Team Update 21

GENERAL

Last One: Team Update 21 is the final Team Update of the 2023 CHARGED UP presented by Haas season.

Recording of Discussions: Laws regarding recording of conversations vary state-to-state and country-to-country, and, in some cases, recording without consent may be criminal. Introducing the idea of recording a conversation with an implied reason of proving someone's error can escalate a discussion and is likely to increase its adversarial nature. Sometimes it's appropriate; often it's neither appropriate nor constructive. Please do not record *FIRST* event staff, or anyone at an event, without the person's consent and please do not challenge the decision to decline consent to be recorded.

GAME MANUAL

SECTION 5.7.1.1 DRIVER STATION LED STRINGS

Table 5-2 GRID light states (field tour video)

Light String State	Criteria	Example
5 center nodes yellow	Set of ALLIANCE GRIDS are complete	

Section 6.4.1 GRID Scoring

Table 6-1 GAME PIECE Scoring Criteria

ROW	GAME PIECE	Scoring Criteria
Bottom	CONE or CUBE	Fully contained in GRIDS and touching FIELD carpet, ~~and/or~~ BARRIER in only 1 HYBRID NODE, and/or GAME PIECES touching FIELD carpet and/or BARRIER in only 1 HYBRID NODE ~~and fully contained in GRIDS~~.
Middle or Top	CONE	The top of the CONE NODE is contained within the volume defined by the conical surface of the CONE

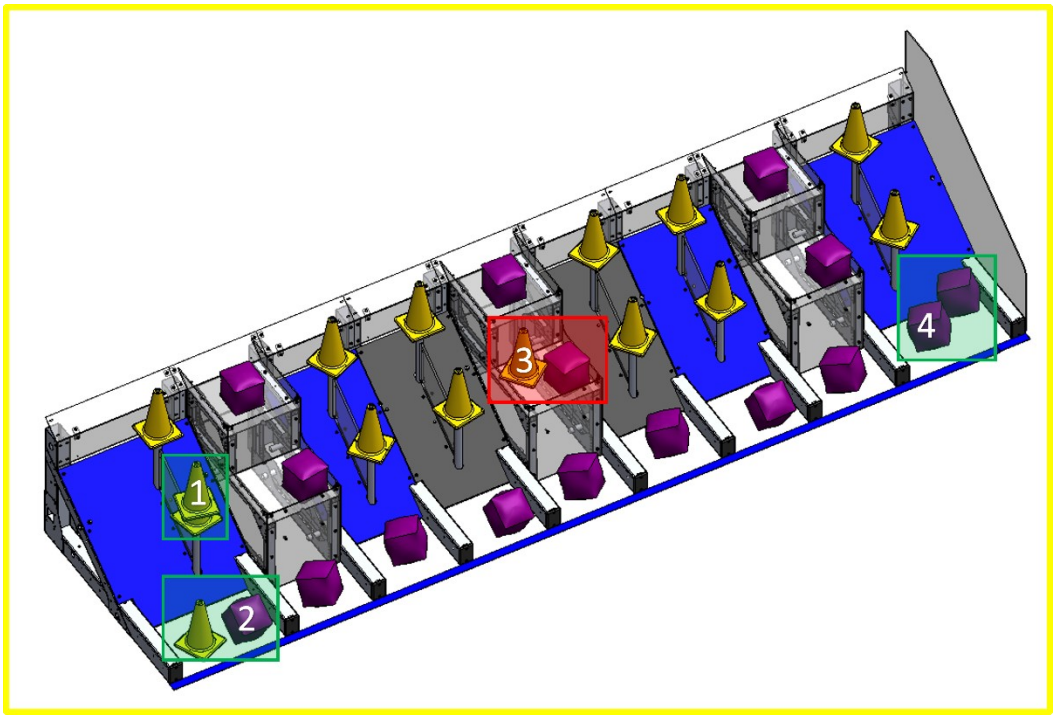
Middle or Top	CUBE	partially or completely (regardless of inflation state) supported by a CUBE NODE and/or by a CUBE at least partially supported by a CUBE NODE.

…

If all ALLIANCE'S NODES are populated with a scored GAME PIECE, i.e. the set of GRIDS is complete, NODES may become SUPERCHARGED. A NODE is SUPERCHARGED if it contains more than 1 scored GAME PIECE, as defined in Table 6-1. A GAME PIECE may only SUPERCHARGE 1 NODE.

On an incomplete set of GRIDS, only 1 GAME PIECE is counted per NODE. On a complete set of GRIDS, additional GAME PIECES are only used to SUPERCHARGE NODES (i.e. they do not earn ROW-specific points or contribute to LINKS). For example, NODES 1, 2, and 4 in Figure 6-3 are SUPERCHARGED, NODE 3 is not SUPERCHARGED because a CONE cannot score on a CUBE NODE, and the ALLIANCE earned 9 SUPERCHARGED NODE points.

Figure 6-3 SUPERCHARGED NODE examples



Section 6.4.3 Point Values

Table 6-2 CHARGED UP points

Award	Awarded for…	AUTO	TELEOP	Qual.	Playoff
SUPERCHARGED NODE	each SUPERCHARGED NODE in a completed set of ALLIANCE GRIDS		3		
SUSTAINABILITY BONUS	At least ~~5~~6 LINKS scored.			1 Ranking Point	
COOPERTITION BONUS	At least 3 GAME PIECES scored on each ALLIANCE'S CO-OP GRID	The SUSTAINABILITY BONUS threshold is reduced to ~~4~~5 LINKS for both ALLIANCES			

Section 8.2 REFEREE Interaction

H201 *Egregious or exceptional violations.

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

a. inappropriate behavior as outlined in the blue box of H101,
b. jumping over the guardrail,
c. behaviors listed in the blue box in H103,
d. PINNING in excess of 15 seconds,
e. exploiting the 3-second window after a MATCH described in Section 6.4 Scoring to avoid rule violations (e.g. triggering an over-extension that enables GRID points or using a ROBOT'S residual energy to impact an opponent ROBOT on their CHARGE STATION)~~.~~,
f. moving a scored GAME PIECE from an opponent's complete set of GRIDS.

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 a-e 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.

H202 *1 STUDENT, 1 Head REFEREE. A team may only address the Head REFEREE with 1 STUDENT. The STUDENT may not be accompanied by more than 1 silent observer.

