Section

7

THE GAME

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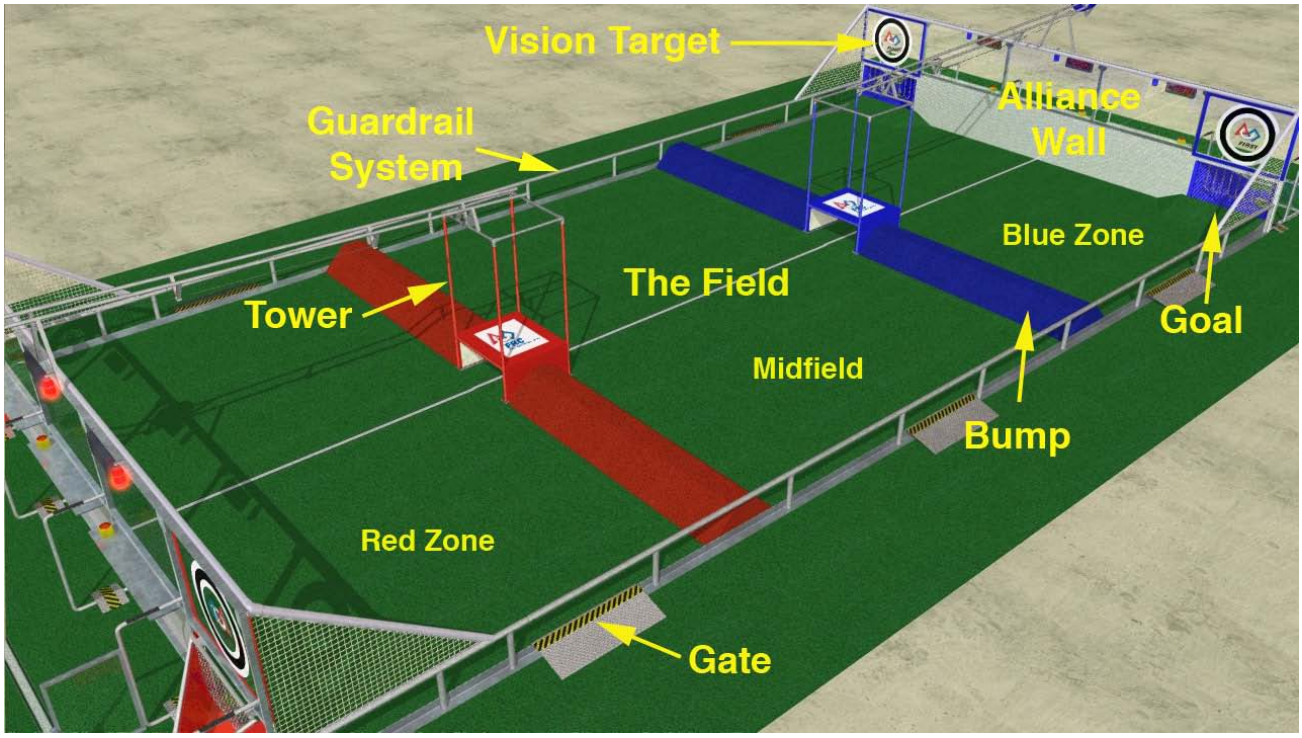
7 THE GAME

7.1 OVERVIEW

Breakaway is a game played on the FIELD (illustrated in the figure below). Two ALLIANCES, one red and one blue, composed of three *FIRST* Robotics Competition (FRC) teams each, compete in each MATCH. The object of the game is to attain a higher score than your opponent by shooting BALLS into a GOAL, climbing on the ALLIANCE TOWER or PLATFORM, or by lifting an ALLIANCE ROBOT off the PLAYING SURFACE.



Note: The illustrations in this section of the manual are for a general visual understanding of the Breakaway arena only. Please refer to the official drawings for exact dimensions and construction detail.

