS

In addition to rule violations explicitly listed throughout this document, YELLOW CARDS and RED CARDS are used in *FIRST* Tech Challenge to address team and ROBOT behavior that does not align with the mission, values, and culture of *FIRST*.

The Head REFEREE may assign a YELLOW CARD as a warning, or a RED CARD for egregious behavior deemed inappropriate at a *FIRST* Tech Challenge event. A team that has received either a YELLOW or a RED CARD

carries a YELLOW CARD into subsequent MATCHES, except as noted below. A RED CARD results in MATCH DISQUALIFICATION.

A YELLOW or RED CARD is indicated by the Head REFEREE holding a YELLOW and/or RED CARD in the air while a member of the FIELD STAFF describes the violation to the audience.

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, including earning a second YELLOW CARD during a single MATCH. A second YELLOW CARD is indicated by the Head REFEREE holding a YELLOW CARD and RED CARD in the air simultaneously after the completion of the MATCH. A team that has received either a YELLOW CARD or a RED CARD carries a YELLOW CARD into subsequent MATCHES, except as noted below. In the event MATCHES are played out-of-order, a subsequent MATCH is any chronologically later MATCH play, regardless of the originally scheduled time or the numbering of the MATCH.

Once a team receives a YELLOW or RED CARD, its team number is presented with a yellow background on the audience screen during all subsequent MATCHES, including any replays, as a reminder to the team, the REFEREES, and the audience that they carry a YELLOW CARD.

Egregious behavior by a team, which cannot be resolved locally by the Head REFEREE or Event Director working directly with the STUDENT and adult team members, will be escalated to *FIRST* Headquarters. In consultation with *FIRST* Headquarters the team may be DISQUALIFIED from all subsequent MATCHES and removed from awards consideration.

Figure 10-6: Example audience screen graphic showing YELLOW CARD indicators

All YELLOW CARDS are cleared at the conclusion of Practice, Qualification, and division Playoff MATCHES. VERBAL WARNINGS issued by the Head REFEREE are cleared after Practice MATCHES and persist from Qualification MATCHES through subsequent tournament phases, except when stated otherwise.

10.6.2 YELLOW and RED CARD application

YELLOW and RED CARDS are applied based on the following:

Table 10-5: YELLOW and RED CARD application

Time YELLOW or RED CARDS earned:	MATCH to which CARD is applied:
Prior to Qualification MATCHES	REFEREES may or may not be present at the FIELD before the start of Qualification MATCHES. With input from event staff, the Head REFEREE may opt to perpetuate a VERBAL WARNING or YELLOW CARD earned prior to Qualification MATCHES to

Time YELLOW or RED CARDS earned:	MATCH to which CARD is applied:
	the first Qualification MATCH for particularly egregious behavior.
during the Qualification MATCHES	team's current (or just completed) MATCH in which they are not a SURROGATE. For SURROGATE MATCHES the card is applied to the team's previous Qualification MATCH.
between the end of Qualification MATCHES and the start of Playoff MATCHES	ALLIANCE'S first Playoff MATCH
during the Playoff MATCHES	ALLIANCE'S current (or just completed) MATCH

A MATCH is no longer the current MATCH once the results of the MATCH have been posted or the Head REFEREE or their designee has indicated that teams can collect their ROBOTS, whichever is later.

Please see examples of the application of YELLOW and RED CARDS as shown in section 10.6.4 Violation Details.

10.6.3 YELLOW and RED CARDS during Playoff MATCHES

During Playoff MATCHES, YELLOW and RED CARDS are assigned to the violating team's entire ALLIANCE instead of to only the violating team. If an ALLIANCE receives 2 YELLOW CARDS, the entire ALLIANCE is issued a RED CARD which results in DISQUALIFICATION for the associated MATCH.

10.6.4 Violation Details

There are several styles of violation wording used in this manual. Below are some example violations and a clarification of the way the violation would be assessed. The examples shown do not represent all possible violations, but rather a representative set of combinations.

Table 10-6: Violation examples

Example Violation	Expanded Interpretation
MINOR FOUL	Upon violation, a MINOR FOUL is assessed against the violating ALLIANCE.
MAJOR FOUL and YELLOW CARD	Upon violation, a MAJOR FOUL is assessed against the violating ALLIANCE. After the MATCH, the Head REFEREE presents the violating team with a YELLOW CARD.
MINOR FOUL per SCORING ELEMENT over the limit.	Upon violation, a number of MINOR FOULS are assessed against the violating ALLIANCE equal to the number of additional SCORING ELEMENTS beyond the permitted quantity.

Example Violation	Expanded Interpretation
MINOR FOUL. MAJOR FOUL if REPEATED.	Upon initial violation in a MATCH, a MINOR FOUL is assessed against the violating ALLIANCE. If the condition in the second statement is met: the ROBOT repeats the infraction in the MATCH, then a MAJOR FOUL is assessed against the violating ALLIANCE. Assuming no additional infractions of that rule by that ROBOT in that MATCH, the ROBOT is assessed a MINOR FOUL and a MAJOR FOUL for their ALLIANCE.
MINOR FOUL and an additional MINOR FOUL for every 3 seconds in which the situation is not corrected	Upon violation, a MINOR FOUL is assessed against the violating ALLIANCE and the REFEREE begins to count. Their count continues until the criteria to discontinue the count are met, and for each 3 seconds within that time, an additional MINOR FOUL is assessed against the violating ALLIANCE. A ROBOT in violation of this type of rule for 15 seconds is assessed a total of 6 MINOR FOULS (assuming no other rules were being simultaneously violated).
MAJOR FOUL and the opposing ALLIANCE is awarded the PATTERN RP.	Upon violation, a MAJOR FOUL is assessed against the violating ALLIANCE and the opposing ALLIANCE is awarded the PATTERN RP, regardless of the status of the scoring achievements during the MATCH.
MAJOR FOUL plus YELLOW CARD if REPEATED.	Upon violation, a MAJOR FOUL is assessed against the violating team. If the condition “if REPEATED” (e.g., a subsequent violation by the same team in the same MATCH) is met, then the violating team is issued another MAJOR FOUL. If these are the only violations during the MATCH: after the MATCH, the Head REFEREE presents the violating team with a YELLOW CARD for the second violation of this rule. In total, 2 MAJOR FOULS and a YELLOW CARD were assessed during the MATCH.
VERBAL WARNING. YELLOW CARD if subsequent violations occur during the event.	Upon violation, a VERBAL WARNING is issued to the violating team. If an additional violation of the same rule occurs later in the event, including during the same MATCH, a later MATCH during the same event phase, or during a later event phase, then following the subsequent violations: after the MATCH, the Head REFEREE presents the violating team with a YELLOW CARD.

Example Violation	Expanded Interpretation
MAJOR FOUL and YELLOW CARD. MAJOR FOUL and RED CARD if opponent ROBOT is unable to drive.	Upon a general violation of this rule, a MAJOR FOUL is assessed against the violating ALLIANCE. After the MATCH, the Head REFEREE presents the violating team with a YELLOW CARD. However, if the opponent ROBOT is unable to drive, then upon violation, a MAJOR FOUL is assessed against the violating ALLIANCE. After the MATCH, the Head REFEREE presents the violating team with a RED CARD. Only 1 MAJOR FOUL is earned for a single violation.

10.7 Head REFEREE

The Head REFEREE has the ultimate authority in the ARENA during the event but may receive input from additional sources, e.g., *FIRST* personnel, FTA, Event Director, or other event staff. The Head REFEREE rulings are final. No event staff, including the Head REFEREE, will review video, photos, artistic renderings, etc. of any MATCH, from any source, under any circumstances.

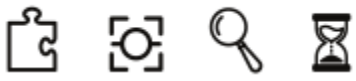
10.8 Other Logistics

SCORING ELEMENTS that leave the FIELD will be returned to the closest ARTIFACT tray or available DRIVER or HUMAN PLAYER at the earliest safe opportunity by FIELD STAFF. Reintroduction of SCORING ELEMENTS must follow rule G432.

