

Team Update 21

General

Last One

Team Update 21 is the final Team Update of the 2024 CRESCENDO presented by Haas season.

FIELD Design

[GE-24006](#) Rev A reflects a material change from ¼ in. polycarbonate to ⅜ in. polycarbonate. The drawing packages and the [SOLIDWORKS](#) and [STEP](#) models also reflect this modification.

FIRST Championship Playoff Communication Document

The FIRST Championship specific [Playoff Communication Document](#) is posted.

Inspection Checklist

The [Inspection Checklist V3](#) is updated to reflect the changes to the ROBOT rules described below.

Q&A Closing

The Q&A System closes April 11th at noon (Eastern). Teams attending the FIRST Championship are invited to submit questions for the Drivers' Meeting to Pit Administration by Wednesday 3:30pm (Central).

Game Manual

Section 6.5.6 Point Values

Table 6-2 CRESCENDO point values

	MATCH points		Ranking Points	Coopertition Points
	AUTO	TELEOP		
MELODY	at least <ul style="list-style-type: none"> 18 (15 if Coopertition Bonus) AMP & SPEAKER NOTES* for Regional & District level events–or 21 (18 if Coopertition Bonus) AMP & SPEAKER NOTES for District Championship events, or 25 (21 if Coopertition Bonus) AMP & SPEAKER NOTES for the FIRST Championship 		1	

Section 8 ROBOT Construction Rules

The edits below accommodate VH-109 radio use as described in this recent [FIRST Robotics Competition blog post](#) and recommendations included in Vivid Hosting's [Mounting Your Radio page](#).

R103 *ROBOT weight limit. The ROBOT weight must not exceed ~~125 lbs~~ **125.5 lbs** (~56 kg).

R616 *Power radio as specified – Part 1. The wireless bridge (radio) power must be supplied by either:

- ...
- using an Ethernet cable between a REV Radio Power Module (RPM) (P/N REV-11-1856) and the ~~"18-24v POE RIO"~~ Ethernet port on the wireless bridge, or
- directly from the PDP or PDH ports described in R617.

Note that this prohibits using any other active POE injector device to power the radio but does not prohibit using any PASSIVE CONDUCTORS to inject the VRM or direct PDP/PDH power into an Ethernet cable plugged into the radio port labeled ~~"18-24v POE RIO"~~

R617 *Power radio as specified – Part 2.

Please reference [How to Wire an FRC ROBOT](#) **Vivid Hosting's 2024 FIRST Championship Radio page** for wireless bridge wiring information.

R702 *Communicate with the ROBOT with the specified radio. 1 OpenMesh **Vivid Hosting** wireless bridge (P/N: OM5P-AN or OM5P-AC **VH-109**), that has been configured with the appropriate encryption key for your team number at each event, is the only permitted device for communicating to and from the ROBOT during the MATCH.

R703 *Use specific Ethernet port for roboRIO. The roboRIO Ethernet port must be connected to the wireless bridge port labeled ~~"18-24v POE RIO"~~ (either directly, via a network switch, via an RPM, or via a CAT5 Ethernet pigtail).

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General

n/a

Game Manual

Section 10.2 MATCH Replays

Typical causes for replays are MATCHES that end in a tie during the Playoffs (due to criteria listed in Table 10-3 or any Finals MATCH), MATCHES that are stopped because FIELD STAFF anticipated FIELD damage or personal injury, or if there is an ARENA FAULT.

Team Update 19

General

Update: Event Data Sync & NOTE Scoring

Please see [today's blog](#) for updated information about event data syncing and NOTE scoring.

Wild Cards

[The Championship Eligibility Criteria webpage](#) is updated to include that a team that receives a *FIRST* Championship slot via the Priority Waitlist generates a Wild Card.

Statement on Game Play

Game play this season is more forceful than past seasons, and *FIRST* Robotics Competition staff, with input and insight from members of the *FIRST* community, commit to working on a long-term solution to meter robot-to-robot impacts and robot-to-field impacts in ways that reduce the likelihood of damage while minimizing cost and complexity for both teams and the fields. Meanwhile, game play is likely to continue to include hard hits and unintentional robot damage. Intentional damage, as perceived by a REFEREE is, and will continue to be prohibited.

Game Manual

Section 7.4.3 ROBOT

G415 [Watch your ARENA interaction](#). With the exception of GAME PIECES, addressed by [G410](#), a ROBOT may not damage an ARENA element. A ROBOT is prohibited from the following interactions with an ARENA element, except chain (see [G416](#)) and a GAME PIECE (see [Section 7.4.2 GAME PIECES](#)).

- A. grabbing,
- B. grasping,
- C. attaching to (including the use of a vacuum or hook fastener to anchor to the FIELD carpet),
- D. becoming entangled with, and
- E. suspending from.

Violation: TECH FOUL, plus YELLOW CARD if REPEATED, or longer than MOMENTARY, or for any subsequent damage during the MATCH or event. If the Head REFEREE infers that damage is likely, DISABLED. 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.

Section 10.5.3 Qualification Ranking

The edit below does not change past event rankings; it updates the documentation to reflect the way the calculation has been implemented all season.

The total number of Ranking Points earned by a team throughout their Qualification MATCHES divided by the number of MATCHES they've been scheduled to play (minus any SURROGATE MATCH), then ~~truncated~~ **rounded** to 2 decimal places, is their Ranking Score (RS).

Section 10.6.5 Pit Crews

During the Playoff MATCHES and because of the distance between the FIELD and the pit area, extra team members may be needed to maintain **and otherwise assist with** the ROBOT between MATCHES. Each team is permitted to have up to 3 additional pit crew members to help with needed ROBOT repairs/maintenance.

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General

Event Results Syncing

We are aware that event schedules, match results, and videos available at frc-events.firstinspires.org and via the API may be delayed or not posting for all events (though the data is stored) and are investigating the issue.

Playoff Communication Document

The [Playoff Communication Document](#) V1 includes the following edits:

- Page 2 is updated to reflect the edit to G301 violation language from [Team Update 17](#).
- Language is added to remind participants that, per Section 10.6.2, once the Playoff tournament progresses to a subsequent round, MATCHES from any previous rounds may not be replayed.

WPILib Update

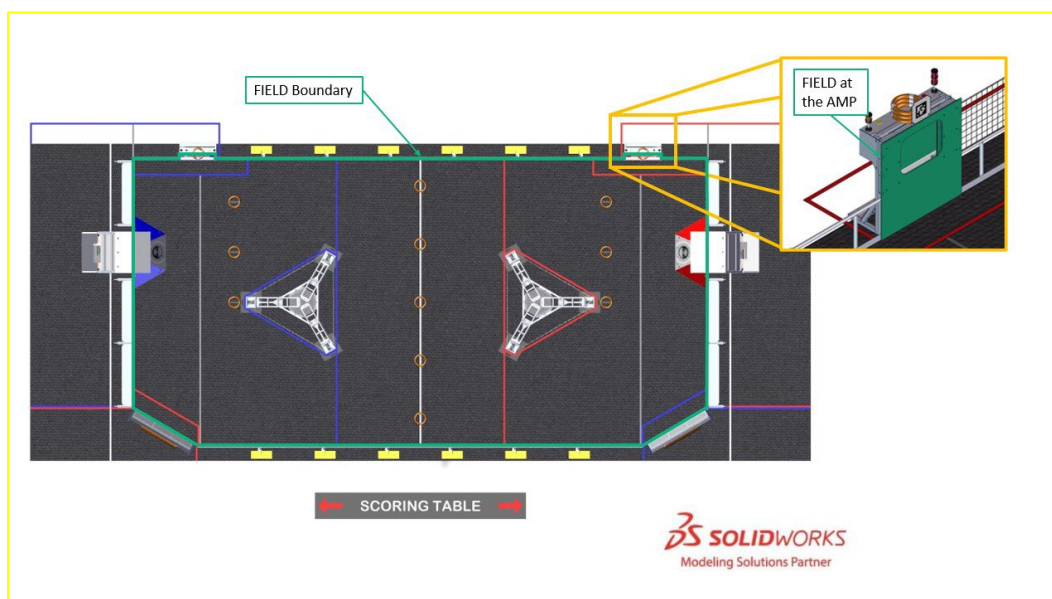
[WPILib version 2024.3.2](#) is published and addresses a number of causes of Java code not restarting after crash or when requested by the DS. A full changelog is published on the release page.

Game Manual

Section 5.1 FIELD

Figure 5-2 is updated to reflect that the AMP pocket walls are part of the FIELD.

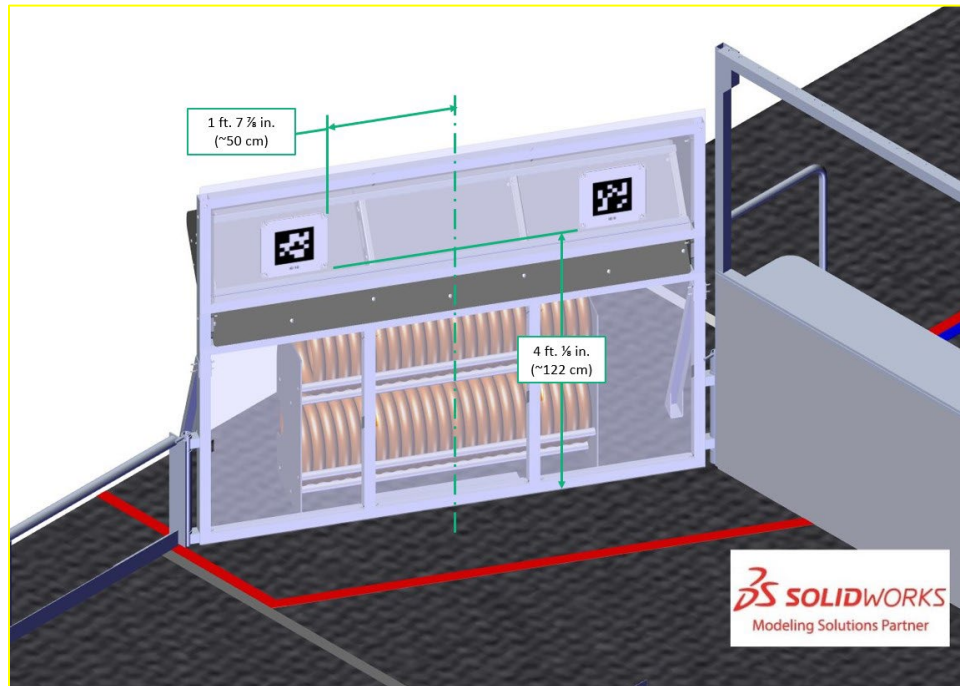
Figure 5-2 FIELD boundary in green



Section 5.8 AprilTags

Figure 5-21 is updated to correct the horizontal dimension (~~1 ft. 7 $\frac{3}{8}$ in.~~ 1 ft. 7 $\frac{7}{8}$ in.)

Figure 2-21 SOURCE AprilTags



Section 6.5.6 Point Values

Table 6-2 CRESCENDO point values

MELODY	At least 18 (15 if <i>Coopertition</i> Bonus) AMP & SPEAKER NOTES* for Regional & District level events or 21 (18 if <i>Coopertition</i> Bonus) AMP & SPEAKER NOTES for District Championship events	1	
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Section 14 Glossary

The definition of MELODY is updated per the edit detailed above.

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General

n/a

Game Manual

Section 7.2 Conduct

G211 ***Don't expect to gain by doing others harm.** A strategy clearly aimed at forcing the opponent ALLIANCE to violate a rule is not in the spirit of FIRST Robotics Competition and not allowed. Rule violations forced in this manner will not result in an assignment of a penalty to the targeted ALLIANCE.