7.1.1 Match Format

A MATCH is 2 minutes and 15 seconds long. An AUTONOMOUS PERIOD starts each MATCH during which the ROBOTS are controlled by pre-programmed instructions. The AUTONOMOUS PERIOD is followed by the TELEOPERATED PERIOD during which the DRIVERS assume control of the robot. The ROBOTS continue to play the game until the TELEOPERATED PERIOD is over.

7.2 DEFINITIONS

ALLIANCE: A set of three FRC TEAMS that work together during a MATCH to play *Breakaway* against an opposing ALLIANCE. ALLIANCES are identified during the MATCH by their assigned color, either red or blue.

CARRYING: POSSESSING a BALL that is not in contact with the FIELD.

ELEVATED: A ROBOT that is completely above the plane of the PLATFORM and in contact with the TOWER shall be considered ELEVATED.

FINALE: The final 20 seconds of the match.

MATCH: A single iteration of play in which ALLIANCES attempt to complete the objectives of the *Breakaway* game during a competition.

PENALTY: A 1-point decrement in the ALLIANCE score assigned when a deserving violation of the game rules has been identified by a Referee.

POSSESSION: Controlling the position and movement of a BALL. A BALL shall be considered in POSSESSION if, as the ROBOT moves or changes orientation (e.g. backs up or spins in place), the BALL remains in approximately the same position relative to the ROBOT.

RED CARD: An indication of disqualification of a TEAM.

SCORED: A BALL is SCORED when it is passes through the GOAL COUNTER.

SUSPENDED: A ROBOT only in contact with an ELEVATED ROBOT and/or a SUSPENDED ROBOT shall be considered SUSPENDED.

TEAM: Four representatives from a registered FRC team that interact with their ROBOT and their ALLIANCE partners to play *Breakaway*. Positions on the TEAM include:

COACH: A student or adult mentor designated as the team coach and advisor during the MATCH and identified as the person wearing the designated "COACH" pin or button. There is one COACH per TEAM.

DRIVER: A pre-college student team member responsible for operating and controlling the ROBOT. There are two DRIVERS per TEAM.

HUMAN PLAYER: A pre-college student team member responsible for properly returning BALLS to the FIELD. There is one HUMAN PLAYER per TEAM. The HUMAN PLAYER is the only TEAM MEMBER that may handle the TRIDENT.

YELLOW CARD: A warning of egregious ROBOT or team member behavior at the ARENA.

Warnings, cautions, and notes appear in blue boxes. These notes are intended to provide insight into the reasoning behind a rule, helpful information on understanding and interpreting a rule, and/or possible “best practices” for use when implementing systems affected by the rule. These notes are not part of the formal rules, and do not carry the weight of a rule (if there is an inadvertent conflict between a rule and a note, the rule applies). However, it is strongly recommended that you pay close attention to their contents.

7.3 RULES

7.3.1 Safety

<S01> Safe Operation and Design - If at any time a ROBOT'S operation or design is deemed unsafe, the ROBOT will be disabled for the remainder of the MATCH. If the safety violation is due to the ROBOT design, the Head Referee has the option to not allow the ROBOT back onto the FIELD until the design has been corrected. An example of unsafe operation would be uncontrolled motion that cannot be stopped by the DRIVERS. *Violation: PENALTY and Disablement.*

<S02> TEAM Member Safety – For reasons of personal safety, contact with ROBOTS and/or entering the FIELD are prohibited during a MATCH.

a. TEAM members may not directly contact any ROBOT at any time during the MATCH. *Violation: PENALTY and Disablement.*

b. TEAM members may not extend any part of their body into the FIELD during the MATCH. *Violation: PENALTY.*

<S03> E-Stop - An Emergency Stop (E-Stop) button is located in each TEAM'S Player Station. Pressing an E-Stop button will cause the TEAM'S ROBOT to be disabled for the remainder of the MATCH. The E-Stop buttons are intended for remote shut down during a MATCH in the event of safety hazards and will not otherwise affect MATCH score or duration. Any TEAM member or referee may press the E-Stop button.