An ARENA FAULT (an error in ARENA operation described in section 13.3 MATCH Replays) is not called for MATCHES that accidentally begin with damaged SCORING ELEMENTS, the incorrect number of SCORING ELEMENTS, or incorrectly placed SCORING ELEMENTS. Damaged SCORING ELEMENTS are not replaced until the next MATCH reset. DRIVE TEAMS should alert the FIELD STAFF to any missing, incorrectly placed, or damaged SCORING ELEMENTS prior to the start of the MATCH. During a MATCH, FIELD STAFF may follow steps in the Field Mitigation Guide to mitigate some FIELD issues during a MATCH.

Once the MATCH is over and the Head REFEREE or their designee determines that the FIELD and FIELD STAFF are ready, they will signal for DRIVE TEAMS to stop their ROBOTS, and to initiate FIELD reset and DRIVE TEAMS to retrieve their ROBOTS.

During MATCH reset, the FIELD is cleared of ROBOTS and OPERATOR CONSOLES from the MATCH that just ended, ROBOTS and OPERATOR CONSOLES for the subsequent MATCH are loaded into the FIELD by DRIVE TEAMS, and FIELD STAFF reset ARENA elements.



11 Game Rules (G)

11.1 Personal Safety

G101 ***Humans, stay off the FIELD during the MATCH.** Other than actions explicitly allowed in section 11.4.6 Human, a DRIVE TEAM member may only enter the FIELD during the following times:

A. pre-MATCH set-up in order to place their ROBOT and pre-loaded SCORING ELEMENTS per G301, G303, and G304, and
B. after a MATCH is over to stop and collect their ROBOT in a reasonable amount of time when instructed to do so by the Head REFEREE or their designee.

Violation: VERBAL WARNING.

> A team may not delay the FIELD reset process through an excessively lengthy process to remove the ROBOT from the FIELD.
>
> It is not a violation of this rule if DRIVE TEAM members contribute to FIELD reset by placing SCORING ELEMENTS that they inadvertently move while setting up their ROBOT or placing removed SCORING ELEMENTS on the FIELD.
>
> Egregious violations of this rule, such as entering the FIELD during a MATCH, are covered by G211.

G102 ***Be careful when interacting with ARENA elements.** A team member is prohibited from the following actions with regards to interaction with ARENA elements:

A. climbing on,
B. hanging from,
C. manipulating such that it does not return to its original shape without human intervention, and
D. damaging.

Violation: VERBAL WARNING. YELLOW CARD if subsequent violations occur during the event.

> DRIVE TEAM members may brace the FIELD perimeter at any point during the MATCH. Moving the FIELD perimeter out of position is considered a violation of G102.C.

11.2 Conduct

G201 ***Be a good person.** All teams must be civil toward everyone and respectful of team and event equipment while at a *FIRST* Tech Challenge event. Please review the *FIRST* Code of Conduct and Core Values for more information.

Violation: VERBAL WARNING. YELLOW CARD if subsequent violations occur during the event.

> Examples of inappropriate behavior include, but are not limited to, the use of offensive language or other uncivil conduct.

Examples of particularly contemptible behavior that is likely to result in ARENA ejection include, but are not limited to, the following:

A. assault, e.g., throwing something that hits another person (even if unintended),
B. threat, e.g., saying something like "if you don't reverse that call, I'll make you regret it,"
C. harassment, e.g., badgering someone with no new information after a decision has been made or a question has been answered,
D. bullying, e.g., using body or verbal language to cause another person to feel inadequate,
E. insulting, e.g., telling someone they don't deserve to be on a DRIVE TEAM,
F. swearing at another person (versus swearing under one's breath or at oneself), and
G. yelling at another person(s) in anger or frustration.

G202 ***DRIVE TEAM Interactions.** DRIVE TEAM members cannot distract/interfere with the opposing ALLIANCE. This includes taunting or other disruptive behavior.

Violation: VERBAL WARNING. YELLOW CARD if subsequent violations occur during the event.

G203 ***Asking other teams to throw a MATCH – not cool.** A team may not encourage an ALLIANCE of which it is not a member to play beneath its ability.

NOTE: This rule is not intended to prevent an ALLIANCE from planning and/or executing its own strategy in a specific MATCH in which all the teams are members of the ALLIANCE.

Violation: VERBAL WARNING. RED CARD if subsequent violations occur during the event.

Example 1: A MATCH is being played by Teams A and B. Team C requests Team A to open the GATE at the end of the MATCH in order resulting in teams A and B not earning the PATTERN RP. Team A accepts this request from team C. Team C's motivation for this behavior is to prevent Team B from rising in the Tournament rankings and negatively affect Team C's ranking. Team C has violated this rule.

Example 2: A MATCH is being played by teams A and B, in which team A is assigned to participate as a SURROGATE. Team D encourages team A not to participate in the MATCH so that team D gains ranking position over team B. Team D has violated this rule.

FIRST considers the action of a team influencing another team to throw a MATCH, to deliberately miss RANKING POINTS, etc. incompatible with *FIRST* values and not a strategy any team should employ.

G204 ***Letting someone coerce you into throwing a MATCH – also not cool.** A team, as the result of encouragement by a team not on their ALLIANCE, may not play beneath its ability.

NOTE: This rule is not intended to prevent an ALLIANCE from planning and/or executing its own strategy in a specific MATCH in which all the ALLIANCE members are participants.

Violation: VERBAL WARNING. RED CARD if subsequent violations occur during the event.

> Example 1: A MATCH is being played by Teams A and B. Team C requests Team A to open the GATE at the end of the MATCH in order resulting in teams A and B not earning the PATTERN RP. Team A accepts this request from team C. Team C's motivation for this behavior is to prevent Team B from rising in the Tournament rankings and negatively affect Team C's ranking. Team A has violated this rule.
>
> Example 2: A MATCH is being played by Teams A and B, in which Team A is assigned to participate as a SURROGATE. Team A accepts Team D's request to not participate in the MATCH so that Team D gains ranking position over Team B. Team A has violated this rule.
>
> *FIRST* considers the action of a team influencing another team to throw a MATCH, to deliberately miss RANKING POINTS, etc. incompatible with *FIRST* values and not a strategy any team should employ.

G205 ***Throwing your own MATCH is bad.** A team may not intentionally lose a MATCH or sacrifice RANKING POINTS in an effort to lower their own ranking and/or manipulate the rankings of other teams.

Violation: VERBAL WARNING. RED CARD if subsequent violations occur during the event.

> The intent of this rule is not to punish teams who are employing alternate strategies, but rather to ensure that it is clear that throwing MATCHES to negatively affect your own rankings, or to manipulate the rankings of other teams (e.g., throw a MATCH to lower a partner's ranking, and/or increase the ranking of another team not in the MATCH) is incompatible with *FIRST* values and not a strategy any team should employ.

G206 ***Don't violate rules for RPs.** A team or ALLIANCE may not collude with another team to each purposefully violate a rule in an attempt to influence RANKING POINTS.

Violation: YELLOW CARD and the ALLIANCE is ineligible for PATTERN and GOAL RPs

> For example, if Team A on the blue ALLIANCE agrees with Team D on the red ALLIANCE to disrupt each other's GATE in violation of G417 resulting in both ALLIANCES being awarded the PATTERN RP.

G207 ***Do not abuse ARENA access.** A team member (except those DRIVE TEAM members on the DRIVE TEAM for the MATCH) granted access to restricted areas in and around the ARENA (e.g., via event issued media badges) may not assist, coach, or use signaling devices during the MATCH. Exceptions will be granted for inconsequential infractions and in cases concerning safety.

Violation: VERBAL WARNING. YELLOW CARD if subsequent violations occur during the event.

> Team members in open-access spectator seating areas are not considered to be in a restricted area and are not prevented from assisting or using signaling devices. See E102 for related details.

G208 ***Show up to your MATCHES.** If a ROBOT has passed initial, complete inspection, at least 1 member of its DRIVE TEAM must report to the ARENA and participate in each of their assigned Qualification MATCHES.