Violation: FOUL, plus TECH FOUL if REPEATED.

This rule does not apply for strategies consistent with standard gameplay, for example:

- A. a red ALLIANCE ROBOT in their STAGE ZONE in the final 20 seconds of the MATCH contacts a blue ALLIANCE ROBOT.
- B. a blue ROBOT attempts to cut between the red AMP ZONE and the red STAGE, and a nearby red ROBOT tries to impede it via a defensive bump and, as a result, the blue ROBOT crosses into the red AMP ZONE.
- C. a blue ROBOT attempts to enter their SOURCE ZONE to retrieve a NOTE and pushes a red ROBOT just outside the blue SOURCE ZONE into it.

This rule requires an intentional act with limited or no opportunity for the team being acted on to avoid the penalty, such as:

- D. forcing an opponent ROBOT to have greater than MOMENTARY CONTROL of more than 1 NOTE.
- E. a blue ALLIANCE ROBOT, already in CONTROL of a NOTE, pushing a red ALLIANCE ROBOT from fully outside and far from (i.e. more than 4 ft. (~121 cm)) the blue SOURCE ZONE into the blue SOURCE ZONE and the REFEREE perceiving that the blue ROBOT is deliberately making the red ROBOT violate [G423](#).
- F. a blue ALLIANCE ROBOT pushes a red ALLIANCE ROBOT from the red WING into the blue STAGE ZONE. The REFEREE infers that the blue ROBOT'S strategy is to force the red ALLIANCE ROBOT to violate G424 via contact with blue ALLIANCE ROBOTS in their STAGE ZONE during the last 20 seconds of the MATCH. This is a violation of this rule, will not result in an assignment of the G424 penalty, and, because severity of the action and magnitude of the attempted outcome, is likely egregious as described in [G212](#).

Section 7.3 Pre-MATCH

G301 ***Be prompt.**

Violation: **If a Qualification MATCH**, verbal warning, or if a subsequent violation within the tournament phase (i.e. ~~Qualifications or Playoffs~~), TECH FOUL applied to their upcoming MATCH. If the DRIVE TEAM is not MATCH ready within 2 minutes of the verbal warning/TECH FOUL and the Head REFEREE perceives no good faith effort by the DRIVE TEAM to quickly become MATCH ready, DISABLED. **If a Playoff MATCH**, verbal warning issued the ALLIANCE, or if an ALLIANCE'S subsequent violation within the tournament phase, TECH FOUL applied to their upcoming MATCH. If the ALLIANCE is not MATCH ready within 2 minutes of the verbal warning having been issued to all 3 teams/TECH FOUL and the Head REFEREE perceives no good faith effort by the DRIVE TEAM to quickly become MATCH ready, their ROBOT is DISABLED.

Team Update 16

General

Driver Station Update

An optional update to the Driver Station software, 24.0.2, is available in the FRC Game Tools software bundle posted on the [NI FRC Game Tools webpage](#). This version corrects an issue with reporting diagnostics to the Field Monitor at events.

ARENA Damage

ARENAS used in week 1 events suffered severe damage due to distinct, violent, and extreme impacts by ROBOTS on the FIELD border. We'd like to use this opportunity to remind DRIVE TEAMS of G415. Head REFEREES are instructed to apply G415 for these scenarios to protect the integrity of the ARENA (and the viability of the event); violently ramming into the FIELD border or other element is likely to result in damage and will be penalized as such.

Game Manual

Section 6.3.2 OPERATOR CONSOLES

Any control devices worn or held by their HUMAN PLAYERS and/or DRIVERS during the MATCH must be disconnected from **or set on or beside** the OPERATOR CONSOLE before the MATCH can begin.

Section 7.3 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

Event volunteers communicate schedule delays with teams to the best of their ability. The Pit Display (which is typically located near the Pit Administration desk) shows any event timing delay. Announcements on the FIELD and in the pits also provide information on delays, and any team uncertain of when to queue for a MATCH should communicate with queuing volunteers.

During Qualification MATCHES, the expected start time of the MATCH is the time indicated on the MATCH schedule or **~4 minutes the cycle time for current round minus 3 minutes** from the end of the previous MATCH (which is reflected on the schedule on the Pit Display), whichever is later.

During Playoff MATCHES, the expected start time of the MATCH is the time indicated on the MATCH schedule or 15 minutes from either ALLIANCE'S previous MATCH, whichever is later.

- B. The DRIVE TEAM has access to the FIELD 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.

Section 7.4.1 AUTO

G405 Limited AUTO opponent interaction. In AUTO, a ROBOT whose BUMPERS have **are** completely crossed **across** the CENTER LINE (i.e. to the opposite side of the CENTER LINE from its ROBOT STARTING ZONE) may contact neither an opponent ROBOT nor a NOTE staged in the opponent's WING (regardless of who initiates the contact).

Violation: TECH FOUL.

Section 7.4.2 GAME PIECES

G407 *Keep NOTES in bounds. A ROBOT may not intentionally eject a NOTE from the FIELD (either directly or by bouncing off a FIELD element or other ROBOT) other than through **a** SPEAKER or AMP.

Violation: TECH FOUL per NOTE

G409 1 NOTE at a time.

Excessive violations of CONTROL limits include, but are not limited to, simultaneous CONTROL of 3 or more NOTES or frequent, **greater-than-MOMENTARY** CONTROL (i.e. more than twice in a MATCH) of 2 or more NOTES.

Section 7.4.4 Opponent Interaction

G418 *This isn't combat robotics.

- A. ...
- B. regardless of intent, by initiating contact, either directly or transitively via a NOTE **GAME PIECE** CONTROLLED by the ROBOT, inside the vertical projection of an opponent ROBOT'S FRAME PERIMETER.

G422 PODIUM protection. Prior to the last 20 seconds of a MATCH, a ROBOT may not contact (either directly or transitively through a NOTE **GAME PIECE CONTROLLED by either ROBOT** and regardless of who initiates contact) an opponent ROBOT whose BUMPERS are in contact with their PODIUM.

G423 SOURCE/AMP ZONE protection. A ROBOT may not contact (either directly or transitively through a NOTE **GAME PIECE CONTROLLED by either ROBOT** and regardless of who initiates contact) an opponent ROBOT if any part of either ROBOT'S BUMPERS are in the opponent's SOURCE ZONE or AMP ZONE.

G424 STAGE protection. A ROBOT may not contact (either directly or transitively through a NOTE **GAME PIECE CONTROLLED by either ROBOT** and regardless of who initiates contact) an opponent ROBOT if either of the following criteria are met:

- A. ...
- B. ...

Section 10.6.3.1 BACKUP TEAM Coupons

T606 ***BACKUP TEAMS due 2 minutes before the MATCH start time.** The BACKUP TEAM Coupon must be submitted to the Head REFEREE (or their designee) by the ALLIANCE CAPTIAN **no later than** 2 minutes before the expected MATCH start time in which the BACKUP TEAM is to play.

Violation: The request is denied

If the Head REFEREE is busy, and there is no designee, the ALLIANCE CAPTAIN remains in the Question Box to submit the BACKUP TEAM coupon.

Team Update 15

General

AMPLIFIED Scoring Timing

We are aware of, and have resolved, an error observed at ISR District Event #1 in which the 3-second extension after AMPLIFICATION described in [Section 6.5.3 AMPLIFICATION](#) was not active. All event results are final and will not be adjusted.

Game Manual

Section 6.2 DRIVE TEAM

There are 4 specific roles on a DRIVE TEAM which ALLIANCES can use to assist ROBOTS with CRESCENDO, and at least 4 of the 5 DRIVE TEAM members must qualify as a STUDENT no more than 1 member of the DRIVE TEAM may be a non-STUDENT.

Section 6.5.2 ROBOT Scoring Criteria

To qualify for ONSTAGE points, a ROBOT may only be contacting:

- A. ...
- ...
- G. ...another a partner ROBOT awarded the ENSEMBLE RP because of a contacted by an opponent in violation of [G424](#) infraction, and
- H. ...

Section 8.4 BUMPER Rules

R406 *Team number on BUMPERS.

- A. ...
- B. ...
- C. must not split individual digits by more than 2 in. (~5 cm) such that the team number is ambiguous, and

As a guideline, spacing between digits or groups of digits which exceeds ~4 in. (~10 cm) may be ambiguous.

- D. ...

Team Update 14

General

Clerical Note

With the edit to the definition of CONTROL in [Team Update 13](#), the Glossary should have been updated to reflect the change and the version incremented. This was an oversight and is now current.

FIELD Design

Field assets (official [drawings](#), [SOLIDWORKS](#) & [STEP](#) CAD models) hosted on the [Playing Field webpage](#) are updated as follows:

- The orientation of item 3 is adjusted on *Ring Counters Red* and *Blue* (GE-24118 & GE24119)
- Items 10 and 11 are added to *Stage Lateral Support* (GE-24250)
- *Speaker Front Wall Addition* (GE-24394) is new and included in the *Speaker* assembly (GE-24300)

NOTE Condition

A [NOTE Usability Guide](#) that details different levels of NOTE degradation is published.

NOTE Counter Guidance for FIELD Staff

A [NOTE Counter Assessment document](#) that details different scenarios for NOTES through the counters is published for FIELD staff.

Q&A

The answer to [Q177](#) is updated with an appropriate response.

Game Manual

Section 5.1 FIELD

The surface of the FIELD is low pile carpet, Shaw Floors, Philadelphia Commercial, Neyland II 20, “66561 Medallion.” Neyland II carpet is not available for purchase, and the closest equivalent is [Shaw, Philadelphia Brand, Profusion 20, Style 54933](#); see results from FIRST’s evaluation in [this blog post](#). The edge of the carpet is secured to the venue floor using 3M™ Premium Matte Cloth (Gaffers) Tape GT2 or comparable gaffers tape.

Section 6.5 Scoring

All scores are assessed and updated throughout the MATCH, except as follows:

- assessment of NOTES scored in SPEAKERS continues for up to 3 seconds after the ARENA timer displays 0:00 following AUTO.

-
- B. assessment of NOTES scored in SPEAKERS continues for up to 3 **5** seconds after the ARENA timer displays 0:00 following TELEOP.
 - C. assessment of STAGE points is made 5 seconds after the ARENA timer displays 0:00 following TELEOP, or when all ROBOTS have come to rest following the conclusion of the MATCH, whichever happens first.

Team Update 13

General

Inspection Checklist

Rev 2 of the [Inspection Checklist](#) includes a check for risk to GAME PIECES (R206) and modified language regarding pool noodles and ROBOT Signal Lights to better reflect [Game Manual](#) content.

Game Manual

Section 5.3 AMP

An AMP is a structure used by ROBOTS to pass NOTES to the ALLIANCE AREA. There is 1 AMP per ALLIANCE. Each AMP has a vertical pocket that is 3 $\frac{7}{8}$ in. deep (~10 cm), 1 ft. 6 in. tall (~46 cm), and 2 ft. wide (~61 cm). The bottom of the pocket is 2 ft. 2 in. (~66 cm) from the carpet. Each AMP is 4 ft. 1 $\frac{1}{2}$ in. (~126 cm) from the closest ALLIANCE WALL. **To keep the AMP clear for scoring, the HUMAN PLAYER can shift scored NOTES away from the AMP exit.**

Section 7.4.1 AUTO

G403 1 NOTE at a time. In AUTO, a ROBOT may not CONTROL more than 1 NOTE at a time, either directly or transitively through other objects.

A ROBOT is in CONTROL of a NOTE if:

- A. the NOTE is fully supported by **or stuck in, on, or under** the ROBOT or
- B. it intentionally pushes a NOTE to a desired location or in a preferred direction (i.e. herding).