<S04> Permitted ROBOTS - Any ROBOT used during a MATCH must be in compliance with all Robot Rules (as defined in Section 8). *Violation: PENALTY and potential YELLOW CARD.*

7.3.2 Game Periods

<G02> AUTONOMOUS PERIOD - The AUTONOMOUS PERIOD is the 15-second period at the start of the MATCH. DRIVER control of the ROBOT is not permitted at this time. During this period, the ROBOTS may react only to sensor inputs and commands programmed into the onboard control system. All ROBOT safety rules are still applicable during the AUTONOMOUS PERIOD. The AUTONOMOUS PERIOD ends when the arena timer displays zero seconds left in the period.

<G03> TELEOPERATED PERIOD – The TELEOPERATED PERIOD is the 2-minute period of game play immediately following the AUTONOMOUS PERIOD. At the beginning of the TELEOPERATED PERIOD the OPERATOR CONSOLE controls are activated and DRIVERS may remotely control their ROBOTS. The DRIVERS continue to teleoperate their ROBOTS for the remainder of the MATCH. The TELEOPERATED PERIOD ends when the arena timer displays zero seconds. This also indicates the end of the MATCH.

7.3.3 Scoring

<G04> Scoring - ALLIANCE scores are determined by a combination of the number of BALLS SCORED in the ALLIANCE GOALS during the MATCH and the number or ROBOTS in the following states at the conclusion of the MATCH, where:

a. Each SCORED BALL is worth 1 point, and

b. Each ELEVATED ROBOT is awarded 2 points, or each SUSPENDED ROBOT is awarded 3 points.

<G05> Scoring Determination - Scores will be assessed after all objects in motion, when the ARENA timer displays zero seconds, come to rest, or 10 seconds after the timer displays zero seconds, whichever comes first. The final score of a MATCH is the total of points assigned under Rule <G04> less any assigned PENALTIES.

<G06> Minimum Score - The minimum score is zero points.

7.3.4 **Game Play**

7.3.4.1 Starting Conditions

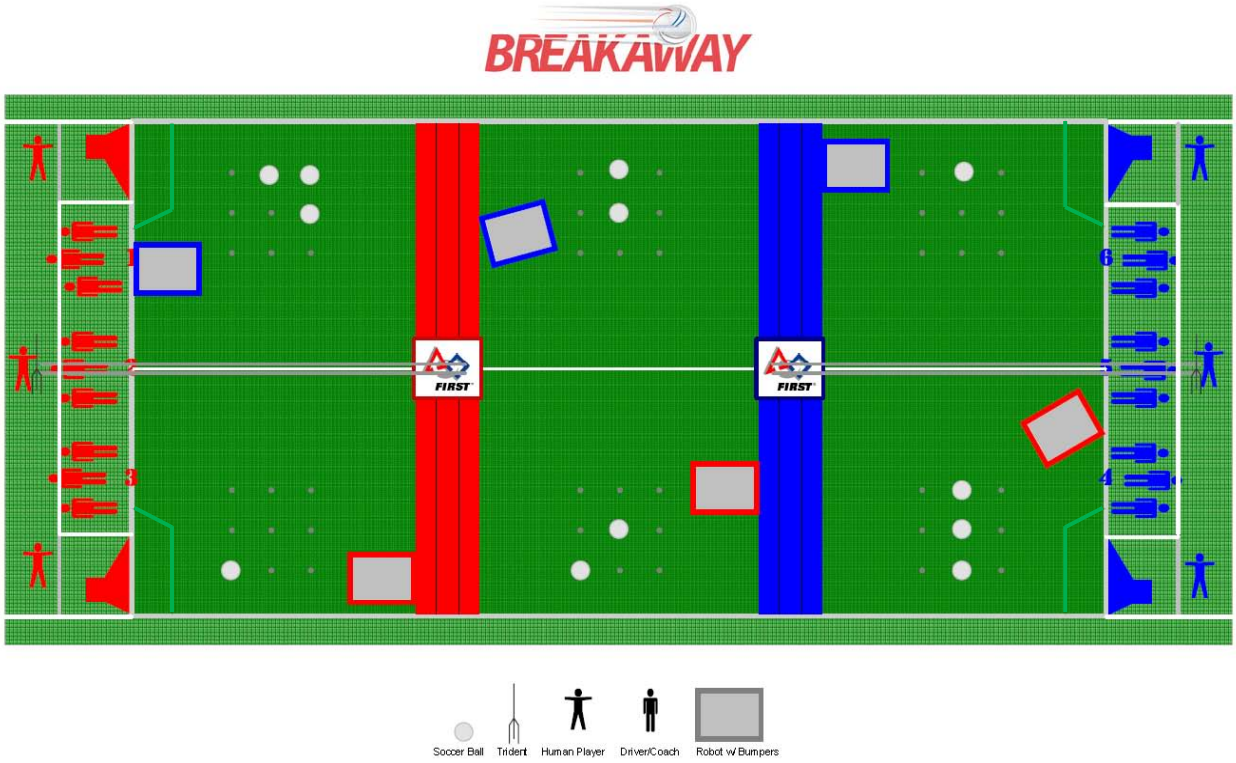
<G07> TEAM Starting Positions – Prior to the MATCH, all members of the TEAM must be standing behind the STARTING LINE and facing their Players Station.