Violation: DISQUALIFIED from the current MATCH.

> The team should inform the Lead Queuer if the team's ROBOT is not able to participate.

G209 ***Keep your ROBOT together.** A ROBOT may not intentionally detach or leave a part on the FIELD.

Violation: RED CARD.

G210 ***Do not expect to gain by doing others harm.** Actions clearly aimed at forcing the opponent ALLIANCE to violate a rule are not in the spirit of *FIRST* Tech Challenge and not allowed. Rule violations forced in this manner will not result in an assignment of a penalty to the targeted ALLIANCE.

Violation: MINOR FOUL. MAJOR FOUL if REPEATED. The ALLIANCE that was forced to break a rule will not be assessed a penalty.

> This rule does not apply for strategies consistent with standard gameplay, for example:
> A. a red ROBOT attempting to access its GATE pushes a blue ROBOT into an ARTIFACT on the red RAMP.
>
> This rule requires an intentional act with limited or no opportunity for the team being acted on to avoid the penalty, such as:
> B. a blue ALLIANCE ROBOT pushing a red ALLIANCE ROBOT from "far away" (more than one TILE distance away) into the blue ALLIANCE LOADING ZONE.
> C. Placing an ARTIFACT into an opponent ROBOT such that it is in violation of G408.

G211 ***Egregious or exceptional violations.** Egregious behavior beyond what is listed in the rules or subsequent violations of any rule or procedure during the event is prohibited.

In addition to rule violations explicitly listed in this manual and witnessed by a REFEREE, the Head REFEREE may assign a YELLOW or RED CARD for egregious ROBOT actions or team member behavior at any time during the event.

Continued 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.

Please see section 10.6.1 YELLOW and RED CARDS for additional detail.

Violation: YELLOW or RED CARD.

> The intent of this rule is to provide the Head REFEREES with the flexibility necessary to keep the event running smoothly, as well as keep the safety of all the participants as the highest priority. There are certain behaviors that automatically result in a YELLOW or RED CARD because this behavior puts the

FIRST community at risk. Those behaviors include, but are not limited to the list below:

A. inappropriate behavior as outlined in the orange box of G201,
B. reaching into the FIELD and grabbing a ROBOT during a MATCH,
C. a single PIN in excess of 15 seconds,
D. descoring SCORING ELEMENTS strategically or REPEATEDLY

The Head REFEREE may assign a YELLOW or RED CARD for a single instance of a rule violation such as the examples given in items above, or for multiple instances of any single rule violation. Teams should be aware that any rule in this manual could escalate to a YELLOW or RED CARD. The Head REFEREE has final authority on all rules and violations at an event.

G212 ***All teams can play.** A team may not encourage another team to exclude their ROBOT or be DISQUALIFIED from a Qualification MATCH for any reason.

Violation: YELLOW CARD. RED CARD if the ROBOT does not participate in the MATCH

11.3 Pre-MATCH

G301 ***Be prompt.** A DRIVE TEAM member may not cause significant delays to the start of their MATCH. Causing a significant delay requires both of the following to be true:

A. The expected MATCH start time has passed, and

During Qualification MATCHES, the expected start time of the MATCH is the time indicated on the MATCH schedule or ~3 minutes from the end of the previous MATCH on the same FIELD, whichever is later. If T206 is in effect, the expected MATCH start time is the later of the end of the T206 time or the time indicated on the schedule.

During Playoff MATCHES, the expected start time of the MATCH is the time indicated on the MATCH schedule or 8 minutes from either ALLIANCE'S previous MATCH, whichever is later.

B. The DRIVE TEAM has access to the ARENA and is neither MATCH ready nor making a good faith effort, as perceived by the Head REFEREE, to quickly become MATCH ready.

Teams that have violated G208 or have 1 DRIVE TEAM member present and have informed event staff that their ROBOT will not be participating in the MATCH are considered MATCH ready and not in violation of this rule.

Violation:

If a Qualification MATCH: VERBAL WARNING. MAJOR FOUL for the upcoming MATCH if a subsequent violation occurs within the tournament phase. If the DRIVE TEAM is not MATCH ready within 2 minutes of the VERBAL WARNING/MAJOR FOUL, and the Head REFEREE perceives no good faith effort by the DRIVE TEAM to quickly become MATCH ready, DISABLED.

If a Playoff MATCH: a VERBAL WARNING is issued to the ALLIANCE. MAJOR FOUL for the ALLIANCE'S upcoming MATCH if a subsequent violation occurs within the tournament phase. If the ALLIANCE is not MATCH ready within 2 minutes of the VERBAL WARNING/MAJOR FOUL having been issued, and the Head REFEREE perceives no good faith effort by the DRIVE TEAM(s) to quickly become MATCH ready, the offending team's ROBOT is DISABLED.

The intent of this rule is to provide an equitable amount of time for both ALLIANCES to prepare for each MATCH and give DRIVE TEAMS grace given extenuating circumstances that cause them to be late.

Once a VERBAL WARNING/MAJOR FOUL is issued, the Head REFEREE starts a 2-minute timer and makes a good faith effort to share the timer's status with the delaying DRIVE TEAM.

Being "MATCH ready" requires that the ROBOT is on the FIELD, in its STARTING CONFIGURATION, and turned on. Additionally, the DRIVE TEAM members must be in their starting positions.

In general, good faith efforts to quickly become MATCH ready are entirely for the purposes of transitioning the ROBOT into a MATCH ready state (i.e., not attempts to significantly alter a ROBOT'S capabilities.) Examples of good faith efforts to quickly become MATCH ready include but are not limited to:

A. walking safely towards the FIELD with a ROBOT that a team is not actively modifying.
B. applying quick fixes such as tape or cable ties to make the ROBOT compliant with STARTING CONFIGURATION requirements.
C. waiting for a DRIVER STATION device to boot.
D. actively working with field technical staff, including the FTA, to resolve an issue in a reasonable amount of time.
E. performing a MOMENTARY "wiggle test" to confirm communication between the DRIVER STATION and the ROBOT CONTROLLER. The ROBOT should not drive or interact with SCORING ELEMENTS (except contact with pre-loaded ARTIFACTS) while performing this test.

G302 ***Limit what you bring to the FIELD**. Items brought to the FIELD to be used for a MATCH, in addition to the ROBOT, OPERATOR CONSOLE, must fit in the team's designated ALLIANCE AREA, be worn or held by members of the DRIVE TEAM, or be an item used as an accommodation (e.g., single-step stools that do not roll/fold, crutches, cushion, kneeling mat,). Regardless of if the equipment fits the criteria above, it may not:

A. be employed in a way that introduces a safety hazard,
B. extend more than 6 ft. 6 in. (~198 cm) above the TILES,
C. communicate with anything or anyone outside of the ARENA with the exception of medically required equipment,
D. block visibility for FIELD STAFF or audience members, or
E. jam or interfere with anything in the ARENA.

Violation: MATCH will not start until the situation is remedied. YELLOW CARD, if discovered or used inappropriately during a MATCH.

It is not a violation of this rule to bring an alignment device to the FIELD to aid pre-MATCH ROBOT set-up and alignment. The use of any alignment devices should not delay MATCH start in violation of G301.

Examples of equipment that may be considered a safety hazard in the confined space of the ALLIANCE AREA include but are not limited to, a folding step stool, ladder, or a large signaling device.

Using an item that has wireless communications disabled complies with G302.C above.

Examples of jamming or interfering with remote sensing capabilities include, but are not limited to, mimicking the FIELD AprilTags and shining bright lighting or laser pointers onto the FIELD.

G303 ***ROBOTS on the FIELD must come ready to play a MATCH.** A ROBOT must meet all following MATCH-start requirements:

A. does not pose a hazard to humans, FIELD elements, or other ROBOTS.
B. has passed inspection, i.e., it is compliant with all ROBOT rules.
C. if modified after initial Inspection, it is compliant with I305.
D. is the only team-provided item left in the FIELD.
E. ROBOT SIGNS must indicate the correct ALLIANCE color (see R101).
F. ROBOT must be motionless following completion of OpMode initialization.