Examples of interaction with a NOTE that are not “CONTROL” include, but are not limited to:

- A. “bulldozing” (inadvertent contact with a NOTE while in the path of the ROBOT moving about the FIELD)
- B. “deflecting” (being hit by a NOTE that bounces into or off a ROBOT).

~~If a NOTE becomes lodged in or on a ROBOT, it is considered CONTROLLED by the ROBOT.~~ It is important to design your ROBOT so that it is impossible to inadvertently or unintentionally CONTROL more than the limit.

A ROBOT that pushes a NOTE from its staged location as described in [Section 6.3.4 GAME PIECES](#) may be considered herding that NOTE per [G403-B](#). A ROBOT that pushes a NOTE that is no longer in its staged location is likely considered having bulldozed the NOTE per part A of this Blue Box.

Violation: TECH FOUL per additional NOTE.

G405 Limited AUTO opponent interaction. In AUTO, a ROBOT whose BUMPERS have completely crossed the CENTER LINE (i.e. to the opposite side of the CENTER LINE from its ROBOT STARTING ZONE) may contact neither an opponent ROBOT nor a NOTE staged in the opponent’s WING **(regardless of who initiates the contact)**.

Violation: **TECH FOUL**.

Section 7.4.2 GAME PIECES

G409 **1 NOTE at a time.** In TELEOP, a ROBOT may neither

- A. leave its SOURCE ZONE with CONTROL of more than 1 NOTE nor
- B. have greater-than-MOMENTARY CONTROL of more than 1 NOTE, either directly or transitively through other objects, while outside their SOURCE ZONE.

Violation: **FOUL** per additional NOTE, plus **YELLOW CARD** if excessive.

Excessive violations of CONTROL limits include, but are not limited to, simultaneous CONTROL of 3 or more NOTES, ~~CONTINUOUS CONTROL of 2 or more NOTES~~, or frequent CONTROL (i.e. more than twice in a MATCH) of 2 or more NOTES.

Section 10.2 MATCH Replays

An ARENA FAULT is an error in ARENA operation that includes, but is not limited to:

- A. broken FIELD elements due to
 - a. normal, expected game play or
 - b. ROBOT abuse of FIELD elements that affects the outcome of the MATCH for their opponents,

A broken FIELD element caused by ROBOT abuse that affects the outcome of the MATCH for their ALLIANCE is not an ARENA FAULT.

- B. power failure to a portion of the FIELD (tripping the circuit breaker in the DRIVER STATION is not considered a power failure),
- C. improper activation by the FMS,
- D. errors by FIELD STAFF (except those listed in [Section 6.8 Other Logistics](#)), and
- E. a ROBOT radio disconnect that impairs operation of other ROBOTS on the FIELD for more than 8 seconds.

...

Note that an ARENA FAULT that does not affect MATCH outcome, in the judgement of the Head REFEREE, does not lead to a MATCH replay. Examples include, but are not limited to:

- A. a piece of FIELD plastic falls into the FIELD, far away from any human or ROBOT activity, and in such a way that it does not affect MATCH outcome,
- B. delay in the playing of an ARENA sound,
- C. mismatch between the timer on the audience screen and the ARENA timer,
- D. any adjustment or delay in assignment of a penalty (including those made after the MATCH), and
- E. **the disconnect described in** scenario E occurring before the last 20 seconds of the MATCH.

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General

n/a

Game Manual

Section 7.4.3 ROBOT

G415 Watch your ARENA interaction. With the exception of GAME PIECES, addressed by G410, a ROBOT may not damage an ARENA element. A ROBOT is prohibited from the following interactions with an ARENA element, except chain (see [G416](#)) and a GAME PIECE (see [Section 7.4.2 GAME PIECES](#)).

- A. grabbing,
- B. grasping,
- C. attaching to (including the use of a vacuum or hook fastener to anchor to the FIELD carpet),
- D. becoming entangled with, and
- E. suspending from.

Violation: TECH FOUL, plus YELLOW CARD if REPEATED or longer than MOMENTARY. If the Head REFEREE infers that damage is likely, DISABLED. 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.

Team Update 11

General

n/a

Game Manual

Section 5.2 Areas, Zones & Markings

- WING: an infinitely tall volume bounded by the ALLIANCE WALL, opponent's SOURCE wall, guardrail, the ALLIANCE colored line that spans the width of the FIELD, and AMP wall. **The WING includes the tape.**

Section 6.6.4 Violation Details

EXAMPLE VIOLATION

EXPANDED INTERPRETATION

**TECH FOUL, PLUS
AND AN
ADDITIONAL TECH
FOUL FOR EVERY 5
SECONDS IN WHICH
THE SITUATION IS
NOT CORRECTED, A
TECH FOUL IS
ASSESSED**

Upon violation, a TECH 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 5 seconds within that time, an additional TECH FOUL is assessed against the violating ALLIANCE. A ROBOT in violation of this type of rule for 15 seconds receives a total of 4 TECH FOULS (assuming no other rules were being simultaneously violated).

Section 7.2 Conduct

G212 *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.

Please see [Section 6.6.1 YELLOW and RED CARDS](#) for additional detail.

Violation: YELLOW or RED CARD.

The intent of this rule is to provide the Head REFEREES 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 **or integrity of the game** at risk. Those behaviors include, but are not limited to the list below:

A. inappropriate behavior as outlined in the blue box of [G201](#),

- B. jumping over the guardrail,
- C. pushing past the FIELD reset person blocking an open gate to get on the FIELD,
- D. reaching into the FIELD and grabbing a ROBOT during a MATCH,
- E. PINNING in excess of 15 seconds,
- F. exploiting the 5-second window after a MATCH described in Section 6.5 Scoring to avoid rule violations (e.g. triggering an over-extension that enables ONSTAGE points or using a ROBOT'S residual energy to impact an opponent ROBOT on their STAGE),
- G. triggering scoring sensors or otherwise interfering with FMS or FIELD operation,
- H. feeding a NOTE to a ROBOT from behind the AMP, violating G429, to increase rate of scoring and accelerate progress toward the MELODY RP, and
- I. climbing on a STAGE.

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.

Section 7.3 Pre-MATCH

G303 *Start your ROBOTS. A ROBOT must meet all following MATCH-start requirements:

- A. it does not pose a hazard to humans, FIELD elements, or other ROBOTS,
- B. has passed **initial, complete** inspection, i.e. it's compliant with all ROBOT rules (for exceptions regarding Practice MATCHES, see [Section 10.4 Practice MATCHES](#)),
- C. ...

Section 7.4.2 GAME PIECES

G410 Don't abuse GAME PIECES. Neither a ROBOT nor a HUMAN PLAYER may damage a GAME PIECE.

*Violation: Verbal warning, plus, **TECH FOUL** if REPEATED **in any subsequent MATCHES during the event.***
If via a ROBOT and the Head REFEREE determines that further damage is likely to occur, DISABLED.
Corrective action (such as eliminating sharp edges, removing the damaging MECHANISM, and/or re-inspection) may be required before the ROBOT may compete in subsequent MATCHES.

Section 7.4.4 Opponent Interaction

G420 *There's a 5-count on PINS. A ROBOT may not PIN an opponent's ROBOT for more than 5 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). A PIN count ends once any of the following criteria below are met:

- A. the ROBOTS have separated by at least 6 ft. (~183 cm) from each other for more than 5 seconds,
- B. either ROBOT has moved 6 ft. from where the PIN initiated for more than 5 seconds, or
- C. the PINNING ROBOT gets PINNED.

For criteria A and B, the PIN count pauses once ROBOTS are separated by 6 ft. until either the PIN ends or the PINNING ROBOT moves back within 6 ft., at which point the PIN count is resumed.

For criteria B, the PIN count pauses once either ROBOT has moved 6ft from where the PIN initiated until the PIN ends or until both ROBOTS move back within 6ft., at which point the PIN count is resumed.

Violation: FOUL, ~~plus and an additional TECH FOUL~~ for every 5 seconds in which the situation is not corrected, ~~a TECH FOUL is assessed~~.

G421 *Don't collude with your partners to shut down major parts of game play. 2 or more ROBOTS that appear to a REFEREE to be working together may not isolate or close off any major element of MATCH play.

Violation: TECH FOUL, ~~plus and an additional TECH FOUL~~ for every 5 seconds in which the situation is not corrected, ~~a TECH FOUL is assessed~~.

Section 8.4 BUMPER Rules

R408 *BUMPER construction. BUMPERS must be constructed as follows, such that the cross section resembles Figure 8-6:

- A. ...
- B. ...
- C. use a stacked pair of 2½ in. (~63 mm) round, petal, or hex "pool noodles" (solid or hollow) as the BUMPER cushion material (see Figure 8-6). All pool noodles used in a BUMPER set (e.g. red set of BUMPERS) may not be modified (with the exception of cutting to length or cutting to facilitate mating pool noodles at the corners as required by [R409](#)) or deformed and must be the same diameter, cross section, and density (e.g. all round hollow or all hex solid). Pool noodles may be attached together using soft fasteners like tape, provided the physical properties of the BUMPER are not significantly altered. Per [R409](#) cushion material may extend beyond the end of the plywood in order to fill a corner (see Figure 8-7). To assist in applying the fabric covering, soft fasteners may be used to attach the pool noodles to the wood backing, so long as the cross section in Figure 8-6 is not significantly altered (e.g. tape compressing the pool noodles).

Section 8.5 Motors & Actuators

R501 *Allowable motors.

Table 8-1 Motor allowances

Motor Name	Part Numbers Available
COTS linear actuators rated for 12V and wired downstream of a breaker 20A or less	

Section 8.6 Power Distribution

R621 *Protect circuits with appropriate circuit breakers.

Table 8-2 Branch circuit protection requirements

Branch Circuit	Circuit Breaker/Fuse Value	Quantity Allowed Per Breaker
Servo Power Module	Up to 20A	1

R625 *Don't modify critical power paths. CUSTOM CIRCUITS shall not directly alter the power pathways between the ROBOT battery, PDP/PDH, motor controllers, relays (per [R504-B](#)), motors and actuators (per [R501](#)), pneumatic solenoid valves, or other elements of the ROBOT control system (items explicitly mentioned in [R701](#) [R710](#)). Custom high impedance voltage monitoring or low impedance current monitoring circuitry connected to the ROBOT'S electrical system is acceptable, if the effect on the ROBOT outputs is inconsequential.

Section 8.7 Control, Command & Signals System

R710 *Only specified modifications to control system devices permitted. The Driver Station Software, roboRIO, PDP/PDH, PCM(s)/PH(s), VRM(s)/RPM(s), RSL, 120A breaker, motor controllers, MXP devices used to control actuators per [R713-C](#), relay modules (per [R504-B](#)), wireless bridge, PDH/PDP breakers and fuses, **Servo Power Module**, and batteries shall not be tampered with, modified, or adjusted in any way (tampering includes drilling, cutting, machining, rewiring, disassembling, painting, etc.), with the following exceptions:

Please note that the Driver Station Software is a separate application from the Dashboard. The Driver Station Software may not be modified, while teams are expected to customize their Dashboard code.

- A. User programmable code in the roboRIO may be customized.
-
- R. adding insulating material to exposed conductors on PDH/PDP breakers and fuses.
- ...
- T. tape may be applied for debris protection.**

Team Update 10

General

Robot Transportation

A link to information about [Robot Transportation](#) is posted in the *Additional Season Material* section of [the Game & Season webpage](#).