<G08> ROBOT Starting Positions – Prior to the MATCH, each TEAM negotiates within their ALLIANCE to select one of the three starting areas for their ALLIANCE.

Each ALLIANCE Robot must be positioned in one of the following starting positions:

- In the far ZONE and in contact with the ALLIANCE STATION WALL and/or ramp.
- In the MIDFIELD and in contact with the farthest BUMP.
- In the near ZONE and in contact with the nearest BUMP.

<G09> BALL Starting Positions – Prior to the MATCH, each ALLIANCE is provided with six BALLS to be placed on the FIELD. The BALLS must be placed on a STARTING GRID location prior to the MATCH start. When the FIELD is viewed from the ALLIANCE STATION, the BALLS must be placed on the right side of the CENTER LINE, with one BALL in the near ZONE, two BALLS in the MIDFIELD, and three BALLS in the far ZONE. The BALLS must not be in contact with a ROBOT at the start of the MATCH.



Note: ROBOT and BALL positions are illustrative, not authoritative.

<G10> ROBOT Size – Prior to the MATCH, each ROBOT shall not exceed the NORMAL CONFIGURATION maximum weight or volume specified in Rule <R10>. The Head Referee may call for an inspector's recertification of the ROBOT size and weight prior to the start of any MATCH. *Violation (for ROBOTS prior to the match): Prohibition from participating in the MATCH.*

<G11> ROBOT Alignment Devices - Alignment devices (templates, tape measures, laser pointers, etc.) that are not part of the ROBOT may not be used to assist with positioning the ROBOT. *Violation: TEAMS that use external alignment devices to position their ROBOT will have their ROBOT arbitrarily repositioned by a referee before the start of the MATCH.*

<G12> FIELD Equipment - Other than the BALLS and competing ROBOTS, no other items shall be placed on the FIELD prior to or during the MATCH. *Violation: PENALTY and YELLOW CARD.*

7.3.4.2 Penalties

<G13> Causing PENALTIES – The actions of an ALLIANCE shall not cause an opposing ALLIANCE to violate a rule and thus incur PENALTIES. Any rule violations committed by the affected ALLIANCE shall be excused, and no PENALTIES will be assigned.

<G14> ALLIANCE PENALTIES - Unless otherwise noted, all PENALTIES assigned by referees are applied to the entire ALLIANCE.