If a ROBOT is DISABLED prior to the start of the MATCH, the DRIVE TEAM may not remove the ROBOT from the FIELD without permission from the Head REFEREE or the FTA.

For assessment of many of the items listed above, the Head REFEREE is likely to consult with the LRI.

Violation: The MATCH will not start until all requirements are met if there is a quick remedy. DISABLED if it is not a quick remedy, and, at the discretion of the Head REFEREE, ROBOT must be re-inspected. RED CARD if a team's ROBOT is not compliant with part B or C participates.

G304 ***ROBOTS must be set up correctly on the FIELD.** A ROBOT must be positioned on the FIELD such that it meets all of the following requirements:

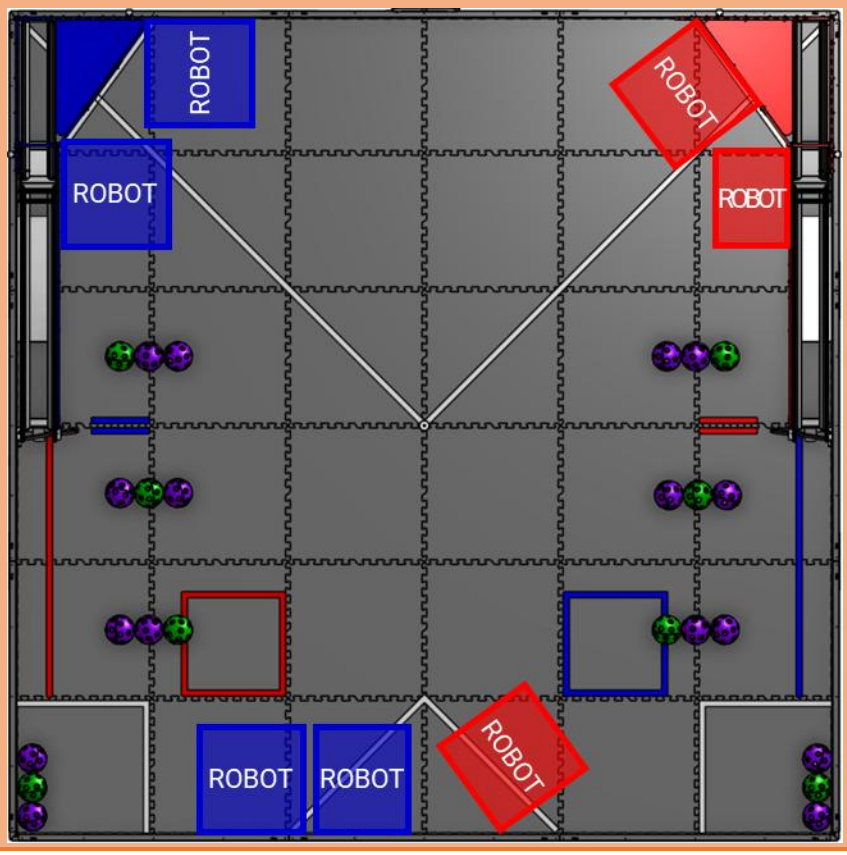
A. is over a LAUNCH LINE,
B. is either touching its own ALLIANCE's GOAL or the FIELD perimeter,
C. is fully contained on its own ALLIANCE's side of the FIELD (FIELD columns A, B, C for blue, or FIELD columns D, E, F for red) (Figure 9-4),
D. not attached to, entangled with, or suspended from any FIELD element,
E. confined to its STARTING CONFIGURATION (see R101 and R102), and
F. in contact with no more than the allowed pre-load possession limit as described in section 10.3.1 SCORING ELEMENTS.

Violation: The MATCH will not start until all requirements are met if there is a quick remedy. DISABLED if it is not a quick remedy.

G304.C requires the ROBOT to be fully contained within the FIELD perimeter and not overhang the FIELD perimeter wall.

Figure 11-1 shows examples of several possible legal ROBOT starting locations.

Figure 11-1: Examples of allowed ROBOT starting locations



G305 ***Teams must select an OpMode.** An OpMode must be selected on the DRIVER STATION app and initialized by pressing the INIT button. If this OpMode is an AUTO OpMode, the 30 second AUTO timer must be enabled.

Violation: MATCH will not start until the situation is remedied. DISABLED if ROBOT cannot initialize an OpMode or the situation cannot be remedied quickly.

This rule requires all teams to select and INIT an OpMode regardless of whether or not an AUTO OpMode is planned to be used during AUTO. FIELD STAFF will use this as an indication that a team is ready to start the MATCH.

Teams without an AUTO OpMode should consider creating a default AUTO OpMode using the BasicOpMode sample and use the auto-loading feature to automatically queue up their TELEOP OpMode.

11.4 In-MATCH

Rules in this section pertain to gameplay once a MATCH begins.

11.4.1 AUTO

AUTO is the first 30 seconds of the MATCH, during which DRIVERS may not provide input to their ROBOTS, so ROBOTS operate with only their pre-programmed instructions.

G401 ***Let the ROBOT do its thing.** As soon as FIELD STAFF begins the randomization process and until the end of AUTO, DRIVE TEAM members may not directly or indirectly interact with a ROBOT or an OPERATOR CONSOLE, with the following exceptions:

A. to press the (▶) start button within a MOMENTARY reaction of the start of the MATCH,
B. to press the (■) stop button either at the team's discretion or instruction of the Head REFEREE per T202, or
C. for personal safety or OPERATOR CONSOLE safety.

Violation: MAJOR FOUL plus the ALLIANCE is not eligible for PATTERN points in AUTO if the ROBOT LAUNCHES an ARTIFACT such that it enters the open top of the GOAL after the interaction and before the end of AUTO.

> FIELD STAFF will not re-randomize the OBELISK due to violations of this rule prior to MATCH start.
>
> Teams do not have to start an OpMode if they choose not to run an AUTO OpMode.
>
> The intent of G401.A is for teams to start AUTO on time, accounting for the variability in human factors. Strategic violations of G401.A will be considered egregious behavior under G211.

G402 **No AUTO opponent interference.** During AUTO, FIELD columns A, B, C constitute the blue side of the FIELD, and columns D, E, F (Figure 9-5) constitute the red side of the FIELD. During AUTO, a ROBOT may not:

A. contact an opposing ALLIANCE'S ROBOT which is completely within the opposing ALLIANCE'S side of the FIELD either directly or transitively through an ARTIFACT, or
B. disrupt an ARTIFACT from its pre-staged location on the opposing ALLIANCE'S side of the FIELD either directly or transitively through contact with an ARTIFACT, or by LAUNCHING an ARTIFACT directly into it.

Violation: MAJOR FOUL per instance of ROBOT contact in G402.A and MAJOR FOUL per ARTIFACT in G402.B.

> Navigating into the opposing ALLIANCE'S side of the FIELD during AUTO is a risky gameplay strategy.
>
> LAUNCHED ARTIFACTS which happen to enter the other side of the FIELD after being deflected by another object in the FIELD (e.g., FIELD element, ROBOT) will not be penalized.
>
> Example 1: A red ROBOT LAUNCHES 1 ARTIFACT onto the opponent side of the FIELD. The LAUNCHED ARTIFACT disrupts 2 pre-staged ARTIFACTS on the blue side of the FIELD. Red is assessed 2 MAJOR FOULS under G402.
>
> Example 2: A red ROBOT LAUNCHES 1 ARTIFACT at their GOAL in an attempt to score, but the ARTIFACT misses the open top of the GOAL, deflects off the GOAL structure and rolls into the blue side of the FIELD, disrupting 2 pre-staged ARTIFACTS. No G402 penalties are assessed.

11.4.2 TELEOP

G403 ***ROBOTS are motionless between AUTO and TELEOP.** Any powered movement of the ROBOT or any of its MECHANISMS is not allowed during the transition period between AUTO and TELEOP.