Game Manual

Section 6.6.4 Violation Details

Table 6-5 Violation examples

EXAMPLE VIOLATION	EXPANDED INTERPRETATION
FOUL, PLUS TECH FOUL IF REPEATED	Upon initial violation in a MATCH, a FOUL is assessed against the violating ALLIANCE. If the ALLIANCE ROBOT repeats the infraction in the MATCH, a FOUL and a TECH FOUL are assessed against the violating ALLIANCE. Assuming no additional infractions of that rule by that ROBOT in that MATCH, the ROBOT has “earned” 2 FOULS and a TECH FOUL for their ALLIANCE.

Section 7.4.3 ROBOT

G414 **No full-court shots.** A ROBOT with any part of its BUMPERS in their opponent’s WING may not cause a NOTE to travel into or through their WING.

Violation: FOUL, plus TECH FOUL for subsequent violations in the MATCH if REPEATED.

Section 7.4.5 Human

G425 ***No wandering.** A DRIVE TEAM member must remain in their designated area as follows:

- A. a DRIVER may not contact anything outside the area in which they started the MATCH (i.e. the ALLIANCE AREA or SOURCE AREA),
- B. a DRIVER must use the OPERATOR CONSOLE in the DRIVER STATION to which they are assigned, as indicated on the team sign,
- C. a HUMAN PLAYER may not contact anything outside the area in which they started the MATCH (i.e. the ALLIANCE AREA or SOURCE AREA),
- D. a COACH may not contact anything outside the ALLIANCE AREA or in front of their COACH LINE, and
- E. a TECHNICIAN may not contact anything outside their designated area.

Exceptions are granted for a HUMAN PLAYER partially outside the ALLIANCE or SOURCE AREA (but not in the opponent ALLIANCE or SOURCE AREA), in cases concerning safety, and for actions that are inadvertent, MOMENTARY, and inconsequential.

Section 8.7 Control, Command & Signal Systems

R710 *Only specified modifications to control system devices permitted.

N. the cover may be removed from the Talon SRX or Talon FX data port.

Section 9 Inspection & Eligibility

At each event, the Lead ROBOT INSPECTOR (LRI) has final authority on the legality of any COMPONENT, MECHANISM, or ROBOT. The LRI may consult with additional sources including the Chief LRIs and/or FIRST personnel before making their final decision. INSPECTORS may re-inspect ROBOTS at any time to ensure compliance with the rules. Teams are encouraged to consult with INSPECTORS or the LRI if they have any questions regarding the legality of a ROBOT or about how to make a ROBOT legal.

The inspection process may progress in blocks, i.e. it may pause for a team's Practice MATCH, ~~slot on the practice field~~, lunch break, etc. The process may employ various INSPECTORS throughout the process based on availability. At the team's discretion, they may request a different INSPECTOR or invite the Lead ROBOT INSPECTOR to participate in their ROBOT'S inspection.

Section 13.1 General Rules

E117 *Inspection for Practice Fields. A team may only use a Practice Field the designated event practice areas with a ROBOT that has passed an initial, complete inspection.

Q&A

The response to [Q134](#) is corrected and reflects the edit to G414.

Team Update 09

General

NOTE Availability

AndyMark was successful in placing a second order of NOTES, and the new batch was delivered. AndyMark opened sales at noon Eastern today and is limiting quantities to 6 per team/order. A third batch of NOTES are expected at AndyMark on or around February 14. AndyMark will fulfill all backorders from the initial sales with this third shipment and communicate details to customers directly. A fourth order of NOTES is likely, but no information is available at this time.

Q&A

The response to [Q135](#) is edited to answer the question asked.

Game Manual

n/a

Team Update 08

General

Control System

[Game Tools 2024 Patch 1](#) is posted with the following updates:

- DS - fix for incorrect printing of error messages
- DS - bug fix that eases requirements of new watchdog behavior
- DS - clicking the button to download logs with no connected roboRIO doesn't lock DS for 60s
- Log File Viewer - fix window loading off screen
- roboRIO Image version 2024_v2.2 - NetworkTables fixes for teams using LabVIEW. C++\Java teams may use this image, but will see no change from version 2024_v2.1.

Inspection Checklist

The [Inspection Checklist](#) is available on the [Season Materials webpage](#).

Game Manual

Section 8.6 Power Distribution

R601 ***Battery limit – everyone has the same power.** The only legal source of electrical energy for the ROBOT during the competition, the ROBOT battery, must be 1 and only 1 non-spillable sealed lead acid (SLA) battery with the following specifications:

- Nominal voltage: 12V
- Nominal capacity at 20-hour discharge rate: minimum 17Ah, maximum 18.2Ah
- Shape: Rectangular
- Nominal Dimensions: 7.1 in. x 3 in. x 6.6 in., +/- .1 in. for each dimension (~ 180 mm x 76mm x 168 mm, +/- 2.5 mm for each dimension)
- Nominal weight: 11lbs. to 14.5 lbs. (~5 kg. to 6.5 kg.)
- Terminals: Nut and bolt style

"Nut and bolt style" refers to any style battery terminal where the connector is secured to the battery using a threaded fastener.

Examples of batteries which meet these criteria include:

- Energys (P/N NP18-12, NP18-12B, NP18-12BFR),
- MK Battery (P/N ES17-12),
- Battery Mart (P/N SLA-12V18),
- Sigma (P/N SP12-18),
- Universal Battery (P/N UB12180),
- Power Patrol (P/N SLA1116),
- Werker Battery (P/N WKA12-18NB),
- Power Sonic (P/N PS-12180NB),
- Yuasa (P/N NP18-12B),

- J. Panasonic (P/N LC-RD-1217),
- K. Interstate Batteries (P/N BSL1116), and
- L. Duracell Ultra Battery (P/N DURA12-18NB).

Teams should be aware that they may be asked to provide documentation of the specifications of any battery not listed above.

Batteries should be charged in accordance with manufacturer's specification. (Please see the [FIRST Safety Manual](#) for additional information.)

R621 *Protect circuits with appropriate circuit breakers.

Table 8-3 Branch circuit protection requirements

Branch Circuit	Circuit Breaker/ Fuse Value	Quantity Allowed Per Breaker
Motor Controller	Up to 40A	1
CUSTOM CIRCUIT	Up to 40A	No limit
Automation Direct Relay 40A (*6M40*)	Up to 40A	1
Fans permitted per R501 and not already part of COTS computing devices	Up to 20A	No limit
Spike Relay Module	Up to 20A	1
Automation Direct Relay 25A (*6M25*)	Up to 20A	1
PCM/PH – with compressor	Up to 20A	1
Additional VRM (non-radio)/Additional PCM/PH (non-compressor)	Up to 20A	3 total
Automation Direct Relay 12A (*6M12*)	Up to 10A	1

Team Update 07

General

n/a

Game Manual

Section 7.1 Personal Safety

- G104** ***Teams may not enable their ROBOTS on the FIELD.** Teams may not tether to the ROBOT while on the FIELD except in special circumstances (e.g. after Opening Ceremonies, before an immediate MATCH replay, etc.) and with the express permission from the FTA or a REFEREE.

Violation: Verbal warning, plus YELLOW CARD if subsequent violations during the event.

Teams are encouraged to consider this rule when developing their ROBOTS.

FMS will not enable ROBOTS after the conclusion of the MATCH.

Tethering For the purposes of this rule, tethering includes any wired or wireless connection used to electrically energize and/or control elements on the ROBOT. The safety of teams and volunteers in close proximity to ROBOTS and ARENA elements on the FIELD is of the utmost importance, therefore ROBOTS or ROBOT COMPONENTS may not be enabled in any way on the FIELD before or after the MATCH.

ROBOTS need to be safely transported off the FIELD and back to the pits after the MATCH, and there may be bystanders, doorways, or height restrictions along the route.

Depluralization

There are many rules in the 2024 Game Manual where plural nouns are used arbitrarily. In some instances, the plural noun makes the rule or the assignment of the violation ambiguous (e.g. if a rule says HIGH NOTES cannot be entered into the FIELD before the final 20 seconds of a MATCH, and a violation results in a FOUL, does that mean it's a FOUL per HIGH NOTE entered prematurely, or a FOUL for entering any number of HIGH NOTES prematurely?) The edits below bring the language of each rule into parity with the intended violation assignment and the language at the start of Section 6.6. Violations ("Upon any instance of a rule violation, unless otherwise noted, 1 or more of the penalties listed in Table 6-3 are assessed.") These edits are considered "housekeeping," and don't change the original intent of any of the rules or their violations.

- G101** ***Humans, stay off the FIELD until green.** ~~Team members~~ A team member may only enter the FIELD if FIELD lighting (SUBWOOFER and FIELD facing side of the team signs and timers) is green, unless explicitly instructed by a REFEREE or an FTA.

Violation: Verbal warning, plus YELLOW CARD if subsequent violations during the event.

- G102** ***Never step over the guardrail.** ~~Team members~~ A team member may only enter or exit the FIELD through open gates.

Violation: Verbal warning, plus YELLOW CARD if subsequent violations during the event.

G103 *Be careful what you interact with. Team members are **A team member is** prohibited from the following actions with regards to interaction with ARENA elements.

- A. climbing on or inside,
- B. hanging from,
- C. manipulating such that it doesn't return to its original shape without human intervention, and
- D. damaging.

Violation: Verbal warning, plus YELLOW CARD if subsequent violations during the event.

G202 *Don't bang on the glass. Team members **A team member** may never strike or hit the DRIVER STATION plastic windows.

Violation: Verbal warning, plus YELLOW CARD if subsequent violations during the event.

G207 *Don't abuse ARENA access. Team members **A team member** (except DRIVERS, HUMAN PLAYERS, and COACHES) granted access to restricted areas in and around the ARENA (e.g. via TECHNICIAN button, event issued Media badges, etc.) may not assist or use signaling devices during the MATCH. Exceptions will be granted for inconsequential infractions and in cases concerning safety.

Violation: YELLOW CARD.

G210 *Keep it together. ROBOTS **A ROBOT** may not intentionally detach or leave parts **a part** on the FIELD.

Violation: RED CARD.

G211 *Don't expect to gain by doing others harm. Strategies **A strategy** clearly aimed at forcing the opponent ALLIANCE to violate a rule **are is** not in the spirit of FIRST Robotics Competition and not allowed. Rule violations forced in this manner will not result in an assignment of a penalty to the targeted ALLIANCE.

Violation: FOUL, plus TECH FOUL if REPEATED.

G301 *Be prompt. DRIVE TEAMS **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
- B. The DRIVE TEAM has access to the FIELD and is neither MATCH ready nor making a good faith effort, as perceived by the Head REFEREE, to quickly become MATCH ready.

Violation: Verbal warning, or if a subsequent violation within the tournament phase (i.e. Qualifications or Playoffs), TECH FOUL applied to their upcoming MATCH. If the DRIVE TEAM is not MATCH ready within 2 minutes of the verbal warning/TECH FOUL and the Head REFEREE perceives no good faith effort by the DRIVE TEAM to quickly become MATCH ready, DISABLED.

G401 *Behind the lines. In AUTO, DRIVE TEAM members **a DRIVE TEAM member** staged behind a STARTING LINE may not contact anything in front of that STARTING LINE, unless for personal or equipment safety, to press the E-Stop or A-Stop, or granted permission by a Head REFEREE or FTA.

*Violation: FOUL **regardless of the number of items contacted.***

G402 *Let the ROBOT do its thing. In AUTO, DRIVE TEAMS **a DRIVE TEAM member** may not directly or indirectly interact with ROBOTS **a ROBOT** or OPERATOR CONSOLES **an OPERATOR CONSOLE** unless for personal safety, OPERATOR CONSOLE safety, or pressing an E-Stop or A-Stop.

Violation: FOUL and YELLOW CARD

G403 1 NOTE at a time. In AUTO, ROBOTS **a ROBOT** may not CONTROL more than 1 NOTE at a time, either directly or transitively through other objects.