7.3.4.3 Handling BALLS

<G15> BALL Handling – BALLS may be handled by any TEAM member when BALLS are in the CORRAL or ALLIANCE STATION. BALLS may not be handled until they have exited from the BALL COUNTER and are in the CORRAL. *Violation: PENALTY.*

<G16> BALL Return - HUMAN PLAYERS must place BALLS on the BALL RETURN using the TRIDENT. No other means are permitted for TEAMS to return BALLS to the FIELD. *Violation: Two PENALTIES and YELLOW CARD.*

<G17> BALL Return Timing - BALLS must be returned to the FIELD within a specified period of time to prevent delaying the game according to the following algorithm:

$$T_{expire} = T_{score} - [11 + (4 * n)]$$

- where T_{expire}, is the match time, in seconds, assigned to each individual BALL, at which point the Field Management System automatically assigns a PENALTY if a BALL is not passed through the BALL RETURN COUNTER,

- T_{score} is the remaining match time, in seconds, on the match timer when the ball enters the BALL COUNTER, and

- n is the number of balls that have passed through either BALL COUNTER of the ALLIANCE, but not yet passed through the BALL RETURN COUNTER.

Violation: One initial PENALTY plus one additional PENALTY for every 2 seconds that a BALL is not returned.

In general, this means that the team will have 11 seconds to return a BALL to the FIELD once it is SCORED, and an additional 4 seconds for each successive BALL in the ALLIANCE STATION, until all BALLS are returned to the FIELD. Once all BALLS are returned to the FIELD, the counter resets and the process begins again.

An expanded explanation of this formula is detailed in the document "Delay of Game Management Algorithm" (DOGMA), posted online at *http://www.usfirst.org/roboticsprograms/frc/content.aspx?id=452*.

<G18> BALLS Out of Bounds - BALLS that leave the FIELD or get dammed on the BALL RETURN will be replaced at the earliest safe opportunity. Out of Bounds BALLS will be returned to the approximate center of the MIDFIELD.

<G19> BALLS Out of Bounds (Intentional Actions) - BALLS may not be intentionally placed out of bounds. *Violation: PENALTY and YELLOW CARD.*

7.3.5 Robot Operations

7.3.5.1 Robot Out Of Bounds

<G20> ROBOT Out of Bounds - ROBOTS may not touch any surface outside of the FIELD boundary during the TELEOPERATED PERIOD. *Violation: Disablement*.

<G21> Grace Period after AUTONOMOUS - If a ROBOT should unintentionally touch any surface outside of the FIELD boundary during the AUTONOMOUS PERIOD, it will have a 10 second "grace period" to right itself and return to the FIELD at the beginning of the TELEOPERATED PERIOD. If the ROBOT is unable to right itself within the grace period, it will be disabled for the remainder of the MATCH. If at any time the Head Referee should determine that the attempts to recover from the situation constitute unsafe operations, Rule <S01> will take precedence. *No PENALTY will be assigned.*

<G22> ROBOT Range - ROBOTS must remain within the FIELD perimeter and asymmetric funnels of the GOALS during a MATCH. *Violation: PENALTY and Disablement.*

<G23> ALLIANCE WALL - ROBOTS may not extend over the ALLIANCE WALL. *Violation: PENALTY and Disablement.*

7.3.5.2 Robot Actions

<G24> ARENA Interaction – With the exception of the BALL RETURN and RETURN BARS, ROBOTS may push or react against any elements of the ARENA, provided there is no damage or disruption of the ARENA elements. With the exception of the TOWER, ROBOTS may not grab, grasp, grapple, or attach to any ARENA structure. *Violation: A warning will be issued when a ROBOT violates this rule. If the referee determines that the TEAM is disregarding the warning, their ROBOT will be disabled for the remainder of the MATCH.*

<G25> ROBOT ARENA Entanglement - ROBOTS that become entangled in the ARENA elements will not be freed until after the MATCH has finished. *No PENALTY will be assigned.*