Violation: MAJOR FOUL.

> Movement that occurs following the conclusion of an AUTO OpMode (due to inertia, gravity, or de-energizing of actuators, etc.) is not a violation of this rule.
>
> Teams may press buttons on their DRIVER STATION app to stop the AUTO OpMode, initialize or start a TELEOP OpMode during the AUTO to TELEOP transition period. If the INIT portion of the OpMode causes the ROBOT to violate this rule (actuators moving or twitching in any way) then the team should wait until TELEOP begins before pressing INIT.
>
> A ROBOT LAUNCHING an ARTIFACT during the transition period is considered a violation of this rule.
>
> Strategic violations of this rule will be considered egregious behavior under G211. Strategic violations include, but are not limited to:
>
> – LAUNCHING multiple SCORING ELEMENTS,
> – operating the GATE, and
> – moving the ROBOT a substantial distance in a preferred direction.

G404 ***ROBOTS are motionless at the end of TELEOP**. ROBOTS must no longer have powered movement after the end of TELEOP until the Head REFEREE or their designee signals that teams may retrieve their ROBOTS.

Violation: MINOR FOUL. MAJOR FOUL per ARTIFACT if ROBOT LAUNCHES an ARTIFACT such that it enters the open top of a GOAL after the end of TELEOP. MAJOR FOUL if ROBOT contacts a GATE after the end of TELEOP.

> DRIVE TEAMS should make it obvious that the ROBOTS are no longer being controlled by pressing the (■) stop button on the DRIVER STATION app or by discontinuing any operation of the ROBOT by the end of the MATCH period and setting down their controllers.
>
> Movement due to inertia, gravity, or de-energizing of actuators, etc. is not considered powered movement.

11.4.3 SCORING ELEMENT

G405 ***ROBOTS use SCORING ELEMENTS as directed.** A ROBOT may not deliberately use a SCORING ELEMENT in an attempt to ease or amplify a challenge associated with a FIELD element other than as intended.

Violation: MAJOR FOUL per SCORING ELEMENT.

> Examples include, but are not limited to:

A. Intentionally positioning SCORING ELEMENTS to impede opponent access to FIELD elements
B. Intentionally placing SCORING ELEMENTS into inaccessible locations on the FIELD such as under the RAMP or GOAL
C. Intentionally using a SCORING ELEMENT to hold open the GATE

G406 ***Keep SCORING ELEMENTS in bounds.** A ROBOT may not intentionally eject a SCORING ELEMENT from the FIELD (either directly or by bouncing off a FIELD element or another ROBOT).

Violation: MAJOR FOUL per SCORING ELEMENT.

SCORING ELEMENTS that leave the FIELD during scoring attempts are not considered intentional ejections.

G407 ***Do not damage SCORING ELEMENTS.** Neither a ROBOT nor a DRIVE TEAM member may damage a SCORING ELEMENT.

Violation: VERBAL WARNING. MAJOR FOUL if REPEATED. DISABLED if the damage is caused by a ROBOT, and the Head REFEREE determines that further damage is likely to occur. Corrective action (such as eliminating sharp edges, removing the damaging MECHANISM, and/or reinspection) may be required before the ROBOT may compete in subsequent MATCHES.

SCORING ELEMENTS are expected to undergo a reasonable amount of wear and tear as they are handled by ROBOTS and humans, such as scratching, marking, and eventually damage due to fatigue. Routinely gouging, tearing off pieces, or marking SCORING ELEMENTS are violations of this rule.

G408 **No more than 3 at a time.** A ROBOT may not simultaneously CONTROL more than 3 ARTIFACTS.

Violation: MINOR FOUL per SCORING ELEMENT over the limit. YELLOW CARD if excessive.

Examples of interaction with a SCORING ELEMENT that are not "CONTROL" include, but are not limited to:
A. "bulldozing" (inadvertent contact with a SCORING ELEMENT while in the path of the ROBOT moving about the FIELD)
B. "deflecting" (being hit by a SCORING ELEMENT that bounces into or off a ROBOT)
C. inadvertent contact with a SCORING ELEMENT while attempting to acquire a SCORING ELEMENT from the LOADING ZONE.
D. SCORING ELEMENTS that have been LAUNCHED by a ROBOT that are no longer in contact with the ROBOT.

It is important to design your ROBOT so that it is impossible to inadvertently or unintentionally CONTROL more than the limit.

Excessive violations of CONTROL limits include, but are not limited to:
A. simultaneous CONTROL of 5 or more ARTIFACTS, or
B. frequent (i.e., 3 or more separate violations in a MATCH), greater-than-MOMENTARY CONTROL of 4 or more ARTIFACTS.

REPEATED excessive violations of this rule do not result in additional YELLOW CARDS unless the violation reaches the level of egregious to trigger a G211 violation.

11.4.4 ROBOT

G409 ***ROBOTS must be under control.** A ROBOT must not pose an undue hazard to a human or an ARENA element during a MATCH in the following ways:

A. the ROBOT or anything it CONTROLS, i.e., a SCORING ELEMENT, disrupts anything outside the FIELD or contacts a human that is outside the FIELD.
B. the ROBOT operation is dangerous.

Violation: DISABLED and VERBAL WARNING. YELLOW CARD if REPEATED or if subsequent violations occur during the event.

Please be conscious of REFEREES and FIELD STAFF working around the ARENA who may be in close proximity to your ROBOT.

Examples of violations include, but are not limited to:
A. Wildly flailing outside the FIELD
B. Knocking over a DRIVER STATION stand
C. Moving/damaging the FIELD timer display
D. Contacting FIELD STAFF or a DRIVE TEAM member outside the FIELD

ROBOT contact with ARENA elements outside the FIELD, such as a DRIVER STATION stand, the floor outside the FIELD, or the FIELD wall perimeter outside of the FIELD is not a violation of this rule.

G410 ***ROBOTS must stop when instructed.** If a team is instructed to DISABLE their ROBOT by a REFEREE per T202, a DRIVE TEAM member must press the (■) stop button on the DRIVER STATION app.

Violation: MAJOR FOUL if greater-than-MOMENTARY delay plus RED CARD if CONTINUOUS.

G411 ***ROBOTS must be identifiable.** A ROBOT'S team number and ALLIANCE color must not become indeterminate by determination of the Head REFEREE.

Violation: VERBAL WARNING. MINOR FOUL if subsequent violations occur during the event.

Teams are encouraged to robustly affix their ROBOT SIGNS to their ROBOT in highly visible locations such that they do not easily fall off or become obscured during normal gameplay.

G412 ***Don't damage the FIELD.** A ROBOT may not damage FIELD elements.

Violation: VERBAL WARNING. DISABLED if the Head REFEREE infers that additional damage is likely. YELLOW CARD for any subsequent damage during the event. Corrective action (such as eliminating sharp edges, removing the damaging MECHANISM, and/or re-inspection) may be required before the ROBOT will be allowed to compete in subsequent MATCHES.

SCORING ELEMENT damage is specifically covered in G407. G407 and G412 do not stack. G412 does not apply to damage caused by normal gameplay actions.

FIELD damage includes, but is not limited to:

- contaminating the FIELD with a liquid or fine solid as in R205,
- damaging TILE in R201,
- causing the GATE to bend or break off

FIELD damage does not include:

- normal GATE interaction resulting in a GATE that "sticks" open
- normal interaction with the GOAL that causes it to lift off the TILES

G413 ***Watch your ARENA interaction.** A ROBOT is prohibited from the following interactions with an ARENA element, except for SCORING ELEMENTS (per G407):

A. grabbing,
B. grasping,
C. attaching to,
D. becoming entangled with, or
E. suspending from.

Violation: MAJOR FOUL plus YELLOW CARD if REPEATED or if greater-than-MOMENTARY. DISABLED if the Head REFEREE infers that damage is likely. Corrective action (such as removing the offending MECHANISM, and/or re-inspection) may be required before the ROBOT will be allowed to compete in subsequent MATCHES.