Please see Section 11.2 Head REFEREE and FTA Interaction for more information about process and expectations. Note that some events may restrict ARENA access to members of the DRIVE TEAM.

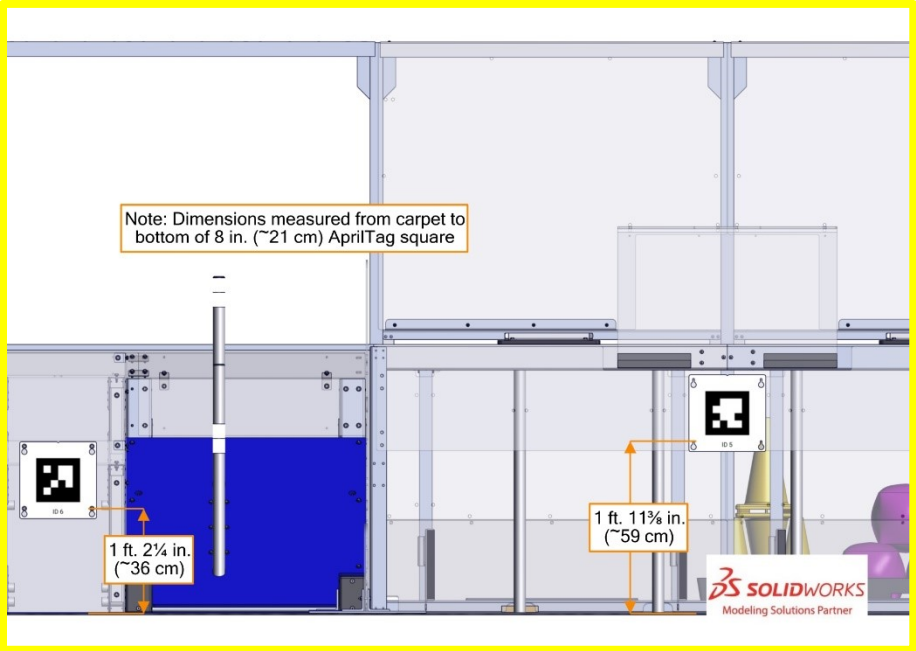
If a Head REFEREE (or any other Event staff) feels they are being recorded without their consent, they may choose to stop participating in the conversation.

Team Update 20

Section 5.9.2 AprilTags

Figure 5-33 was updated per Team Update 18, but inadvertently incorporated incorrect dimension callouts. This edit restores the correct dimensions.

Figure 5-33 AprilTag locating dimensions



Team Update 19

No changes.

Team Update 18

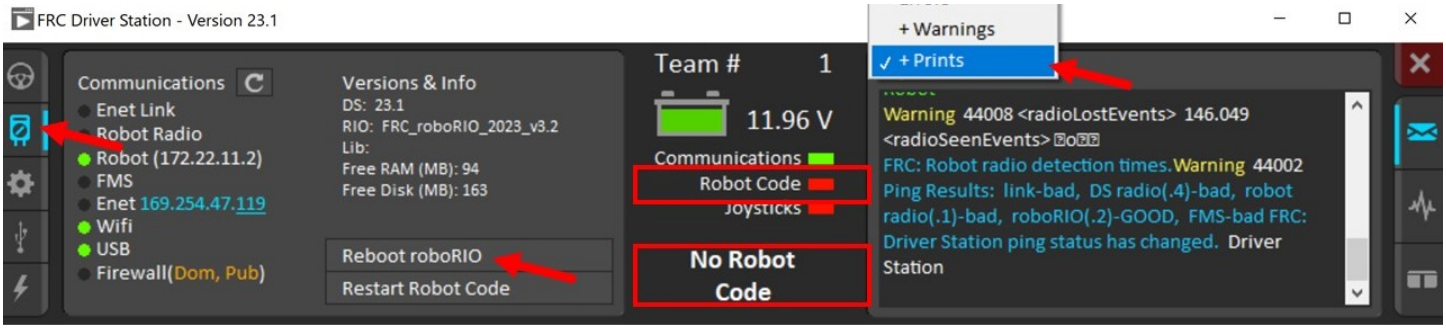
GENERAL

Official Drawings

GE-23128 and GE-23129 (and their parent drawings and folders, including the game specific drawing package and CAD model) are updated to reflect additional material added to reinforce the Double Substation structure.

Control System Message

We are tracking an issue being reported where previously working Robot Code does not load as expected on roboRIO boot, as shown by the "No Robot Code" indication in the image below persisting for longer than usual, and no messages related to robot code starting to appear in the console, shown by pressing the Gear icon then the +Prints button shown below. In these cases, the code generally does load properly after the roboRIO is rebooted using either the Reset button or the "Reboot roboRIO" button in the Diagnostics tab of the Driver Station software. We are still in the process of trying to reproduce this issue and identify the root-cause. *FIRST* Technical Advisors (FTAs) and Control System Advisors (CSAs) were advised to be aware of this issue and work with teams to reboot their roboRIO prior to a match if encountering this issue.



GAME MANUAL

Section 5 ARENA

Figures 5-3, -17, -19, -20, -21, and -33 are updated to reflect the modification described in "Official Drawings" above.

Team Update 17

Section 5.2 Areas, Zones, & Markings

- STAGING MARK: … Each set of 4 marks is centered about the width of the COMMUNITY and is located 18 ft. 8 in. (~569 cm) from the far edge of the corresponding GRID tape as shown in Figure 5-7. A small, light mark may be added to each STAGING MARK to distinguish STAGING MARKS from black tape used to patch carpet.

Section 7.1 ROBOT Restrictions

G108 **Opponent's zone, no extension.** A ROBOT whose BUMPERS are intersecting the opponent's LOADING ZONE or COMMUNITY may not extend beyond its FRAME PERIMETER. ~~Extensions~~ Violations which are both MOMENTARY and inconsequential are an exception to this rule.

Violation: FOUL or TECH FOUL if REPEATED.

Section 7.2 ROBOT to ROBOT Interaction

G201 ***Don't expect to gain by doing others harm.**

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

a. …
b. a blue ROBOT attempts to cut in front of the red LOADING ~~STATION~~ ZONE to reach its COMMUNITY, and a nearby red ROBOT tries to impede it via a defensive bump and, as a result, the blue ROBOT crosses into the red LOADING ~~STATION~~ ZONE.