A ROBOT is in CONTROL of a NOTE if:

- A. the NOTE is fully supported by the ROBOT or
- B. it intentionally pushes a NOTE to a desired location or in a preferred direction (i.e. herding).

Violation: TECH FOUL per additional NOTE.

G405 Limited AUTO opponent interaction. In AUTO, a ROBOT whose BUMPERS have completely crossed the CENTER LINE (i.e. to the opposite side of the CENTER LINE from its ROBOT STARTING ZONE) may contact neither an opponent ROBOT nor NOTES **a NOTE** staged in the opponent's WING.

Violation: TECH FOUL.

G406 *ROBOTS: use GAME PIECES as directed. ROBOTS **A ROBOT** may not deliberately use ~~GAME PIECES~~ **a GAME PIECE** in an attempt to ease or amplify ~~challenges~~ **a challenge** associated with ~~FIELD elements~~ **a FIELD element**.

Violation: TECH FOUL per ~~NOTE~~

G407 *Keep NOTES in bounds. ROBOTS **A ROBOT** may not intentionally eject ~~NOTES~~ **a NOTE** from the FIELD (either directly or by bouncing off a FIELD element or other ROBOT) other than through their SPEAKER or AMP.

Violation: TECH FOUL per ~~NOTE~~

G408 ROBOTS, no HIGH NOTES. ROBOTS **A ROBOT** may not cause ~~HIGH NOTES~~ **a HIGH NOTE** to leave the FIELD (including through an AMP or SPEAKER), score on a MICROPHONE, or enter a TRAP.

Violation: TECH FOUL per ~~HIGH NOTE~~. If a ROBOT scores a HIGH NOTE on a MICROPHONE, its ALLIANCE is ineligible for the ENSEMBLE RP.

G410 Don't abuse GAME PIECES. **Neither a** ROBOTS ~~and~~ **nor a** HUMAN PLAYERS ~~may not~~ damage **a** GAME PIECES.

Violation: Verbal warning, plus TECH FOUL if REPEATED. If via a ROBOT and the Head REFEREE determines that further damage is likely to occur, DISABLED. Corrective action (such as eliminating sharp edges, removing the damaging MECHANISM, and/or re-inspection) may be required before the ROBOT may compete in subsequent MATCHES.

G411 *ROBOTS must be safe. A ROBOT may not pose **an** undue hazards to ~~humans~~ **a human**, ~~ARENA elements~~ **an ARENA element**, or ~~other ROBOTS~~ **another ROBOT** in the following ways:

- A. the ROBOT or anything it CONTROLS, e.g. a NOTE, contacts anything outside the FIELD except for either of the following:
 - a. MOMENTARY contact inside the CHUTE and
 - b. contact with a surface inside the AMP via a NOTE
- B. its BUMPERS fail such that a segment completely detaches,
- C. a corner (as defined in [R401](#)) of its FRAME PERIMETER is exposed,
- D. its team number or ALLIANCE color are indeterminate,
- E. its BUMPERS leave the BUMPER ZONE REPEATEDLY or for more than a MOMENTARY amount of time, or
- F. its operation or design is dangerous or unsafe.

Violation: DISABLED.

G414 **No full-court shots.** A ROBOT with any part of its BUMPERS in their opponent's WING may not cause NOTES a NOTE to travel into or through their WING.

Violation: FOUL, plus TECH FOUL for subsequent violations in the MATCH.

G415 **Watch your ARENA interaction.** A ROBOT may not damage an ARENA element. ROBOTS are A ROBOT is prohibited from the following interactions with ARENA elements an ARENA element, except chain (see G416) and GAME PIECES a GAME PIECE (see [Section 7.4.2 GAME PIECES](#)).

- A. grabbing,
- B. grasping,
- C. attaching to (including the use of a vacuum or hook fastener to anchor to the FIELD carpet),
- D. becoming entangled with, and
- E. suspending from.

Violation: TECH FOUL, plus YELLOW CARD if REPEATED or longer than MOMENTARY. If the Head REFEREE infers that damage is likely, DISABLED. 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.

G420 ***There's a 5-count on PINS.** ROBOTS A ROBOT may not PIN an opponent's ROBOT for more than 5 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). A PIN count ends once any of the following criteria below are met:

- A. the ROBOTS have separated by at least 6 ft. (~183 cm) from each other for more than 5 seconds,
- B. either ROBOT has moved 6 ft. from where the PIN initiated for more than 5 seconds, or
- C. the PINNING ROBOT gets PINNED.

For criteria A and B, the PIN count pauses once ROBOTS are separated by 6 ft. until either the PIN ends or the PINNING ROBOT moves back within 6 ft., at which point the PIN count is resumed.

Violation: FOUL, plus an additional TECH FOUL for every 5 seconds in which the situation is not corrected.

G425 ***No wandering.** DRIVE TEAMS A DRIVE TEAM member must remain in their designated areas area as follows:

- A. DRIVERS a DRIVER may not contact anything outside the area in which they started the MATCH (i.e. the ALLIANCE AREA or SOURCE AREA),
- B. DRIVERS a DRIVER must use the OPERATOR CONSOLE in the DRIVER STATION to which they are assigned, as indicated on the team sign,
- C. HUMAN PLAYERS a HUMAN PLAYER may not contact anything outside the area in which they started the MATCH (i.e. the ALLIANCE AREA or SOURCE AREA),
- D. COACHES a COACH may not contact anything outside the ALLIANCE AREA or in front of their COACH LINE, and
- E. TECHNICIANS a TECHNICIAN may not contact anything outside their designated area.

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

Violation: FOUL

G427 ***DRIVE TEAMS, watch your reach.** DRIVE TEAM members A DRIVE TEAM member may not extend into the CHUTE.

Violation: FOUL.

- G428** ***Humans: use GAME PIECES as directed.** ~~DRIVE TEAM members~~ **A DRIVE TEAM member** may not deliberately use ~~GAME PIECES~~ **a GAME PIECE** in an attempt to ease or amplify ~~challenges~~ **a challenge** associated with ~~FIELD elements~~ **a FIELD element**.

Violation: TECH FOUL ~~per GAME PIECE~~.

- G429** ***NOTE delivery.** ~~NOTES~~ **A NOTE** may only be introduced to the FIELD through the SOURCE.

Violation: TECH FOUL ~~per NOTE~~

- G430** **HIGH NOTE delivery.** ~~HIGH NOTES~~ **A HIGH NOTE** may only be entered on to the FIELD during the last 20 seconds of the MATCH by a HUMAN PLAYER in front of the COACH LINE.

Violation: FOUL.

- G501** ***Leave promptly.** ~~DRIVE TEAMS~~ **A DRIVE TEAM member** may not cause significant or multiple delays to the start of a subsequent MATCH, scheduled break content, or other FIELD activities.

Violation: Verbal warning plus YELLOW CARD if subsequent violations at any point during the event.

Team Update 06

General

KitBot

The KitBot [Java Code Zip](#) had code updated to disable the formatting check when building.

Playoff Tournament Information

The [Playoff Alliance Communication](#) document is published in the *Additional Season Material* section of the [CRESCENDO – Season Materials page](#).

Game Manual

Section 7.4.3 ROBOT

G411 ***ROBOTS must be safe.** A ROBOT may not pose undue hazards to humans, ARENA elements, or other ROBOTS in the following ways:

- A. the ROBOT or anything it CONTROLS, e.g. a NOTE, contacts anything outside the FIELD (except for either of the following:
 - a. MOMENTARY contact inside the CHUTE), and
 - b. contact with a surface inside the AMP via a NOTE
- B. ...

G413 **Expansion limits.** A ROBOT may not expand beyond either of the following limits:

- A. its height, as measured when it's resting normally on a flat floor, may not exceed 4 ft. (~122 cm) or
- B. it may not extend more than 1 ft. (~30 cm) from its FRAME PERIMETER.

Overexpansion due to damage, provided the expansion isn't leveraged for strategic benefit, is an exception to this rule. If the over-expansion is due to damage and not used for strategic benefit, as perceived by a REFEREE, it is an exception to this rule, and no penalty is imposed.

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

...

The intent of this rule is to prevent piling a punitive response to a ROBOT that's already experienced hardship and not leveraging that hardship for gain.

Examples for this rule include the following:

- A. a physical device on a team's ROBOT, whose purpose is to restrain their TRAP scoring arm from extending beyond the limit defined in B, breaks after a collision with another ROBOT. Provided the ROBOT does not use the now-too-long extension to score in the AMP, no violation is assigned.
- B. a vertical structural member of a ROBOT breaks at the bottom and rotates out such that it breaches the limit imposed in part B. The ROBOT then

- C. parks such that its extension blocks opponent ROBOTS from reaching their PODIUM. A TECH FOUL is issued.
- C. a latch restraining a shooter MECHANISM from extending above the limit defined in A breaks, allowing the MECHANISM to shift such that it's above the plane of other ROBOTS. The ROBOT uses this new height to get above a defender and score NOTES in their SPEAKER. A TECH FOUL is issued.

Section 7.4.3 ROBOT

G415 **Watch your ARENA interaction.** A ROBOT may not damage an ARENA element. ROBOTS are prohibited from the following interactions with ARENA elements, except chain (see [G416](#)) and GAME PIECES (see [Section 7.4.2 GAME PIECES](#)).

- A. grabbing,
- B. grasping,
- C. attaching to (including the use of a vacuum or hook fastener to anchor to the FIELD carpet),
- D. becoming entangled with,
- E. ~~damaging,~~ and
- F. suspending from.

Section 8.2 ROBOT Safety & Damage Prevention

R201 ***No digging into carpet.** Traction devices must not have surface features that could damage the ARENA (e.g. metal, sandpaper, ~~hard plastic~~ inflexible studs, cleats, hook-loop fasteners or similar attachments).

Team Update 05

General

Field Assets

- The [Layout & Marking Diagram](#) is updated to reflect the width of the AMP ZONE as measured from the guardrail plastic instead of the guardrail metal.
- [TE-24300 SPEAKER ReadMe document](#) V2 removes a duplicate Row C from the Example Cut List section.

FIRST Impact Award

The *FIRST* Impact Award Eligibility section of [the Submitted Awards webpage](#) is updated as follows:

Teams are eligible for the *FIRST* Impact Award at each Regional or District event at which they compete. District Teams are not eligible to win, **nor can they interview for** the *FIRST* Impact Award at Regional events or inter-district events. Teams will be restricted to earning this award once at each level of competition **and once they have won, they cannot interview**. In other words, once a team has earned the *FIRST* Impact Award at a Regional or District event, they may not interview for or earn it again that season at a later Regional or District Event.

KitBot

The KitBot Java code [in this .zip](#) and [Java Code Guide](#) is updated to add missing subsystem requirements in the auto example.

WPILib

An update for C++\Java WPILib (2024.2.1) has been released, fixing a number of bugs discovered since Kickoff. More details and upgrade instructions can be found on the [WPILib Releases page](#).

Game Manual

Section 11.1.3 Playoff Performance

This attribute measures team performance as part of an ALLIANCE.