<G26> ARENA Damage - ROBOTS may not damage any part of the ARENA or BALLS. For ROBOTS that violate this rule, the TEAM may be required to take corrective action (such as eliminating sharp edges, removing the damaging MECHANISM, and/or re-inspection) before the ROBOT will be allowed to compete in subsequent MATCHES. *Violation: Potential Disablement if the Head Referee determines that further damage is likely to occur.*

<G27> Disabled ROBOTS and PENALTIES – If a ROBOT becomes incapacitated (e.g. the ROBOT overturns and cannot be righted, the battery falls out, etc.), it may be disabled by pressing the E-Stop Button in the corresponding Player Station. *ROBOTS that are disabled in this manner cannot incur further PENALTIES.*

<G28> AUTONOMOUS PERIOD ROBOT Movement - During the AUTONOMOUS PERIOD, a ROBOT cannot completely cross the CENTER LINE. *Violation: Two PENALTIES; plus two PENALTIES and a YELLOW CARD if a BALL or ROBOT is contacted after completely crossing the CENTER LINE, and two additional PENALTIES for each additional BALL or ROBOT contacted.*

<G29> Defending ROBOT Restriction - Only one opposing ALLIANCE ROBOT is allowed in the opponent's ZONE. A ROBOT is considered in this ZONE if any part of the ROBOT is in contact with the ZONE's green carpet. *Violation: PENALTY; plus a RED CARD if effort to remedy is not immediate.*

<G30> ROBOT Volume – During a MATCH, no part of the ROBOT shall extend outside the vertical projection of the FRAME PERIMETER, except as follows:

a. BALL Interaction Volume – Solely for the purposes of interacting with a BALL, MECHANISMS that are below the BUMPER ZONE may extend up to the BUMPER PERIMETER, for a period not exceeding two seconds. After returning inside the FRAMER PERIMETER, such MECHANISMS are not permitted to re-extend beyond the FRAME PERIMETER for at least two seconds.

b. ROBOT Righting Volume - ROBOTS attempting to right themselves or their ALLIANCE partners may expand up to the FINALE CONFIGURATION maximum volume while, and only while, performing the righting operation. While beyond the NORMAL CONFIGURATION volume and righting, ROBOTS may not actively interact with BALLS or opponent ROBOTS.

c. TOWER Contact ROBOT Volume - During a MATCH, ROBOTS in contact with their ALLIANCE TOWER may extend beyond their NORMAL CONFIGURATION volume but may not exceed the FINALE CONFIGURATION maximum volume.

d. FINALE ROBOT Volume - During the FINALE, ROBOTS may extend up to the limits of the FINALE CONFIGURATION maximum volume.

e. BUMPERS may extend outside the FRAME PERIMETER, within the constraints defined in Rule <R07>.

Violation: PENALTY and YELLOW CARD.

<G31> BALL RETURN and RETURN BARS Protection - ROBOTS may not contact the BALL RETURN or the RETURN BARS (black tape). *Violation: PENALTY for inadvertent contact; plus a RED CARD for obviously intentional contact or damaging contact.*

<G32> ROBOT Protection while Righting – Before the FINALE, ROBOTS attempting to right themselves or their ALLIANCE partners have one 10-second grace period per fallen ROBOT in which they may not be contacted by an opposing ROBOT. This protection continues for either 10 seconds or when the protected ROBOTS have completed the righting operation, whichever time comes first. *Violation: PENALTY for inadvertent contact; plus a RED CARD for obviously intentional contact.*

<G33> ROBOT Righting Limitations - During the grace period described in Rule <G32>, the protected ROBOTS may not actively interact with BALLS or opponent ROBOTS. *Violation: PENALTY.*

<G34> FINALE PERIOD ROBOT Protection - During the FINALE, ROBOTS in contact with their TOWER or in contact with an ELEVATED ALLIANCE partner may not be contacted by an opponent. *Violation: PENALTY for inadvertent contact; plus a RED CARD for obviously intentional contact.*