G205 ***This isn't combat robotics.** A ROBOT may not damage or functionally impair an opponent ROBOT in either of the following ways:

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

Damage or functional impairment because of contact with a tipped-over opponent ROBOT, which is not perceived by a REFEREE to be deliberate, is not a violation of this rule.

Violation: TECH FOUL and YELLOW CARD. If opponent ROBOT is unable to drive, TECH FOUL and RED CARD

Section 11.7.2 Playoff MATCH Bracket

Table 11-3 Typical Playoff MATCH Schedule

MATCH	Blue	Red	Blue Gap (minutes)	Red Gap (minutes)	Winner moves to	Loser moves to
Lower Bracket – Round 3 - MATCH 9	Winner of MATCH 6	Loser of MATCH 7	24m	17m	~~Red~~ Blue – MATCH 12	
Lower Bracket – Round 3 - MATCH 10	Winner of MATCH 5	Loser of MATCH 8	38m	17m	~~Blue~~ Red – MATCH 12	

Team Update 16

General

Control System: NI FRC Game Tools are updated. Last week's release contains version 23.1 of the Driver Station application which corrects an issue with detecting USB devices at application launch. Per the edit to R901 below, this update is required for competition. The update also contains roboRIO image version 2023_v3.2 which contains Network Tables stability fixes for LabVIEW teams; C++\Java teams do not need to update to the new image (though there is no harm in doing so).

An update to C++\Java WPILib (2023.4.2) has been released. All teams are encouraged to update to at least version 2023.4.1 prior to competition as this version contains stability fixes for Network Tables that may impact dashboard performance at events.

Official FIELD Drawings: GE-23300, Rev B, is updated to reflect a change to the orientations of the 4 *Charge Station Pivot Hinge Assemblies* (from the same to alternating).

Inspection Checklist: The Robot Inspection Checklist Rev 3 is posted and reflects the change to R901 depicted below.

Section 7.2 ROBOT to ROBOT Interaction

G209 **During the ENDGAME, don't touch ROBOTS touching their CHARGE STATION.** During the ENDGAME, a ROBOT may not contact, either directly or transitively through a GAME PIECE, an opponent ROBOT contacting its CHARGE STATION or supported by a partner contacting its CHARGE STATION, regardless of who initiates contact. A ROBOT in contact with its CHARGE STATION and partially in its opponent's LOADING ZONE is not protected by this rule.

Violation: The contacted opponent ROBOT, and any ROBOTS contacting their CHARGE STATION when the violation occurred, and any partners it's supporting, will be considered DOCKED and ~~ENGAGED~~ all DOCKED ROBOTS at the end of the MATCH are considered ENGAGED.

Section 7.3 FIELD Interaction

G304 **Don't mess with the opponent's CHARGE STATION.** ROBOTS, either directly or transitively through a GAME PIECE, may not cause or prevent the movement of the opponent CHARGE STATION. The following are exceptions to this rule:

A. movement, or prevention of movement, of an opponent CHARGE STATION because of a MOMENTARY ROBOT action resulting in minimal CHARGE STATION movement
B. a ROBOT forced to contact an opponent's CHARGE STATION because of contact by an opponent ROBOT, either directly or transitively through a GAME PIECE or other ROBOT (e.g. a ROBOT wedged underneath the CHARGE STATION by the opposing ALLIANCE either intentionally or accidentally).

Violation: FOUL per instance. During the ENDGAME, any ROBOTS contacting their CHARGE STATION when the violation occurred, and any partners it's supporting, will be considered DOCKED and ~~ENGAGED~~ all DOCKED ROBOTS at the end of the MATCH are considered ENGAGED.

Section 8.3 Before/After the MATCH

A reminder about H301: DRIVE TEAMS are expected to be MATCH ready or making a good faith effort to be MATCH ready at the end of the Playoff break (i.e. when the timers in stations 2 reach 0). Walking safely with the ROBOT to the FIELD is an example of making a good faith effort to be MATCH ready. Continuing to work on repairs or modifications to the ROBOT is not considered making a good faith effort to be MATCH ready.

Section 9.9 OPERATOR CONSOLE

R901 **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 ~~22.0~~ 23.1 or newer.

Section 11.7.2 Playoff MATCH Bracket

As shown in Figure 11-3 and Table 11-3, Playoff MATCHES consist of 6 rounds with breaks between rounds and between the Finals MATCHES. Breaks begin after the FIELD has been cleared from the previous MATCH. The Blue and Red Gap columns indicate the approximate time between each ALLIANCE'S MATCHES. The expected start time of the scheduled MATCH is the time indicated on the MATCH schedule or 15 minutes from the end of either ALLIANCE'S previous MATCH, whichever is later.

If a Playoff MATCH needs to be replayed as described in Section 11.3 MATCH Replays, teams are notified of when the replay will occur. A minimum 10-minute delay is provided for teams to reset their ROBOTS prior to the replay unless all teams are ready sooner. The affected MATCH must be replayed before the next round begins.

Section 11.7.2.2 Playoff Finals

If a Finals MATCH ends in a tie score, the tie is not broken using the criteria in Table 11-4, the MATCH remains a tie. In the case where an ALLIANCE hasn't won 2 MATCHES after 3 MATCHES have been played (because of tied MATCHES), the Playoffs proceed with up to 3 additional Finals MATCHES, called Overtime MATCHES, until an ALLIANCE has won 2 Finals MATCHES. In the case where the Overtime MATCH scores for both ALLIANCES are equal, the win for that Overtime MATCH is awarded based on the criteria listed in Table 11-4.

~~If a Playoff MATCH needs to be replayed as described in Section 11.3 MATCH Replays, teams are notified of when the replay will occur. A minimum 10-minute delay is provided for teams to reset their robots prior to the replay unless all teams are ready sooner. The affected MATCH must be replayed before the next round begins.~~

Team Update 15

Section 7.2 ROBOT to ROBOT Interaction

G201 ***Don't expect to gain by doing others harm.** Strategies clearly aimed at forcing the opponent ALLIANCE to violate a rule are 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. If REPEATED, TECH FOUL.