Teams ~~earn points based on how far their ALLIANCE advances in the Playoff MATCHES and the percentage of MATCH wins in which the team participated (i.e. was on the LINEUP for that MATCH).~~ The ALLIANCE Advancement points are shown **that advance to at least MATCH 12 earn Double Elimination (DE) Points per the formula below, where β is defined** in Table 11-4.

$$DE \text{ Points} = \frac{\# \text{ of DE MATCHES in which ALLIANCE won \& team participated}}{\# \text{ of DE MATCHES the ALLIANCE won}} \times \beta$$

 Table 11-4 District Playoff Performance Double Elimination Points, β values

ALLIANCE Finish	ALLIANCE Advancement Points β
Finals MATCH wins 1st Place (Winners)	5 20
2nd Place (Finalists)	20
3rd Place (loser of MATCH 13)	13
4th Place (loser of MATCH 12)	7

In most cases, unless a BACKUP is recruited, a team plays in 100% of the Playoff DE MATCHES won by their ALLIANCE, thus their Playoff Performance points DE Points simply equals their ALLIANCE Advancement points β . If a team does not play 100% of the Playoff DE MATCHES won by their ALLIANCE, their Playoff Performance points DE Points equals their ALLIANCE Advancement points earned during the double-elimination portion of the Playoffs (i.e. MATCHES 1-13) β value multiplied by the percentage of Playoff DE MATCHES won by their ALLIANCE in which that team was a participant, plus points earned per Finals MATCH win participated. If the result is not a whole number, the value is rounded up to the nearest integer.

Teams on the winning ALLIANCE are awarded additional Finals Points, which are 5 points for each Finals MATCH won and in which the team participated, up to a maximum of 10 points.

For example, if Team X's ALLIANCE wins the event, but Team X only played in 2 MATCHES won by their ALLIANCE, MATCH 13 and Final 1, Team X's Playoff Performance points are $20 * (1/5) + 5 = 9$ points. If the result is not a whole number, the value is rounded up to the nearest integer.

The maximum ALLIANCE Advancement points number of Playoff Performance Points a team can earn is 30 (20 points from the double-elimination tournament DE points + 10 in Finals MATCHES Points).

Team Update 04

General

Official Q&A

[Question 23](#) in the FIRST Robotics Competition Q&A led to a good discussion among the folks who answer those questions. The answer is nuanced, and we'd like to use this Team Update to bring attention to it.

Game Manual

Section 5.7 GAME PIECES

NOTES undergo wear and tear during a competition. Generally, a NOTE that still appears to look approximately like a NOTE is considered a NOTE for the purposes of rule evaluation and scoring, whether damaged or not. Small chunks of a NOTE are not considered a NOTE.

Section 6.5.4 SPOTLIGHTING

ALLIANCES may SPOTLIGHT ROBOTS by scoring a HIGH NOTE on a MICROPHONE. A HIGH NOTE is scored on the MICROPHONE if the NOTE surrounds, i.e. encircles, the MICROPHONE.

[Q70](#) has been updated to reflect this edit.

Section 6.8 Other Logistics

NOTES that leave the FIELD are not returned to game play by FIELD STAFF.

Section 7.4.3 ROBOT

G415 [Watch your ARENA interaction](#). ROBOTS are prohibited from the following interactions with ARENA elements, except chain (see [G416](#)) and GAME PIECES (see [Section 7.4.2 GAME PIECES](#)).

- A. grabbing,
- B. grasping,
- C. attaching to (including the use of a vacuum or hook fastener to anchor to the FIELD carpet),
- D. becoming entangled with, and
- E. damaging, and
- F. suspending from.

Violation: TECH FOUL, plus YELLOW CARD if REPEATED or longer than MOMENTARY. If the Head REFEREE infers that damage is likely, DISABLED. 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.

Section 10.5.3 Qualification Ranking

Table 10-1 Qualification MATCH ranking criteria

Order Sort	Criteria
5 th	Average ALLIANCE PARK, ONSTAGE, and NOTE in TRAP STAGE points

Section 10.6.2.1 Playoff MATCH Ties

Table 10-3 Playoff MATCH Tiebreaker Criteria

Order Sort	Criteria
3 rd	ALLIANCE PARK, ONSTAGE, and NOTE in TRAP STAGE points

Section 11.2 District Championship Eligibility

Table 11-5 2024 District Championship Capacities

District Championship	Capacity	Divisions
FIRST Chesapeake District Championship	64 54	1

Team Update 03

General

KitBot

The [KitBot Build Instructions](#) now include a troubleshooting tip regarding current limits.

NOTE Availability

FIRST and AndyMark are working with the manufacturer on a second production run of NOTES. We expect a second order to be manufactured by January 25, and it will be sent to AndyMark in Indiana by air.

AndyMark expects to be able to accept new orders the week of February 5. The actual date will be announced as soon as shipping details are confirmed. To receive this notification, enter your preferred email address on AndyMark's [Note Product page](#).

Existing backorders will receive (up to) an additional 24 notes. New orders are still capped at 6 per team.

We apologize for the inconvenience and appreciate your patience as we worked through this challenge.

Team Versions

- [TE-24316 Speaker Top Side Panel, Rev A](#) repositions a dimension on p2 from B3 to B4.
- The [ReadMe document for TE-24200, V3](#) updates the length of TE-24211 in the example cut list from 56¼ in. to 52⅝ in.

Game Manual

Section 5.6.1 SPEAKER

ALLIANCE colored lights in the SUBWOOFER turn on when AMPLIFICATION starts and recede, second by second, as AMPLIFICATION progresses, and if AMPLIFICATION ends before the countdown completes (because the maximum number of NOTES have been scored), the SUBWOOFER and SPEAKER lights turn off.

Section 7.2 Conduct

G206 ***Don't violate rules for RPs.** A team or ALLIANCE may not collude with their opponent to each purposefully violate a rule in an attempt to earn each ALLIANCE a Ranking Point.

Violation: YELLOW CARD and the ALLIANCE is ineligible for MELODY and ENSEMBLE RPs.

For example, if Team A on the blue ALLIANCE agrees with Team F on the red ALLIANCE to feed NOTES to opponent ROBOTS to decrease the cycle time and improve the chance of achieving the MELODY, enter the blue STAGE ZONE during the last 20 seconds of a Qualification MATCH and wait to be contacted by Team F, and then both ROBOTS drive to the red STAGE ZONE so that Team A

can contact Team F in their STAGE ZONE leading in both ALLIANCES being awarded the ENSEMBLE RP.

Section 11.2 District Championship Eligibility

Table 11-5 2024 District Championship Capacities

District Championship	Capacity	Divisions
FIRST Israel District Championship	40 45	1

Team Update 02

General

KitBot

- The [CAD and Drawings Zip](#) package and [the Onshape model](#) posted on the [KitBot webpage](#) are updated to reflect the correct location for 2 of the “long churros.”
- The following translated materials are now available on the [KitBot webpage](#):
 - [KitBot Enhancement/Iteration Guide in Chinese](#)
 - [KitBot LabVIEW Code Guide in French](#)
 - [KitBot C++ Code Guide in French](#)
- The axis cubing examples in the [C++](#) and [Java](#) Code Guides are updated to reflect that the inputs are already squared.

Q&A

The answer to [Q9](#) has been revised as follows:

We cannot comment absolutely on hypothetical scenarios. The ultimate decision would be determined by the REFEREES at your event, with the final call made by the Head REFEREE. However the intent of CONTROL is not considered when determining violations of [G403](#) (part A or a NOTE lodged in a ROBOT) and [G409](#).

Game Manual

Section 5.2 Areas, Zones, & Markings

- SPIKE MARK: 1 of 11 **1 ft. 1 in. (33 cm)** marks used to identify placement of NOTES before the MATCH.

Section 6.3.4 GAME PIECES

NOTES on SPIKE MARKS are staged such that each NOTE covers the opposite ends of each SPIKE MARK.

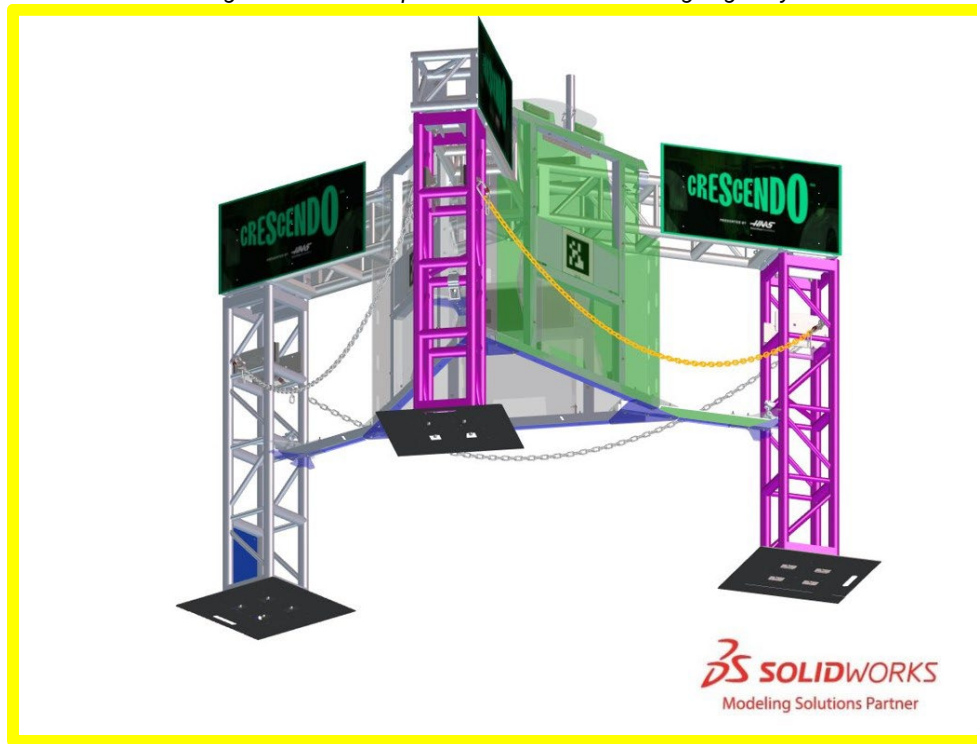
Section 6.5.2 ROBOT Scoring Criteria

To qualify for ONSTAGE points, a ROBOT may only be contacting:

- their** truss legs (pink shaded elements in Figure 6-3) via ROBOT BUMPERS,
- GAME PIECES,
- chain-facing vertical surfaces of **their** core **or the nearest flap** (with regards to the chain used by the ONSTAGE ROBOT, green shaded elements in Figure 6-3),
- carpet facing surfaces of **their** core (blue shaded elements in Figure 6-3), and
- a single STAGE chain **(on their STAGE)** (highlighted in orange in in Figure 6-3),
- another ROBOT qualified for ONSTAGE points,
- another ROBOT awarded the ENSEMBLE RP because of a [G424](#) infraction, and
- an opponent ROBOT.

Figure 6-3 is updated to reflect the edit to C above.

Figure 6-3 Contact points for ONSTAGE scoring eligibility



Section 6.5.3 AMPLIFICATION

AMPLIFICATION increases the number of MATCH points awarded for NOTES scored in a SPEAKER per Table 6-2. To AMPLIFY, an ALLIANCE must have at least 2 NOTES through their AMP. Once this criterion is met, the HUMAN PLAYER may press the AMP button which AMPLIFIES their SPEAKER for 10 seconds or until 4 NOTES are scored **in that SPEAKER**, whichever comes first. Due to NOTE transit time from the SPEAKER opening to the sensor array, there is a 3-second extension on the end of the nominal AMPLIFICATION time in account for NOTES that entered the SPEAKER within 10 seconds of the AMP button being pressed but haven't yet been processed. An ALLIANCE must collect another 2 NOTES through their AMP after AMPLIFICATION ends before they are able to AMPLIFY their SPEAKER again. While NOTES delivered through the AMP **after the 2-NOTE threshold is reached or** during AMPLIFICATION do not contribute to the next AMPLIFICATION **or Coopertition requirement**, they do earn MATCH points **(in other words, and ALLIANCE can only "bank" up to 2 NOTES at a time toward AMPLIFICATION or Coopertition)**.