<G35> FINALE PERIOD TOWER Protection - During the FINALE, ROBOTS in may not contact the OPPONENT'S TOWER. *Violation: PENALTY for inadvertent contact; plus a RED CARD for obviously intentional contact.*

<G36> ROBOT to ROBOT Interaction - Strategies aimed solely at the destruction, damage, tipping over, or entanglement of ROBOTS are not in the spirit of the FRC and are not allowed. *Violation: YELLOW CARD*

<G37> Permitted ROBOT to ROBOT Contact - *Breakaway* is a highly interactive game. Robust construction of ROBOTS will be very important in this high-speed competition. ROBOTS should be designed to withstand the contact that will occur during the MATCH. Appropriate contact is allowed under the following guidelines for which no PENALTY will be assigned:

a. High speed accidental collisions may occur during the MATCH and are an expected part of the game.

b. Incidental contact, both inside and outside the BUMPER ZONE, is to be expected and is generally acceptable.

c. Contact outside the BUMPER ZONE is an expected part of the game during the following scenarios:

   i. for ROBOTS on a RAMP or BUMP,

   ii. for ROBOTS that have been tipped and are not attempting to right themselves,

   iii. for ROBOTS that have exceeded their NORMAL CONFIGURATION volume to right themselves or an ALLIANCE partner as permitted by Rule <G30> and have either exceeded the 10-second grace period permitted by Rule <G32> or completed the righting operation,

   iv. for ROBOTS that have exceeded their NORMAL CONFIGURATION volume to interact with a BALL as allowed by Rule <G30-a>, and

   v. for ROBOTS in the process of being ELEVATED or SUSPENDED prior to the FINALE.

<G38> Prohibited ROBOT to ROBOT Contact - Except as permitted in Rule <G37>, contact is prohibited under the following conditions:

a. Aggressive or intentional contact outside of the BUMPER ZONE. *Violation: PENALTY; plus a RED CARD if the offense is particularly egregious or if it results in substantial damage to another ROBOT.*

b. A ROBOT may not intentionally attach to and/or climb onto an opposing ALLIANCE ROBOT. Obvious attempts to do so will be interpreted as an attempt to damage an opposing ROBOT. *Violation: PENALTY and RED CARD.*

> ROBOTS should be designed to withstand the expected contact outside the BUMPER ZONE. For example, ROBOT designs should anticipate the scenario of a ROBOT coming off a BUMP and landing on a ROBOT on the green carpet.

<G39> Pinning - A ROBOT may not pin (inhibit the movement of another ROBOT that is in contact with a field element, border, or goal) for more than 5 seconds. If a ROBOT has been pinned for 5 seconds, the team with the pinning ROBOT will be signaled by a referee to release the pinned ROBOT and back away approximately 6 feet. Once the pinning ROBOT has backed off by 6 feet for 3 seconds, it may again attempt to pin its opponent, and if successful, the 5 second count will start over. *Violation: One PENALTY for each violation.*

<G40> ROBOT to ROBOT Entanglement – ROBOTS may not entangle other ROBOTS. The TEAM will be required to repair the entangling elements before the ROBOT will be permitted to participate in subsequent MATCHES. *Violation: Disablement if attempts to disengage are causing damage or a dangerous situation or if entanglement occurs repeatedly, plus a RED CARD if a ROBOT intentionally entangles an opposing ROBOT.*

<G41> Detaching MECHANISMS - ROBOTS may not intentionally detach parts or leave MECHANISMS on the FIELD. *Violation: PENALTY for each incident and potential RED CARD if an intentionally detached COMPONENT or MECHANISM impedes MATCH play.*

a. Bumper covers must not detach, even unintentionally, from the ROBOT. *Violation: PENALTY.*

<G42> ARENA Reset Delay - ROBOTS must release any portions of the TOWER, PLATFORM, or ALLIANCE ROBOT without power after a MATCH. *Violation: YELLOW CARD*.