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

a. a red ALLIANCE ROBOT in their COMMUNITY in the final 30 seconds of the MATCH contacts a blue ALLIANCE ROBOT.

b. a blue ROBOT attempts to cut in front of the red LOADING STATION to reach its COMMUNITY, and a nearby red ROBOT tries to impede it via a defensive bump and, as a result, the blue ROBOT crosses into the red LOADING STATION.

c. a blue ROBOT attempts to enter their COMMUNITY to score a GAME PIECE and pushes a red ROBOT just outside the blue COMMUNITY into the blue COMMUNITY.

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 the opposing ROBOT to have greater than MOMENTARY CONTROL of more than 1 GAME PIECE.

e. a blue ALLIANCE ROBOT, already in CONTROL of a GAME PIECE, pushing a red ALLIANCE ROBOT from fully outside and far from (i.e. more than 4 ft.) the blue LOADING ZONE into the blue LOADING ZONE and the REFEREE perceiving that the blue ROBOT is deliberately making the red ROBOT violate G207.

Section 9.7 Control, Command, & Signal Systems

Q207 has been updated to reflect the edit to R710.

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 R503-B), wireless bridge, PDH/PDP breakers and fuses, 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:

A. User programmable code in the roboRIO may be customized.

…

S. functional equivalents to CONTROL SYSTEM power terminal blocks.

Team Update 14

General

The 2023-PlayoffAllianceCommunication.pdf is used to summarize important Playoff Tournament information for participating DRIVE TEAMS soon after ALLIANCE pairing is complete. Paper copies are distributed to Playoff teams at events. It is now posted in the "Additional Season Materials" section of the Game & Season Materials webpage.

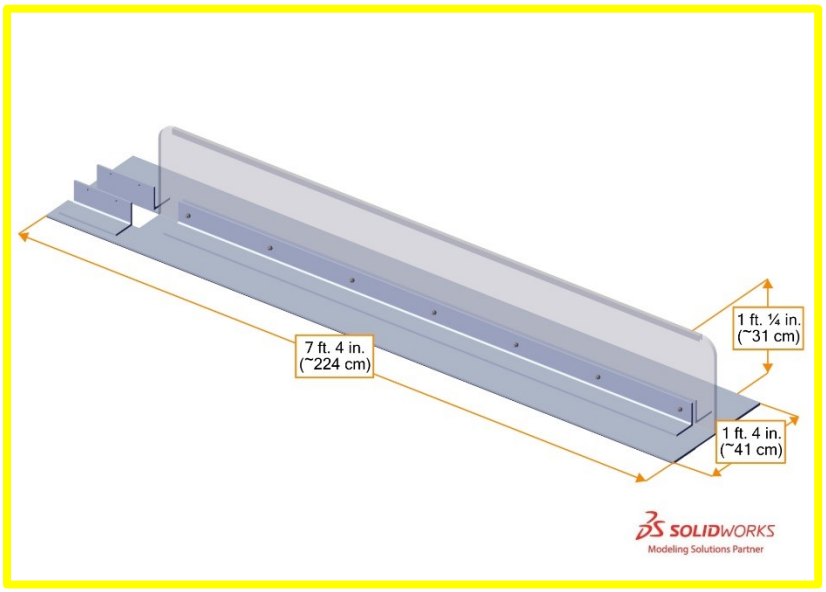
Section 1.10 Question and Answer System

a. Questions from "FRC ~~0~~ 99999" represent content asked by key volunteers (e.g., REFEREES, INSPECTORS, etc.), answered by *FIRST*, and are considered relevant to teams.

Section 5.3 BARRIER

All related assets (additional applicable manual images, official field drawings & CAD models, etc.) are updated to reflect the addition of white tape described in Section 5.3.

Figure 5-8: BARRIER



A BARRIER is a 7 ft. 4 in. (~224 cm) long assembly that separates each COMMUNITY from its adjacent LOADING ZONE. The BARRIER has a base that is 1 ft. 4 in. (~41 cm) wide and ¼ in. (~6 mm) tall. The base supports a ½ in. (~13 mm) thick, 1 ft. ¼ in. (~31 cm) tall polycarbonate wall. A strip of white tape traces the top of the BARRIER plastic as shown in Figure 5-8.

Section 8.3 Before/After the MATCH

H301 ***Be prompt.** DRIVE TEAMS 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 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 H305 or have 1 DRIVE TEAM member present and have informed event staff that their ROBOT will not be participating in the MATCH are considered MATCH ready and not in violation of this rule.

Violation: 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.

Section 11.8.1.3 Playoff ~~Round~~ Performance

Note that the phrase "Playoff Round Performance" is replaced by "Playoff Performance" throughout the manual to avoid confusion with "rounds" used to describe Playoff tournament phases.

Table 11-8 District Playoff ~~Round~~ Performance

ALLIANCE Finish	**ALLIANCE Advancement Points**
Winner	30
Finalist	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 MATCHES won by their ALLIANCE, thus their Playoff ~~Round~~ Performance points simply equals their ALLIANCE Advancement points. If a team does not play 100% of the Playoff MATCHES won by their ALLIANCE, their Playoff ~~Round~~ Performance points equals their ALLIANCE Advancement points multiplied by the percentage of Playoff MATCHES won by their ALLIANCE in which that team was a participant. For example, if Team X's ALLIANCE wins the event, but Team X only played in 4 of the 5 Playoff MATCHES won by their ALLIANCE, Team X's Playoff ~~Round~~ Performance points are 30*(4/5) = 24 points. If the result is not a whole number, the value is rounded up to the nearest integer.

Team Update 13

Section 7.2 ROBOT to ROBOT Interaction

G205 ***This isn't combat robotics.** A ROBOT may not damage or functionally impair an opponent ROBOT in either of the following ways:

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

Violation: TECH FOUL and YELLOW CARD. If opponent ROBOT is unable to drive, TECH FOUL and RED CARD

Section 8.1 General

H109 ***Be careful what you interact with.** Team members are prohibited from the following actions with regards to interaction with ARENA elements. Temporary deformation of a GAME PIECE (e.g.to pre-load a ROBOT) is an exception to this rule.

A. climbing on or inside (unless instructed by FIELD staff),
B. hanging from,
C. deforming, and
D. damaging.

Violation: Verbal warning. If subsequent violations at any point during the event, YELLOW CARD.

Section 8.3 Before/After the MATCH

H312 **Leave promptly.** DRIVE TEAMS may not cause significant or multiple delays to the start of a subsequent MATCH, scheduled break content, or other FIELD activities.

Violation: Verbal warning. If subsequent violations at any point during the event, YELLOW CARD.