Section 7.4.2 GAME PIECES

G408 ROBOTS, no HIGH NOTES. ROBOTS may not cause HIGH NOTES to leave the FIELD (including through an AMP or SPEAKER), score on a MICROPHONE, or enter a TRAP.

*Violation: TECH FOUL per HIGH NOTE. **If a ROBOT scores a HIGH NOTE on a MICROPHONE, its ALLIANCE is ineligible for the ENSEMBLE RP.***

Section 7.4.4 Opponent Interaction

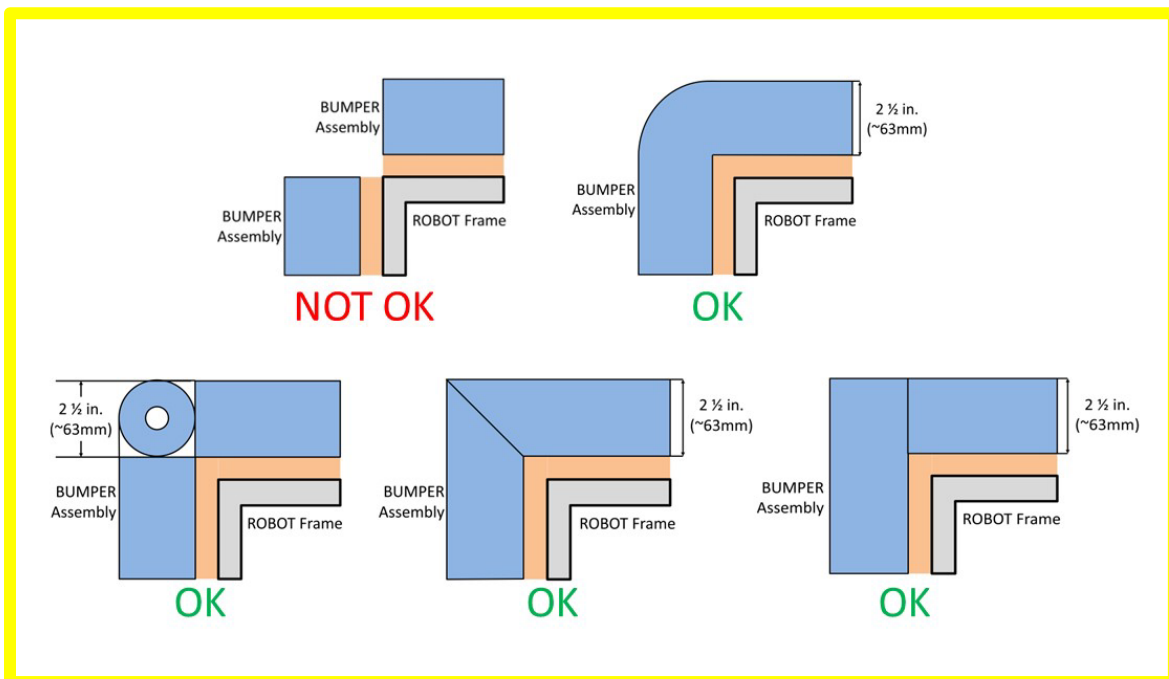
G424 STAGE protection. A ROBOT may not contact (either directly or transitively through a NOTE and regardless of who initiates contact) an opponent ROBOT if either of the following criteria are met:

- A. the opponent ROBOT has any part of its BUMPERS in its STAGE ZONE and it is not in contact with the carpet or
- B. any part of either ROBOT'S BUMPERS are in the opponent's STAGE ZONE during the last 20 seconds of the MATCH.

Section 8.4 BUMPER Rules

R409 *Fill BUMPER corners.

Figure 8-7 has been updated to improve conceptual clarity...



Section 14 Glossary

Only edited rows shown below.

Term	Definition
CHUTE	a 50° sloped tunnel that leads to the opening in the SOURCE wall
MICROPHONE	a vertical post centered above each TRAP and mounted to top of core structure

Team Update 01

General

NOTE Availability

Due to NOTE demand exceeding inventory, *FIRST* and AndyMark are capping the quantity of NOTES shipping to teams. Orders placed before NOTES went out of stock will ship, however not with more than 24 NOTES (e.g. an order of 10 will get 10, and order of 30 will get 24). For teams with more than 24 NOTES on their order, AndyMark will “backorder” the extra NOTES and work closely with customers to determine future NOTE shipments, based on availability. NOTE sales will reopen at noon (Eastern) on Wednesday, January 10, 2024, and orders will be capped at 6 per team.

We apologize for underestimating the number of NOTES teams would require, regret the inconvenience and frustration this is causing, and hope to remedy the situation soon (we are working with the manufacturer to explore having additional NOTES produced quickly).

Thank you for your patience.

Team Field Versions

The [ReadMe file for the STAGE, TE-24200](#) is updated to exclude internal editorial comments.

FIRST Championship Radios

The plan is to use the next generation of ROBOT radio at the 2024 *FIRST*® Championship, assuming the devices successfully pass decision gates over the next 3 months. For more information, please see [this recent blog](#).

Kit of Parts

The [Kickoff Kit Checklist for Season Specific Box](#) is updated to correct the number of participation pins in each box (correct amount is 30).

Game Manual

Section 5.1 FIELD

This edit is replicated in the definition of the FIELD in Section 14 Glossary.

Each FIELD for CRESCENDO is an approximately 26 ft. 11¼ in. (~802 **821** cm) by 54 ft. 3¼ in. (~1654 cm) carpeted area bounded by inward facing surfaces of the ALLIANCE WALLS, SOURCES, AMPS and AMP pocket walls, and guardrails.

Section 5.6.1 SPEAKER

The opening is 3 ft. 5³/₈ in. (~105 cm) wide and extends 1 ft. 16 6 in. (~46 cm) into the FIELD.

Section 5.9 The FIELD Management System

Table 5-1 Audio cues

Event	Timer Value	Audio Cue
MATCH start	0:15 (for AUTO)	"Cavalry Charge"
AUTO ends	0:00 (for AUTO)	"Buzzer"
TELEOP begins	2:15	"3 Bells"
Final 20 seconds	0:20	"Guitar Riff"
MATCH end	0:00	"Buzzer"
MATCH stopped	n/a	"Foghorn"

Section 6.5.3 AMPLIFICATION

This edit is to remedy an accidental omission; the content was meant to be in the original manual release.

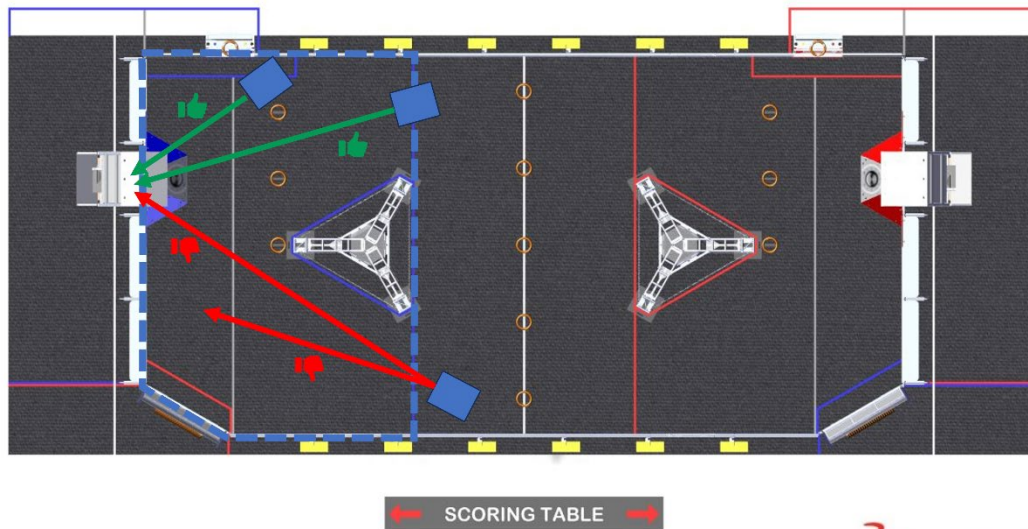
Once this criterion is met, the HUMAN PLAYER may press the AMP button which AMPLIFIES their SPEAKER for 10 seconds or until 4 NOTES are scored, whichever comes first.

Section 7.4.1 AUTO

G404 **Only close shots in AUTO.** In AUTO, a ROBOT whose BUMPERS are completely outside their WING may not cause a NOTE to travel into or through their WING such that the NOTE enters the WING while not in contact with that ROBOT.

Violation: TECH FOUL.

Figure 7-2 NOTE movement limitations in AUTO



SOLIDWORKS
Modeling Solutions Partner

Section 7.4.2 GAME PIECES

G408 **ROBOTS, no HIGH NOTES.** ROBOTS may not cause HIGH NOTES to leave the FIELD (including through an AMP or SPEAKER), **score on a MICROPHONE**, or enter a TRAP.

Violation: TECH FOUL per HIGH NOTE.

Section 7.4.3 ROBOT

G413 **Expansion limits.** A ROBOT may not expand beyond either of the following limits:

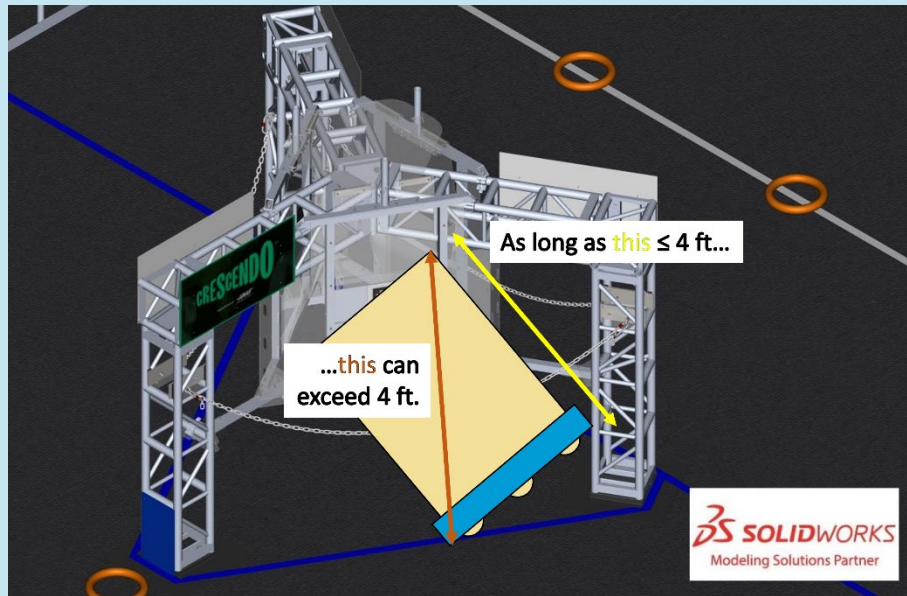
- it's height, as measured when it's resting normally on a flat floor, may not exceed 4 ft. (~132 **122** cm) or
- it may not extend more than 1 ft. (~40 **30** cm) from its FRAME PERIMETER.

Overexpansion due to damage, provided the expansion isn't leveraged for strategic benefit, is an exception to this rule.

Violation: FOUL, or TECH FOUL if the over-expansion impedes or enables a scoring action.

Height is intended to be measured as if the ROBOT is resting on a flat floor, not relative to the height of the ROBOT from the FIELD carpet. For example, a ROBOT that is attempting to get ONSTAGE may actually exceed the height limit when compared to the carpet of the FIELD.

Figure 7-3 ROBOT height elaboration



MOMENTARY and inconsequential extensions include a wire or cable tie swinging out of the FRAME PERIMETER, including while an extension is deployed.