ROBOTS operating the GATE should make it clear that they do not violate this rule. ROBOTS are expected to push the GATE lever down to open, but no closing force (e.g., pulling) should be applied.

G414 **ROBOTS have horizontal expansion limits.** ROBOTS must comply with the horizontal expansion limits outlined in R105.A during the MATCH. Exceptions:

A. If the over-expansion is due to damage and not used for strategic benefit.

Violation: MINOR FOUL. MAJOR FOUL if the over-expansion is used for strategic benefit, including if it impedes or enables a scoring action.

ROBOTS are allowed to have moving parts that extend outside its STARTING CONFIGURATION, but these extensions must stay within the expansion limit as described in R105.

G415 **ROBOTS have vertical expansion limits, with exceptions.** ROBOTS must comply with the vertical expansion limits outlined in R105. ROBOTS may only expand above 18 in. (45.70 cm) up to 38 in. (96.50 cm) if both of the following conditions are true:

A. during the final 20 seconds of the MATCH, and
B. when not in any LAUNCH ZONES.

Violation: MINOR FOUL. MAJOR FOUL if the over-expansion is used for strategic benefit, including if it impedes or enables a scoring action.

> ROBOTS are allowed to have moving parts that extend outside its STARTING CONFIGURATION, but these extensions must stay within the expansion limit as described in R105.

G416 **LAUNCHING in the LAUNCH ZONE only.** ROBOTS may only LAUNCH SCORING ELEMENTS when inside a LAUNCH ZONE or overlapping a LAUNCH LINE.

Violation: MINOR FOUL per LAUNCHED SCORING ELEMENT. MAJOR FOUL per LAUNCHED SCORING ELEMENT if the SCORING ELEMENT enters the open top of the GOAL.

> A SCORING ELEMENT is considered LAUNCHED if it is shot into the air, propelled across the floor to a desired location or in a preferred direction, or thrown in a forceful way.
>
> "Bulldozing" (inadvertent contact with a SCORING ELEMENT while in the path of the ROBOT moving about the FIELD) is not considered LAUNCHING
>
> This is not intended to penalize teams with active manipulators which are expelling SCORING ELEMENTS through normal operation, such as:
> A. Running an intake in reverse causing a SCORING ELEMENT to travel a short distance from the ROBOT.
> B. A ROBOT pushing a SCORING ELEMENT a short distance away in the process of herding it across the FIELD.

G417 **ROBOTS only operate GATES as directed.** ROBOTS may not:

A. contact, either directly or transitively through a SCORING ELEMENT, an opposing ALLIANCE'S GATE, or
B. apply, either directly or transitively through a SCORING ELEMENT, any closing force to either GATE.

Violation: MAJOR FOUL and the opposing ALLIANCE is awarded the PATTERN RP if G417.A.

> Closing force includes any force applied to the GATE in the direction that closes the GATE, even if the GATE is already closed. A ROBOT bumping into a GATE handle which is stuck open to try to get it to close is not considered a closing force.

G418 **ROBOTS may not meddle with ARTIFACTS on RAMPS.** ROBOTS may not contact, either directly or transitively through a SCORING ELEMENT CONTROLLED by the ROBOT, ARTIFACTS on a RAMP, including their own RAMP. Additionally, ROBOTS may not:

A. remove an ARTIFACT from their own RAMP except by operating the GATE, or
B. remove an ARTIFACT from the opponent's RAMP by any means.

Violation: MAJOR FOUL per ARTIFACT, and the ALLIANCE is ineligible for the PATTERN RP if G418.A, or the opposing ALLIANCE is awarded the PATTERN RP if G418.B.

> Exceptions are granted for inconsequential and inadvertent contact made by a ROBOT while operating a GATE.

Example 1: A red ROBOT that contacts an ARTIFACT on the blue RAMP is in violation of this rule and is assessed 1 MAJOR FOUL under G418.

Example 2: A red ROBOT that LAUNCHES an ARTIFACT at an ARTIFACT on the red RAMP, removing it from the RAMP is in violation of this rule. The red ALLIANCE is assessed 1 MAJOR FOUL and is ineligible for the PATTERN RP under G418.A.

Example 3: A red ROBOT contacts and opens the blue GATE, causing 5 ARTIFACTS that were on the blue RAMP to leave the RAMP and return to the FIELD. Red is assessed a total of 6 MAJOR FOULS – 1 under G417.A and 5 under G418.B – in addition to blue being awarded PATTERN RP under G417.A/G418.B.

G419 **ROBOTS LAUNCH into their own GOAL.** ROBOTS may not:

A. intentionally place or LAUNCH ARTIFACTS directly onto their own RAMP, or
B. place or LAUNCH ARTIFACTS into the opponent's GOAL or onto the opponent's RAMP.

Violation: MAJOR FOUL per ARTIFACT and the opposing ALLIANCE is awarded the PATTERN RP if G419.B.

The intent is for ROBOTS to score by LAUNCHING into the open top of their own GOAL. Attempts to intentionally score points with actions that enter the ARTIFACT further down on the RAMP are considered violations of this rule.

Attempts to score points for the opponent either through the opponent GOAL or with actions that enter an ARTIFACT further down on the opponent RAMP are also considered violations of this rule.

There is no violation for scoring in an opponent's DEPOT.

11.4.5 Opponent Interaction

Note, G420 and G421 are mutually exclusive. A single ROBOT to ROBOT interaction which violates more than 1 of these rules results in the most punitive penalty, and only the most punitive penalty, being assessed.

G420 ***This is not combat robotics.** A ROBOT may not deliberately functionally impair an opponent ROBOT. Damage or functional impairment because of contact with a tipped-over or DISABLED opponent ROBOT, which is not perceived by a REFEREE to be deliberate, is not a violation of this rule.

Violation: MAJOR FOUL and YELLOW CARD. MAJOR FOUL and RED CARD if opponent ROBOT is unable to drive.

FIRST Tech Challenge can be a high-contact competition and may include rigorous gameplay. While this rule aims to limit severe damage to ROBOTS, teams should design their ROBOTS to be robust. Teams are expected to act responsibly.

An example of a violation of this rule includes, but is not limited to:

A. A ROBOT high-speed rams and/or REPEATEDLY smashes an opponent ROBOT and causes damage. The REFEREE infers that the ROBOT was deliberately trying to damage the opponent's ROBOT.

Examples of functionally impairing another ROBOT include, but are not limited to:

B. disconnecting wires for operation of a component inside the ROBOT CHASSIS.
C. disconnecting the opponent ROBOT'S battery (this example also clearly results in a RED CARD because the ROBOT is no longer able to drive).
D. powering off an opponent's ROBOT using their reasonably well-protected power switch (This example also clearly results in a RED CARD because the ROBOT is no longer able to drive).

Teams should mount their main power switch so it is protected per R609. A team that mounts their ROBOT'S power switch in an exposed location puts themselves at high risk of incidental contact. Powering off an opponent's ROBOT by their exposed power switch during normal interactive gameplay will be considered incidental and not deliberate.

At the conclusion of the MATCH, the Head REFEREE may elect to visually inspect a ROBOT to confirm violations of this rule made during a MATCH and remove the violation if the damage cannot be verified.

"Unable to drive" means that because of the incident, the DRIVER can no longer drive to a desired location in a reasonable time (generally). For example, if a ROBOT can only move in circles, or can only move extremely slowly, the ROBOT is considered unable to drive.

G421 ***Do not tip or entangle.** A ROBOT may not deliberately, as perceived by a REFEREE, attach to, tip, or entangle an opponent ROBOT.

Violation: MAJOR FOUL and YELLOW CARD. MAJOR FOUL and RED CARD if CONTINUOUS or opponent ROBOT is unable to drive.

Examples of violations of this rule include, but are not limited to:

A. using a wedge-like MECHANISM to tip over an opponent ROBOT
B. making frame-to-frame contact with an opponent ROBOT that is attempting to right itself after previously falling over and causing them to fall over.
C. causing an opponent ROBOT to tip over by contacting the ROBOT after it starts to tip if, in the judgement of the REFEREE, that contact could have been avoided.