Team Update 12

Section 7.1 ROBOT Restrictions

G102 ***ROBOTS, stay on the FIELD during the MATCH.** ROBOTS and anything they control, e.g. GAME PIECES, may not contact anything outside the FIELD except for MOMENTARY ~~incursions into~~ contact inside the PORTALS.

Section 7.2 ROBOT to ROBOT Interaction

G205 ***This isn't combat robotics.** A ROBOT may not damage or functionally impair an opponent ROBOT in either of the following ways:

A. deliberately, as perceived by a REFEREE.
B. regardless of intent, by initiating contact inside the vertical projection of an opponent ROBOT'S FRAME PERIMETER. 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 ~~is an~~ exceptions to this rule.

Section 9.4 BUMPER Rules

R405 ***BUMPERS indicate your ALLIANCE.** Each ROBOT must be able to display red or blue BUMPERS to reflect their ALLIANCE color, as assigned in the MATCH schedule distributed at the event (as described in Section 11.1 MATCH Schedules). BUMPER markings visible when installed on the ROBOT, other than the following, are prohibited:

A. those required per R406,
B. hook-and-loop tape, ~~or~~ snap fasteners, or functional equivalents backed by the hard parts of the BUMPER,
C. solid white *FIRST* logos between 4¾ in. (~12 cm) and 5¼ in. wide (~13 cm) (i.e. comparable to those available in the CHARGED UP Virtual Kit), and
D. narrow areas of underlying fabric exposed at seams, corners, or folds.

> The FRAME PERIMETER facing surfaces of BUMPERS are not "displayed" and thus this rule does not apply.

Section 11.2.2 YELLOW and RED CARD Rules

A second YELLOW CARD is indicated by the Head REFEREE ~~standing in front of the team's DRIVER STATION and~~ holding a YELLOW CARD and RED CARD in the air simultaneously after the completion of the MATCH.

Team Update 11

Section 7.1 ROBOT Restrictions

G107 Don't overextend yourself. …

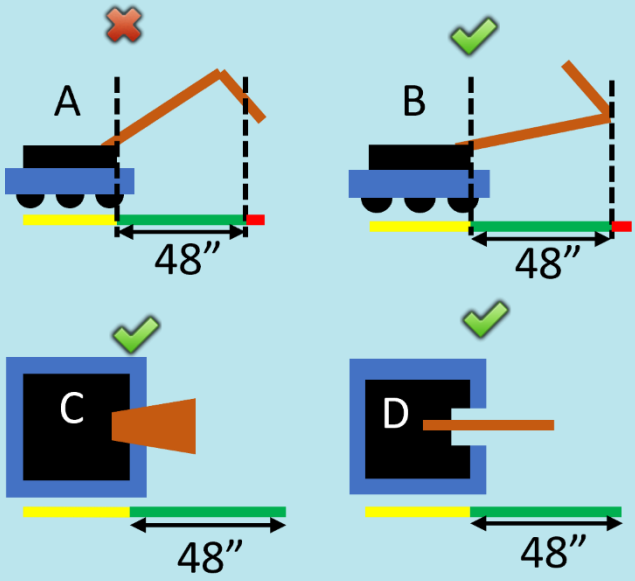
…

Examples of compliance and non-compliance of this rule are shown in Figure 7-2.

…

- ROBOT A violates this rule for having an extension that is too long
- ROBOT B does not violate this rule
- ROBOT C does not violate this rule
- ROBOT D does not violate this rule ~~because its extension is only extending in one direction despite edges that are non-perpendicular to the ROBOT BUMPERS~~

Figure 7-2 Examples of compliance and non-compliance of this rule



Section 7.3 FIELD Interaction

G302 Stay on your side before TELEOP. Before TELEOP, a ROBOT may not intersect the infinite vertical volume created by the opponent's ALLIANCE WALL, the ROBOT'S DOUBLE SUBSTATION, guardrails, and CENTERLINE of the FIELD.

Section 8.3 Before/After the MATCH

H301 ***Be prompt.** DRIVE TEAMS may not cause significant delays to the start of ~~a~~ their MATCH. Causing a significant delay requires both of the following to be true:

…

H310 **Know your DRIVE TEAM positions**. Prior to the start of the MATCH, DRIVE TEAM members must be positioned as follows:

A. DRIVERS: inside their ALLIANCE AREA and behind the STARTING LINE,
B. COACHES: inside their ALLIANCE AREA and behind the STARTING LINE, and
C. HUMAN PLAYERS:
   a. at least one HUMAN PLAYER in their SUBSTATION AREA and behind the STARTING LINE,
   b. any remaining HUMAN PLAYERS: inside their ALLIANCE AREA and behind the STARTING LINE, and
D. TECHNICIANS: in the event-designated area near the FIELD.

Violation: MATCH won't start until the situation is corrected.

H312 **Leave promptly.** DRIVE TEAMS may not cause significant or multiple delays to the start of a subsequent MATCH.

Violation: Verbal warning. If subsequent violations at any point during the event, YELLOW CARD.

Section 9.3 ROBOT Safety & Damage Prevention

R204 ***GAME PIECES stays with the FIELD.** ROBOTS must allow removal of GAME PIECES from the ROBOT and the ROBOT from FIELD elements while DISABLED and powered off.

> ROBOTS will not be re-enabled after the MATCH, so teams must be sure that GAME PIECES and ROBOTS can be quickly, simply, and safely removed.
>
> Teams are encouraged to consider ~~H301~~ H312 when developing their ROBOTS.

Section 11.7.2 Playoff MATCH Bracket

Table 11-3 Typical Playoff MATCH Schedule

MATCH	Blue	Red	Blue Gap (minutes)	Red Gap (minutes)	Winner moves to	Loser moves to
Lower Bracket – Round 5 - MATCH 13	Winner of MATCH 12	Loser of MATCH 11	~~24m~~ 17m	~~17m~~ 24m	Blue – MATCH 14	
15-minute Awards Break						
Finals – Match 14	Winner of MATCH 13	Winner of MATCH 11	17m	~~37m~~ 44m	MATCH 15	MATCH 15

Team Update 10

No updates.

Team Update 09

GENERAL

Avatar Submission System Bug

A bug in the Team Avatar submission system was deleting submissions! The issue is fixed, but teams that submitted a *new* Avatar for 2023 need to resubmit it (regardless of approval state).