7.3.5.3 Robot BALL Manipulation

<G43> ROBOT BALL POSSESSION - ROBOTS may POSSESS only one BALL at a time. *Violation: PENALTY.*

<G44> BALL CARRYING – ROBOTS may not CARRY BALLS. *Violation: 2 PENALTIES for each CARRIED BALL.*

> It is important to design your ROBOT so that it is impossible to inadvertently or intentionally CARRY a BALL.

<G45> Active BALL control - ROBOTS may not control BALL direction with active MECHANISMS above the BUMPER ZONE. *Violation: PENALTY.*

<G46> BALL Penetration Restriction – The BALL must not extend more than 3 inches inside the FRAME PERIMETER as defined in Rule <R19>. *Violation: PENALTY for a basic infraction, plus a YELLOW CARD if no immediate attempt to remedy.*

> A BALL trapped under a ROBOT, intentionally or unintentionally, will be considered POSSESSED until it is dislodged from the ROBOT. Teams are encouraged to design and drive with this in mind.

<G47> BALL RETURN Interference - ROBOTS may not interfere with BALLS in contact with the BALL RETURN. *Violation: Two PENALTIES per affected BALL.*

> It is important to consider this rule when designing mechanisms that interact with the TOWER. Be careful to make sure that your hanging apparatus doesn't dam the BALLS on the BALL RETURN.

7.3.6 Team Member Actions

<G48> TEAM Members in ARENA – Each ALLIANCE shall have no more than the four designated members of each of the three participating TEAMS in the ARENA during a MATCH. *Violation: Any ALLIANCE with additional personnel in the ARENA must have the additional personnel to leave the area before the MATCH may proceed.*

<G49> TEAM Positions during AUTONOMOUS PERIOD – During the AUTONOMOUS PERIOD, all TEAM members stand behind the STARTING LINE in their ALLIANCE ZONE. The HUMAN PLAYERS are permitted to reach into the CORRAL to retrieve BALLS. Any control devices worn or held by the DRIVERS must be disconnected from the OPERATOR CONSOLE, and not connected until after the AUTONOMOUS PERIOD. *Violation: One PENALTY for each violation (stepping outside the designated area, or stepping across the STARTING LINE). Exceptions will be allowed in cases involving personal or OPERATOR CONSOLE safety.*

HUMAN PLAYERS are expected to retrieve and re-enter BALLS into play during the AUTONOMOUS PERIOD, as detailed in Rule <G17>.

<G50> TEAM Positions during TELEOPERATED PERIOD - During the TELEOPERATED PERIOD, the DRIVERS, COACH and HUMAN PLAYER may travel anywhere within the ALLIANCE STATION, but they must stay within the ALLIANCE STATION boundaries, and not step outside the designated area. *Violation: One PENALTY for each violation. Exceptions will be allowed in cases involving TEAM member safety.*

<G51> DRIVERS Operating ROBOTS - During a MATCH, the OPERATOR CONSOLE shall be operated solely by the DRIVERS. *Violation: Disablement and RED CARD.*

<G52> Respect and Professional Demeanor - *FIRST* competitions promote respect and professional demeanor. While in the ARENA, including before and after a MATCH, TEAM members must be civil towards competition personnel, other TEAMS, and event attendees. *Violation: Potential RED CARD*. *TEAMS will not receive MATCH PENALTIES for off-field actions; however designated event personnel will hold them accountable for their off-field actions.*

7.3.7 Referee Interactions

<G53> REFEREE Discussions - Any discussions regarding calls, rules, scores, or penalties must be between a pre-college student member of the TEAM and the Head Referee.

<G54> Information Sources - When making a ruling, the Head Referee may receive input from other sources, particularly Game Design Committee members, *FIRST* personnel, and technical staff that may be present at an event. However, the Head Referee's decision is final as stated in Rule <T03>.