Tipping as an unintended consequence of normal ROBOT-to-ROBOT interaction, including single frame-to-frame hits that result in a ROBOT tipping, as perceived by the REFEREE, is not a violation of this rule.

"Unable to drive" means that because of the incident, the DRIVER can no longer drive to a desired location in a reasonable time (generally). For example, if a

ROBOT can only move in circles, or can only move extremely slowly, the ROBOT is considered unable to drive.

G422 ***There is a 3-count on PINS.** A ROBOT may not PIN an opponent's ROBOT for more than 3 seconds. A ROBOT is PINNING if it is preventing the movement of an opponent ROBOT by contact, either direct or transitive (such as against a FIELD element) and the opponent ROBOT is attempting to move. A PIN count ends once any of the following criteria below are met:

A. the ROBOTS have separated by at least 2 ft. (~61 cm) from each other for more than 3 seconds,
B. either ROBOT has moved 2 ft. from where the PIN initiated for more than 3 seconds, or
C. the PINNING ROBOT gets PINNED.

For criteria A, the PIN count pauses once ROBOTS are separated by 2 ft. until either the PIN ends or the PINNING ROBOT moves back within 2 ft., at which point the PIN count is resumed.

For criteria B, the PIN count pauses once either ROBOT has moved 2ft from where the PIN initiated until the PIN ends or until both ROBOTS move back within 2ft., at which point the PIN count is resumed.

Violation: MINOR FOUL and an additional MINOR FOUL for every 3 seconds in which the situation is not corrected.

G423 ***Do not use strategies intended to shut down major parts of gameplay.** A ROBOT or ROBOTS may not, in the judgment of a REFEREE, isolate or close off any major element of MATCH play for a greater-than-MOMENTARY duration.

Violation: MINOR FOUL and an additional MINOR FOUL for every 3 seconds in which the situation is not corrected.

Examples of violations of this rule include, but are not limited to:
A. shutting down access to all SCORING ELEMENTS,
B. quarantining an opponent to a small area of the FIELD,
C. quarantining SCORING ELEMENTS out of the opposing ALLIANCE'S reach, or
D. completely blocking access to the opponent's GATE.

G424 **GATE ZONE is OFF LIMITS.** A ROBOT may not contact, directly or transitively though a SCORING ELEMENT, an opponent ROBOT if either ROBOT is in the opponent's GATE ZONE, regardless of who initiates contact. Exceptions:

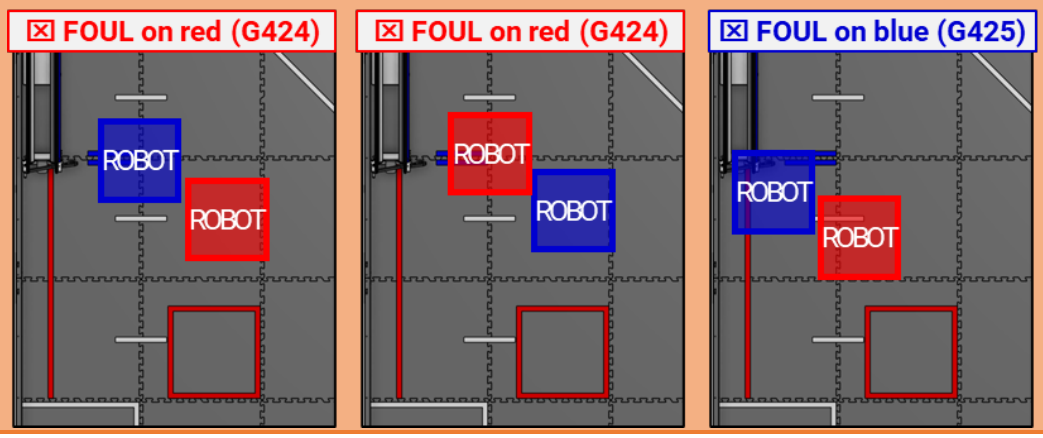
A. A ROBOT in their own ALLIANCE'S GATE ZONE and in their opponent's SECRET TUNNEL ZONE is not protected under G424.

Violation: MINOR FOUL.

For the exception in G424.A, G425 would apply instead.

Figure 11-2 shows some examples of typically protected and non-protected contact in the GATE ZONE. The intent of this rule is to ensure an ALLIANCE has access to their own GATE. Some of the actions shown below may also fall under other penalties including G423 or escalate to G211.

Figure 11-2: G424 Examples

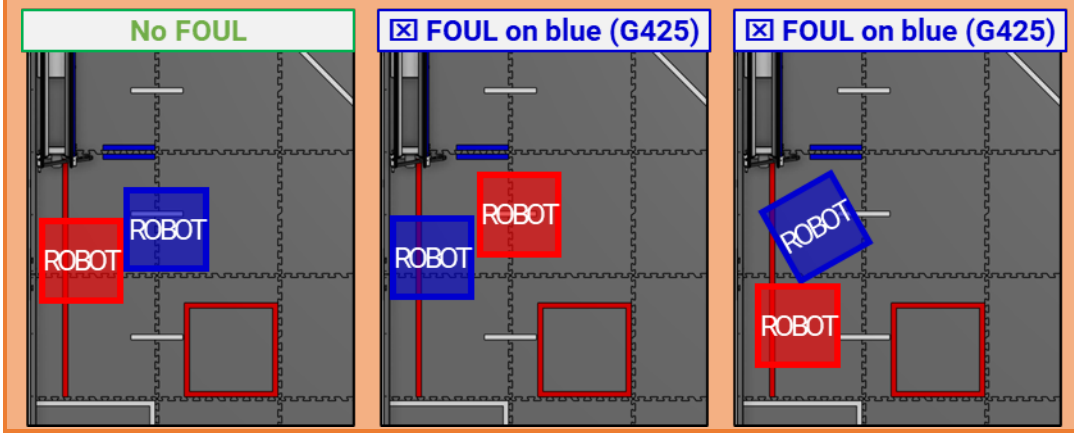


G425 **Keep out of opponent's SECRET TUNNEL** A ROBOT in the opponent's SECRET TUNNEL ZONE may not contact, directly or transitively though a SCORING ELEMENT, an opponent ROBOT regardless of who initiates contact.

Violation: MINOR FOUL.

Figure 11-3 shows some examples of typically protected and non-protected contact in the SECRET TUNNEL ZONE. The intent of this rule is to ensure an ALLIANCE has access to ARTIFACTS exiting from the opponent's GATE, but still allow the opponent the opportunity to also access ARTIFACTS if there is no defender present.

Figure 11-3: G425 Examples



G426 **LOADING ZONE protection.** A ROBOT may not contact, directly or transitively through a SCORING ELEMENT, an opponent ROBOT while either ROBOT is in the opponent's LOADING ZONE, regardless of who initiates contact.

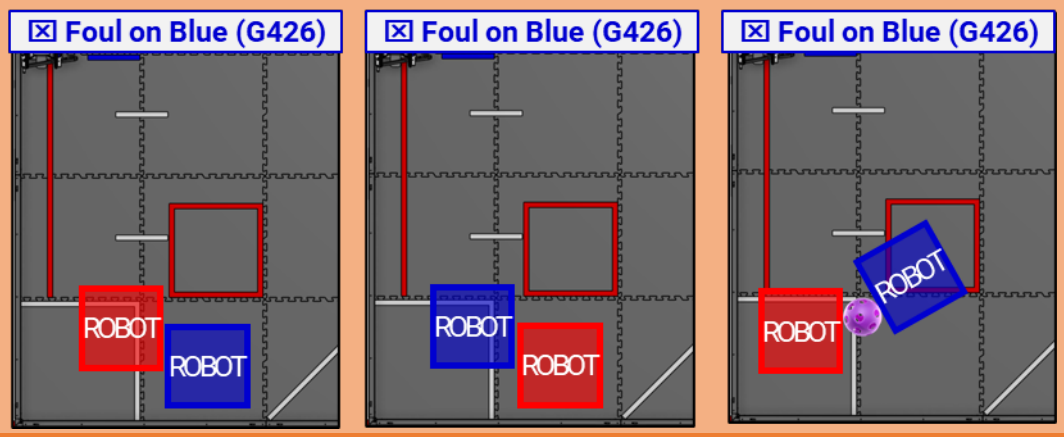
Violation: MINOR FOUL.