To check the status of your submission, log in using the portal. If you're expecting a submission, but it's not there, please resubmit. If you want to continue using an approved Avatar from last season, no further action is needed.

We apologize for the inconvenience!

Inspection Checklist Update

The Inspection Checklist has been updated as follows:

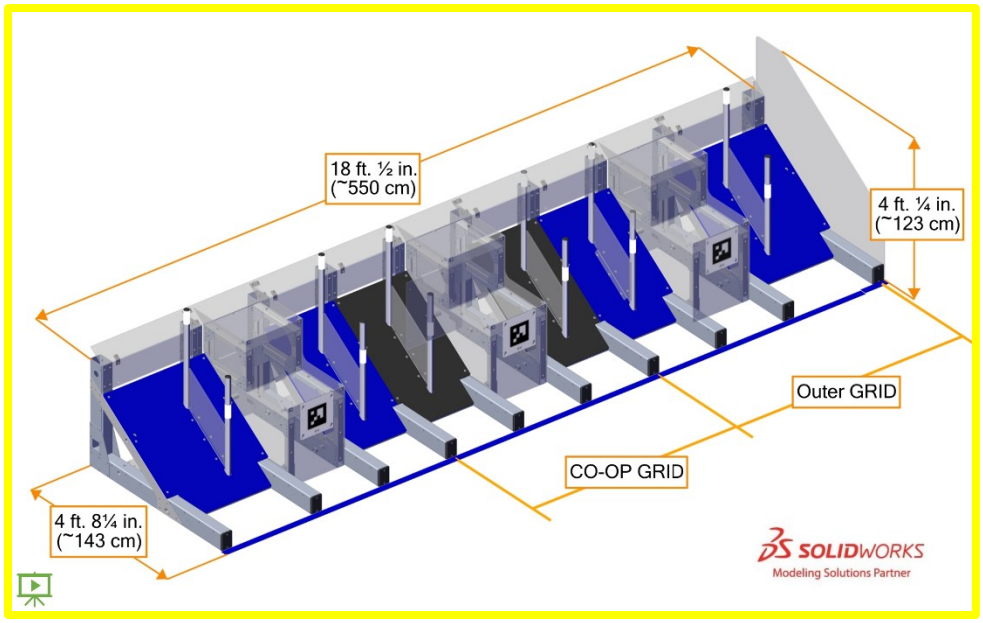
- Team number displayed with white Arabic numerals, min. font 4" (~11cm) tall x ½"(~13mm) stroke~~, in white or outlined in white with a minimum 1/16in. (~2mm) outline~~ and be easily read when walking around the perimeter of the robot.

GAME MANUAL

Section 5.5 GRIDS

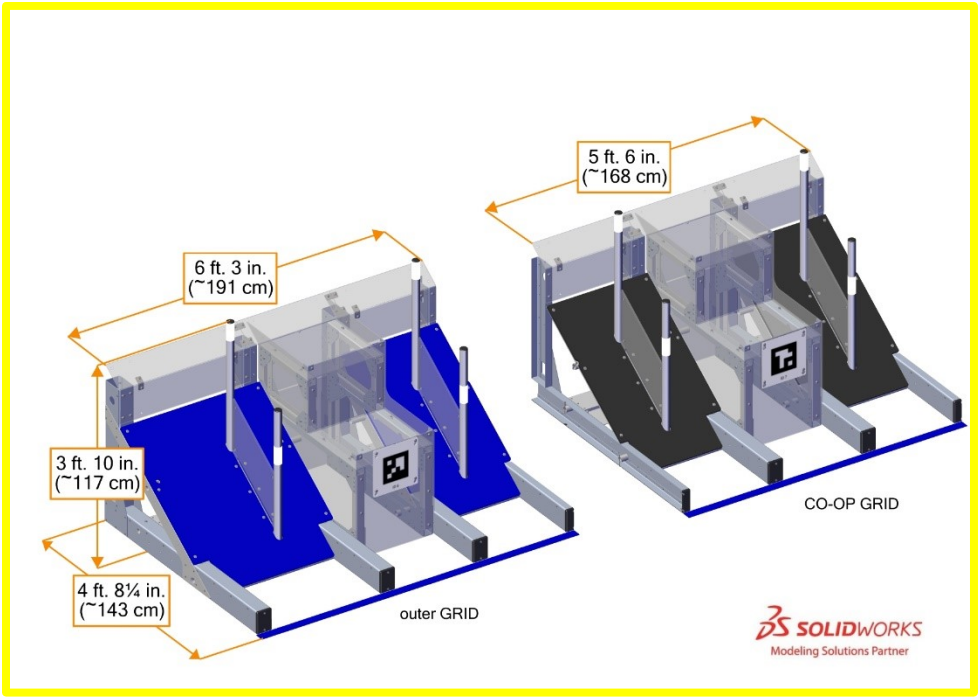
Figures 5-12 & 5-13 are edited to correct the depth dimension of the GRIDS; ~~4 ft. 6¼ in. (~138 cm)~~ 4 ft. 8¼ in. (~143 cm).

Figure 5-12 BLUE ALLIANCE GRIDS (click image to see field tour video)



A collection of 3 GRIDS consisting of 2 outer GRIDS and a Coopertition (CO-OP) GRID is located in front of each ALLIANCE WALL adjacent to the guardrail and BARRIER. The full ~~structure~~ assembly is ~~an~~ 18 ft. ½ in. (~550 cm) wide, 4 ft. ¼ in. (~123 cm) tall, and ~~4 ft. 6¼ in. (~138 cm)~~ 4 ft. 8¼ in. (~143 cm) deep ~~assembly~~. A strip of ALLIANCE-colored tape is included ~~in the~~ as part of the assembly of GRIDS and defines its front plane.

Figure 5-13 Individual GRID overall sizing



A GRID is a 3 ft. 10 in. (~117 cm) tall, ~~4 ft. 6¼ in. (~138 cm)~~ 4 ft. 8¼ in. (~143 cm) deep assembly that includes the ALLIANCE colored tape line.

Team Update 08

GENERAL

Official Field Drawings: Drawing GE-23017 from the Game Specific elements drawing package has been updated to correct the retroreflective tape location.