Examples of compliant and non-compliant extensions are shown in Figure 7-4. ROBOT A violates this rule for having an extension that is too long, while ROBOTS B, C, and D do not violate this rule.

Section 7.4.5 HUMAN

G426 *COACHES and other teams: hands off the controls. A ROBOT shall be operated only by the DRIVERS and/or HUMAN PLAYERS of that team. A COACH activating their E-Stop or A-Stop is the exception to this rule.

Violation: TECH FOUL, plus RED CARD if greater-than-MOMENTARY.

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

Section 8.5 Motors & Actuators

R503 *Don't modify motors (mostly).

H. Any number of #10-32 plug screws may be removed from the Falcon 500 and the Kraken X60.

R505 *Don't overload controllers.

Table 8-2 Power regulating device allotments (edited rows only)

Electrical Load	Motor Controller	Relay Module	Pneumatics Controller
AndyMark RedLine Motor Banebots CIM REV Robotics NEO Brushless REV Robotics NEO 550 REV Robotics NEO Vortex VEX Mini-CIM WCP Kraken X60 WCP RS775 Pro	Yes	No	No
CTR Electronics/VEX Falcon 500 Nidec Dynamo BLDC Motor w/ Controller Playing With Fusion Venom WCP Kraken X60	Yes (integrated controller only)	No	No

Section 8.7 Control, Command & Signal Systems

R701 *Control the ROBOT with a roboRIO. ROBOTS must be controlled via 1 programmable NI roboRIO or roboRIO 2.0 (P/N am3000 or am3000a, both versions referred to throughout this manual as “roboRIO”), with image version 2024_v3.1 **2024_v2.1** or later.

There are no rules that prohibit co-processors, provided commands originate from the roboRIO to enable and disable all power regulating devices. This includes motor controllers legally wired to the CAN bus.

Section 8.9 OPERATOR CONSOLE

R901 *Use the specified Driver Station Software. The Driver Station Software provided by National Instruments ([install instructions found here](#)) is the only application permitted to specify and communicate the operating mode (i.e. AUTO/TELEOP) and operating state (Enable/Disable) to the ROBOT. The Driver Station Software must be version 24.1 **24.0** or newer.

Teams are permitted to use a portable computing device of their choice (laptop computer, tablet, etc.) to host the Driver Station Software while participating in MATCHES.

Section 11.2 District Championship Eligibility

Table 11-5 2024 District Championship Capacities (edited rows only)

District Championship	Capacity	Divisions
Indiana State Championship	32 38	1

Team Update 00

The [FIRST® Robotics Competition Game Manual](#) has undergone significant reorganization and modification since the 2023 season. Because of the degree of the changes, red-line coverage of the changes would be extensive and difficult to parse. As a result, the approach taken in this *Team Update 00* is to describe changes to content only. Editorial changes to verbiage (e.g. improving explanation language like in the blue box for G419), rule and section references, game specific examples that relate to evergreen content, and formatting changes are not described.

As always, it's important to read the whole manual at least once and become an expert on sections of the manual that directly relate to your role and responsibilities on your team. As always, you're welcome to ask (thoughtful, informed) questions through the [official Q&A system](#), opening at noon (Eastern time) on Wednesday, January 10, 2023.

Organizational Changes

Changes that relate to the layout and order of the document's contents are described in the list below:

- Some content formerly presented as a rule is now presented as a process description or in a list of prerequisites. For example, the requirement that DRIVE TEAMS in the ALLIANCE AREA start behind the STARTING LINE is now presented in a list of requirements for a MATCH to being instead of as a rule with a violation imposed if broken.
- Some rules are combined.
- Some rules or parts of rules are broken up and distributed to other rules, process descriptions, or stand alone.
- The Event Manual is incorporated into the end of the document.

Content Changes

Changes to evergreen content (i.e. rules with green headlines) are described below. Sections are presented according to the 2024 manual presentation, and rule references present the 2023 rule number first followed by the 2024 rule number.

Section 7 Game Rules

- **G103 ⇒ G412, Keep your BUMPERS low.**

Because the reference to REPEATED and greater than MOMENTARY violations of the BUMPER ZONE is in G411, the violation omits

If REPEATED or greater than MOMENTARY, DISABLED

- **G202 ⇒ G420, There's a 5-count on PINS.**

The description of the procedural PIN count and PIN count suspension is promoted from the Blue Box to the rule itself.

-
- **G204 ⇒ G417, Stay out of other ROBOTS.**

The reference to contact within a BUMPER opening is omitted.

- **G205 ⇒ G418, This isn't combat robotics.**

Part B omits

Contact between the ROBOT'S BUMPERS or COMPONENTS inside the ROBOT'S FRAME PERIMETER and COMPONENTS inside an opening of an opponent's BUMPERS or in the space above the BUMPER opening are exceptions to this rule.

- **G401 ⇒ G407, Keep NOTES in bounds.**

The violation changed from

FOUL

to

TECH FOUL

- **H101 ⇒ G201, Be a good person.**

Violation language changed from

Behavior will be discussed with team or individual. Violations of this rule are likely to escalate to YELLOW or RED CARDS rapidly (i.e. the threshold for egregious violations is relatively low.)

to

Verbal warning, plus YELLOW CARD if subsequent violations during the event.

- **H102 ⇒ G209, Enter only 1 ROBOT.**

Violation language changed from

Verbal warning. Egregious or subsequent violations at any point during the event will be addressed by the Head REFEREE, the Lead ROBOT INSPECTOR (LRI), and/or Event Management.

to

Verbal warning.

- **H105 ⇒ G203, Asking other teams to throw a MATCH – not cool.**

H106 ⇒ G204, Letting someone coerce you into throwing a MATCH – also not cool.

H107 ⇒ G205, Throwing your own MATCH is bad.

Violation language changed from

Behavior will be discussed with team or individual. Violations of this rule are likely to escalate rapidly to YELLOW or RED CARDS and may lead to dismissal from the event (i.e. the threshold for egregious violations is relatively low.)

to

Verbal warning, plus YELLOW CARD if subsequent violations during the event.

- **H109 ⇒ G103, Be careful what you interact with.**

Rule language omits

Temporary deformation of a GAME PIECE (e.g. to pre-load a ROBOT) is an exception to this rule.

Item A omits

(unless instructed by FIELD staff)

Item C was changed from

deforming

to

manipulating such that it doesn't return to its original shape without human intervention.

- **H202 ⇒ Q101, 1 STUDENT, 1 Head REFEREE.**

The blue box language incorporates language related to recording conversations published in [2023 Team Update 21](#).

- **H302 ⇒ G104, Teams may not enable their ROBOTS on the FIELD.**

Violation language changed from

YELLOW CARD

to

Verbal warning, plus YELLOW CARD if subsequent violations during the event.

- **H305 ⇒ G208, Show up to your MATCHES.**

Violation language changed from

RED CARD

to

DISQUALIFIED

Image 7-1 reflects the change described above and removes the reference to an uninspected team competing in Playoff MATCHES.

- **H501 ⇒ G426: COACHES** and other teams: hands off the controls.

Violation language changed from

DISABLED

to

TECH FOUL, plus RED CARD if greater-than-MOMENTARY.

- **H503 ⇒ n/a, COACHES, GAME PIECES** are off limits.

Removed

Section 8 ROBOT Construction Rules

- **R203 ⇒ R203, General safety.**

Blue Box item C changes vision target reference to 36h11 AprilTags.

- **R401 ⇒ R401, BUMPERS all around.**

Headline changed from

BUMPERS should protect all corners.

to

BUMPERS all around.

Rule language updated to require BUMPERS around the full FRAME PERIMETER.

- **R406 ⇒ R406, Team number on BUMPERS.**

Rule language listing requirements for team number visibility adds

from as far as approximately 60 ft. (1829 mm)

and new item C states that team numbers

must not split individual digits by more than 2 in. (~5 cm),

- **R408 ⇒ R408, BUMPER construction.**

The Blue Box below item C changes lower limit of measured pool noodle diameter from

2¼ in. (~57 mm)

to

2⅞ in. (~54 mm).

The Blue Box below item D adds

Non-woven materials such as leather or pleather are not considered cloth.

- **R501 ⇒ R501, Allowable motors.**

Table 8-1 includes the West Coast Products' Kraken x60 and the REV Robotics NEO Vortex and their respective available part numbers. (along with Table 8-2 updated accordingly).

The language describing permitted electric solenoid actuators is changed from

Electrical solenoid actuators, no greater than 1 in. (nominal) stroke and rated electrical input power no greater than 10 watts (W) continuous duty at 12 volts (VDC)

to

Electrical solenoid actuators or electromagnets with rated electrical input power no greater than 50 watts (W) continuous duty at 12 volts (VDC)

- **n/a** ⇒ **R502**, Only 4 propulsion motors.

Added, and additional context is available in [this August 2022 blog](#).

- **R503** ⇒ **R504**, Power (most) actuators off of approved devices.

Item A adds subitem e

Spark Flex Motor Controller (P/N REV-11-2159, am-5276)

Item A, subitem h adds alternate part number for the Talon FX Motor Controller

WCP-0940

- **R602** ⇒ **R602**, Other batteries for cameras or computers only.

The battery pack max output per port is increased from

2.5 Amps

to

5 Amps

and rule language listing permitted batteries adds

or coin cell batteries used to power CMOS/RTC features

- **R604** ⇒ **R604**, Charge batteries at a safe rate.

The type of charge current limit changes from

peak

to

average

- **R621** ⇒ **R621**, Protect circuits with appropriate circuit breakers.

Rule language adds

...with the exception of devices downstream of a Kraken X60 Powerpole adapter board (WCP-1380).

- **R622 ⇒ R622, Use appropriately sized wire.**

Table 8-4 adds

Kraken X60 Powerpole Adapter protected circuit

- *Section 8.8 Pneumatic System* includes comparable Bar units for pressure measurements.
- **R808 ⇒ R808, Working air pressure limit.**

Rule language adds

Additional regulators may be located downstream of the single primary regulator.

- **R810 ⇒ R810, Pressure gauges must be visible.**

The list of approved units for displaying pressure adds

Bar

- **R814 ⇒ R814, Don't connect solenoid outputs together.**

Rule language changes from

The outputs from multiple solenoid valves must not be plumbed together.

to

The output air from multiple solenoid valves must not be combined.

A new Blue Box states

Manifolds, shuttle valves, and other devices which do not combine output airflow, even though it may be plumbed into the same device, are not violations of this rule.

- **R901 ⇒ R901, Use the specified Driver Station Software.**

Changes Driver Station Software version requirement from

23

to

24.1

Section 9 Inspection & Eligibility

Introductory language adds

A safe ROBOT has functional BUMPERS that approximately meet the required coverage (R401), height (R402), and cross section (R408) requirements.

Section 10 Tournaments

- Section 10.2 MATCH Replays adds item G

a ROBOT radio disconnect that impairs operation of other ROBOTS on the FIELD for more than 8 seconds.

The following Blue Box adds item E

scenario G occurring before the last 20 seconds of the MATCH.

- Section 10.6.2 Playoff MATCH Bracket, Table 10-2 is updated per [this August blog post](#).
The new table
 - increases the cycle time to 9 minutes,
 - removes the break between rounds 1 and 2,
 - removes the break between rounds 2 and 3,
 - decreases the break length between rounds 3 and 4 to 6 minutes,
 - specifies which awards are presented in which breaks.

Section 13 Event Rules

- **E115, E117, E605, and E606** are new.
- **E301, No wireless communication.**

The prohibited wireless network list changed from

802.11a/b/g/n/ac/ax (2.4GHz or 5GHz)

to

802.11a/b/g/n/ac/ax/be