Figure 11-4 shows some examples of typically protected and non-protected contact in the LOADING ZONE. The intent of this rule is to ensure an ALLIANCE has access to ARTIFACTS exiting from the opponent's GATE but still allows the

opponent the opportunity to also access ARTIFACTS if there is no defender present.

Some of the actions shown below may also fall under other penalties including G423.

Figure 11-4: G426 Examples (before the last 20 seconds of the match)



G427 **BASE ZONE protection.** During the last 20 seconds of the MATCH, a ROBOT may not contact, directly or transitively through a SCORING ELEMENT, an opponent ROBOT while either ROBOT is in the opponent's BASE ZONE, regardless of who initiates contact.

Violation: MAJOR FOUL and opponent ROBOT and any ROBOT fully supported by the contacted ROBOT are awarded fully returned to BASE points.

11.4.6 Human

G428 ***No wandering.** DRIVE TEAM members must remain in their designated ALLIANCE AREA.

A. DRIVE TEAMS may be anywhere in their respective ALLIANCE AREA during a MATCH.
B. DRIVE TEAM members must be staged inside their respective ALLIANCE AREA prior to MATCH start.

Violation: VERBAL WARNING. MINOR FOUL if subsequent violations occur during the event.

The intent of this rule is to prevent DRIVE TEAM members from leaving their assigned AREA during a MATCH to gain a competitive advantage. For example, moving to another part of the FIELD for better viewing or reaching into the FIELD. Simply breaking the plane of the AREA during normal MATCH play is not a FOUL.

DRIVE TEAM members may retrieve SCORING ELEMENTS that have left the FIELD if they are able to do so without violating G428, G430, and G434. Reintroduction of SCORING ELEMENTS must follow rule G432.

Exceptions are granted in cases concerning safety and for actions that are inadvertent, MOMENTARY, and inconsequential.

G429 ***DRIVE COACHES and other teams: hands off the controls.** A ROBOT shall be operated only by the DRIVERS of that team; DRIVE COACHES may not handle the gamepads. DRIVE COACHES, if desired, may help the DRIVERS in the following ways:

A. holding the DRIVER STATION device,
B. troubleshooting the DRIVER STATION device,
C. selecting OpModes on the DRIVER STATION app,
D. pressing the INIT button on the DRIVER STATION app,
E. pressing the (▶) start button on the DRIVER STATION app, or
F. pressing the (■) stop button on the DRIVER STATION app.

Violation: MAJOR FOUL. YELLOW CARD if greater-than-MOMENTARY.

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

G430 ***DRIVE COACHES, SCORING ELEMENTS are off limits.** DRIVE COACHES may not contact SCORING ELEMENTS, unless for safety purposes.

Violation: MINOR FOUL.

G431 ***DRIVE TEAMS, watch your reach.** Once a MATCH starts, a DRIVE TEAM member inside the FIELD may not:

A. directly contact a ROBOT,
B. contact a SCORING ELEMENT in contact with a ROBOT,
C. disrupt SCORING ELEMENT scoring, or
D. contact a FIELD element.

Violation: MAJOR FOUL plus YELLOW CARD if G431.A. RED CARD and the opposing ALLIANCE is awarded the PATTERN RP if G431.C.

> Exceptions are granted in cases concerning safety and for actions that are inadvertent, MOMENTARY, and inconsequential.
>
> For G431.A and G431.B, the penalty is applied to the DRIVE TEAM member regardless of whether the DRIVE TEAM member or ROBOT initiates contact.
>
> Impacting ARTIFACT scoring includes, but is not limited to:
> A. Contacting an ARTIFACT LAUNCHED by the opponent within the FIELD
> B. Contacting an ARTIFACT in the opponent's GOAL
> C. Disrupting the scoring of an ARTIFACT on the opponent's RAMP or by operating the opponent's GATE

G432 **Humans, only meddle with ARTIFACTS in the LOADING ZONE.** DRIVE TEAM members may only introduce ARTIFACTS to, remove ARTIFACTS from, or move ARTIFACTS within the LOADING ZONE and only the LOADING ZONE. Actions must occur:

A. only during TELEOP,
B. without using a tool,
C. without causing an ARTIFACT to enter into the LOADING ZONE from elsewhere on the FIELD, and
D. without causing an ARTIFACT to leave the LOADING ZONE and enter the rest of the FIELD unless the ARTIFACT is CONTROLLED by a ROBOT as follows:
    i. ARTIFACT CONTROL begins when the ROBOT is in the LOADING ZONE, and
    ii. ARTIFACT is still CONTROLLED by the ROBOT when the ROBOT leaves the LOADING ZONE.

Violation: MINOR FOUL per ARTIFACT. MAJOR FOUL per ARTIFACT that enters the open top of the GOAL.

DRIVE TEAM members may load SCORING ELEMENTS into a ROBOT that is partially or fully in the LOADING ZONE.

ARTIFACTS that are unintentionally deflected, e.g., a DRIVE TEAM member protecting themselves from a LAUNCHED ARTIFACT, are an exception to this rule.

DECODE is a fast-paced game and teams should practice coordination and communication between the DRIVE TEAM members to avoid unintentional contact between the ROBOT and any humans in violation of G431.A.

G433 **Humans may only enter SCORING ELEMENTS.** DRIVE TEAM members may only enter ARTIFACTS onto the FIELD.

Violation: MINOR FOUL per non-ARTIFACT item entered onto the FIELD.

G434 **The ALLIANCE AREA has a storage limit.** During TELEOP, each ALLIANCE may not store more than 6 ARTIFACTS out of play. DRIVE TEAM members making a good-faith effort to immediately enter additional ARTIFACTS back into play is an exception to this rule.

Violation: MINOR FOUL per ARTIFACT over the limit and an additional MINOR FOUL per ARTIFACT over the limit for every 3 seconds in which the situation is not corrected.

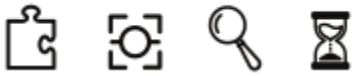
The intent of this rule is to prevent an ALLIANCE from starving the FIELD of ARTIFACTS during TELEOP.

Examples of “out of play” include, but are not limited to:
A. A DRIVE TEAM member holding an ARTIFACT inside or outside of the FIELD
B. DRIVE TEAM member storing an ARTIFACT outside the FIELD

During AUTO and transition, this rule is not enforced. Upon the start of TELEOP, DRIVE TEAM members must make a good-faith effort to immediately enter ARTIFACTS into the FIELD until compliant with G434.

Teams will not be in violation of this rule if FIELD STAFF return ARTIFACTS to the DRIVE TEAM that have left the FIELD per section 10.8 Other Logistics such that the ALLIANCE holds a number of ARTIFACTS over the limit. However, if the DRIVE TEAM does not then make a good-faith effort to immediately enter ARTIFACTS into the FIELD until compliant with G434, they will be in violation of this rule.

DRIVE TEAM members must keep ARTIFACTS accessible. DRIVE TEAM members intentionally losing access to ARTIFACTS, e.g., by purposefully removing them from the FIELD and ALLIANCE AREA, will be considered egregious behavior and handled per G211.



12 ROBOT Construction Rules (R)

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

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

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

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

ROBOTS are made up of COMPONENTS and MECHANISMS.

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

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

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

fabricate the gearbox. The finished gearbox itself would be a FABRICATED ITEM, and not a COTS item.

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

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

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

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

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

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

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

FIRST desires to permit teams to have the broadest choice of legitimate sources possible, and to obtain COTS items from the sources that provide them with the best prices and level of service available. Teams also need to protect against