GAME MANUAL

Section 7.3 FIELD Interaction

G302 **Stay on your side ~~in AUTO~~ before TELEOP.** ~~During AUTO~~ Before TELEOP, a ROBOT may not intersect the infinite vertical volume created by the CENTERLINE of the FIELD.

Violation: FOUL. If contact with an opponent ROBOT, TECH FOUL. If contact with opponent's CHARGE STATION, the opponent ALLIANCE will be considered to have a successfully DOCKED and ENGAGED ROBOT at the end of AUTO.

> If an ALLIANCE uses a GAME PIECE to prevent motion of the CHARGE STATION, G402 may also apply.

G303 **Do not interfere with opponent GAME PIECES ~~in AUTO~~ before TELEOP.** ~~During AUTO~~ Before TELEOP, a ROBOT action may not cause GAME PIECES staged on the opposing side of the FIELD to move from their starting locations.

Violation: TECH FOUL per moved GAME PIECE

Section 10 Inspection & Eligibility Rules

> An Inspection Checklist ~~(not yet published)~~ is available to help teams self-inspect their ROBOT before their event. Teams are strongly encouraged to self-inspect prior to their event.

Team Update 07

GENERAL

Kit of Parts

AndyMark has identified a defect in the "Toughbox S Series ½ in. Hex Output Shafts" (am-4722) that shipped in the drive base kits. See additional information here. The lead mentors 1 and 2 for each team that received a drive base kit will also receive an email on this matter.

GAME MANUAL

Section 9.7 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 R503-B), wireless bridge, PDH/PDP breakers and fuses, 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:

…

R. adding insulating material to exposed conductors on PDH/PDP breakers and fuses.

Section 11.8.2 District Championship Eligibility

Table 11-9 2023 District Championship Capacities

District Championship	Capacity	Divisions
***FIRST* Chesapeake District Championship**	60	1
***FIRST* Israel District Championship**	40	1
***FIRST* Mid-Atlantic District Championship**	60	1
***FIRST* North Carolina State Championship**	40	1
***FIRST* Ontario Provincial Championship**	80	2
***FIRST* in Texas District Championship**	80	2
Indiana State Championship	32	1

District Championship	Capacity	Divisions
Michigan State Championship	160	4
New England District Championship	90	2
Pacific Northwest District Championship	50	1
Peachtree District State Championship	50	1

Section 11.8.3 District Championships with Multiple Divisions

~~Some District Championships have a sufficient number of teams to justify using more than 1 division.~~ If a District Championship has too many teams to allow all teams 12 Qualification MATCHES, then the event hosts multiple divisions. These events have 2 or 4 divisions (based on the number of teams participating, see Table 11-9) with approximately 40–60 teams in each division. Teams are assigned divisions by *FIRST* using a process developed by *FIRST* in Michigan.

Section 11.8.3.1 District Championship Playoffs

In these cases:

- Division winning ALLIANCES play each other in District Championship Playoffs, employing the brackets ~~below~~ shown in Figures 11-4 and 11-5 (and detailed in Table 11-11) and that corresponds to their District, until a winning ALLIANCE for the event is determined.

…

Table 11-11 District Championship 4-ALLIANCE Playoff MATCH schedule

MATCH	Blue	Red	Blue Gap (minutes)	Red Gap (minutes)	Winner moves to	Loser moves to
Upper Bracket – Round 1 – MATCH 1	B	A	-	-	Red – MATCH 3	Red – MATCH 4
Upper Bracket – Round 1 – MATCH 2	D	C	-	-	Blue – MATCH 3	Blue – MATCH 4
15-minute Break						
Upper Bracket – Round 2 – MATCH 3	W2	W1	17m	24m	Red – MATCH 6	Red – MATCH 5
Lower Bracket – Round 2 – MATCH 4	L2	L1	24m	31m	Blue – MATCH 5	
15-minute Break						

MATCH	Blue	Red	Blue Gap (minutes)	Red Gap (minutes)	Winner moves to	Loser moves to
Lower Bracket – Round 3 – MATCH 5	W4	L3	17m	24m	6	
15-minute Break						
Finals - MATCH 6	W5	W3	17m	44m		
15-minute Break						
Finals - MATCH 7	W5	W3	17m	17m		
15-minute Break						
Finals - MATCH 8*	W5	W3	17m	17m		

** if required*

Team Update 06

GENERAL

Playing Field

- GE-23300 is updated to include a note stating that dry lubricant may be applied to prevent ramps from binding and locking CHARGE STATION movement.

GAME MANUAL

The edits to Table 5-2, Section 6.2, and Section 8.2 are not a change to when scoring is assessed but attempts to avoid a reasonable perception that the original language is not consistent with language in Section 6.4.

Section 5.7.1.1 DRIVER STATION LED Strings

Table 5-2 GRID light states (field tour video)

Light String State	Criteria	Example
White	~~3 second scoring assessment period~~ within 3 seconds of the ending of AUTO or TELEOP	○○○○○○○○○○○○○○○○○○○○

Section 6.2 Autonomous Period

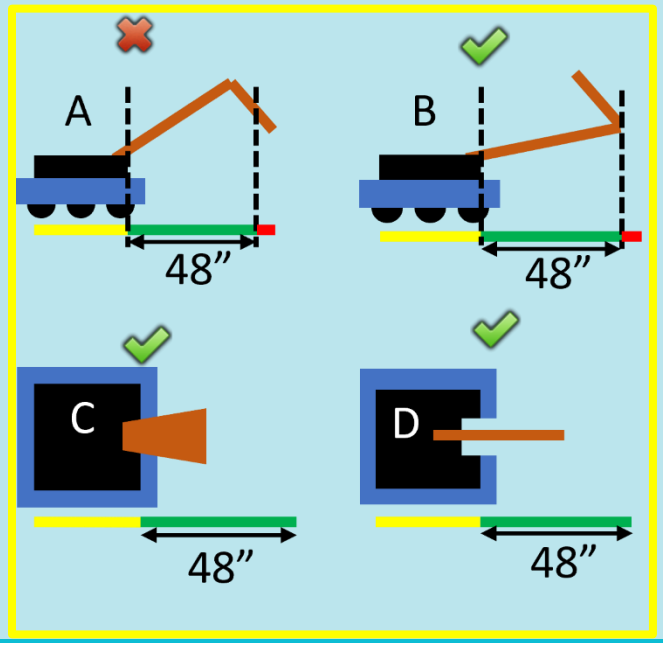
There is a 3 second delay between AUTO and ~~the Teleoperated Period during which time AUTO scores are assessed~~ TELEOP for scoring purposes as described in Section 6.4 Scoring.

Section 7.1 ROBOT Restrictions

Figures 7-2 and 7-3 are updated to correct the yellow and green references so they transition at the FRAME PERIMETER instead of the BUMPERS in all cases (we didn't catch them all in Team Update 01, apologies!).

G107 Don't over extend yourself.

Figure 7-2 Examples of compliance and non-compliance of this rule

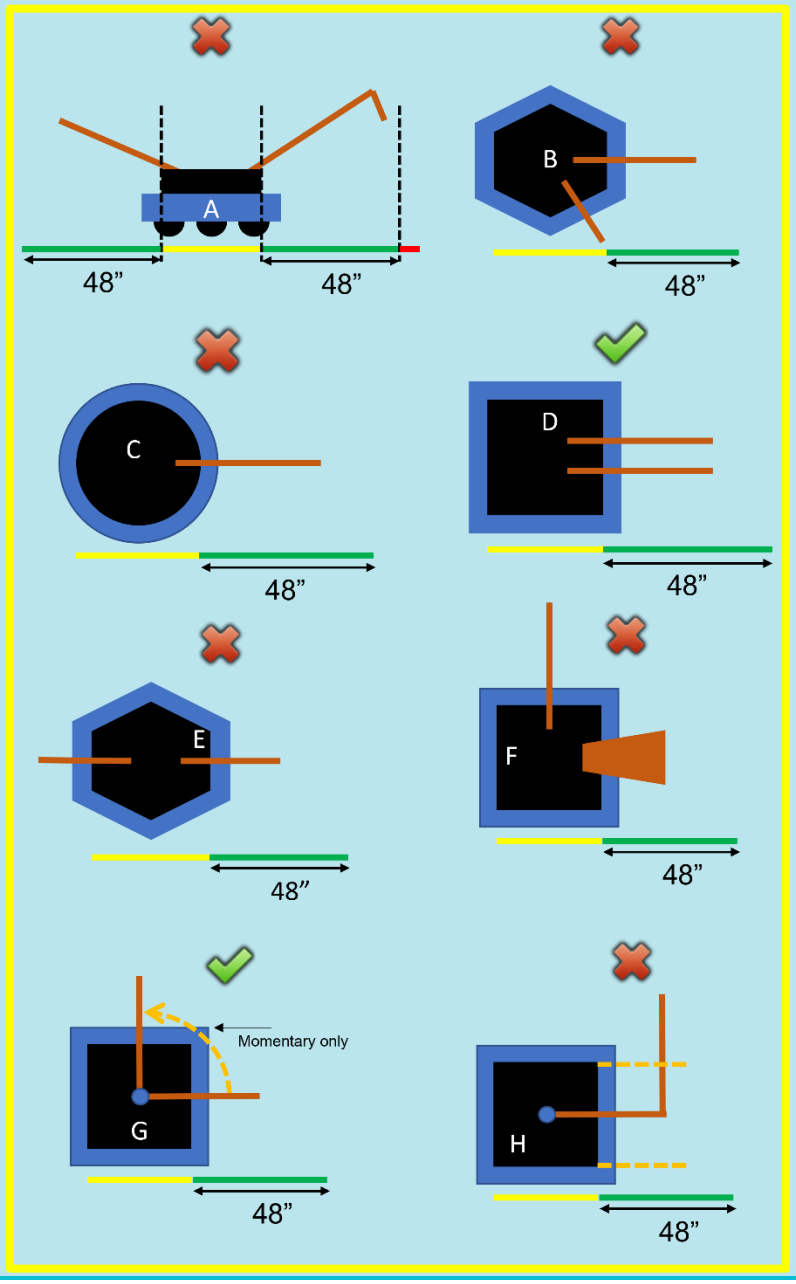


G108 Opponent's zone, no extension. A ROBOT whose BUMPERS are intersecting the opponent's LOADING ZONE or COMMUNITY may not extend beyond its FRAME PERIMETER. Extensions which are both MOMENTARY and inconsequential are an exception to this rule.

Violation: FOUL or TECH FOUL if ~~. If~~ REPEATED~~, TECH FOUL per instance~~.

G109 Don't extend in multiple directions.

Figure 7-3 Examples of compliance and non-compliance of this rule



Section 8.2 REFEREE Interaction

H201 *Egregious or exceptional violations.

e. exploiting the 3-second ~~scoring assessment period~~ window after a MATCH described in Section 6.4 Scoring to avoid rule violations (e.g. triggering an over-extension that

enables GRID points or using a ROBOT'S residual energy to impact an opponent ROBOT on their CHARGE STATION).

Section 8.4 During the MATCH: AUTO

H401 ***Behind the lines.** During AUTO, DRIVE TEAM members in ALLIANCE AREAS and HUMAN PLAYERS in their SUBSTATION AREAS may not contact anything in front of the STARTING LINES, unless for personal or equipment safety or granted permission by a Head REFEREE or FTA.

Violation: FOUL ~~per item contacted~~.

Section 8.5 During the MATCH

Q108 is edited to acknowledge the addition of H506.

H506 **DRIVE TEAMS, avoid ROBOTS.** A DRIVE TEAM member may neither

A. extend any body part into a PORTAL while any part of a ROBOT is in that PORTAL nor

B. contact a GAME PIECE in contact with a ROBOT.

Violation: Verbal warning. If subsequent violations at any point during the event, YELLOW CARD.

Section 9.4 BUMPER Rules

R408 ***BUMPER construction.** BUMPERS must be constructed as follows (see Figure 9-7):

A. be backed by ¾ in. thick (nominal, ~19mm) by 5 in. ± ½ in. (~127 mm ± 12.7 mm) tall plywood, Oriented Strand Board (OSB) or solid wood (with the exception of balsa). Small clearance pockets to accommodate minor protrusions permitted per R101, and/or ~~access~~ holes needed to access or recess mounting hardware in the wood backing are permitted, as long as they do not significantly affect the structural integrity of the BUMPER.

Section 11.7.3.1 BACKUP TEAM Coupons

The Head REFEREE will not accept the BACKUP TEAM coupon unless it lists the number of the team whose ROBOT is being replaced and is initialed by the ALLIANCE CAPTAIN.

Section 11.7.4.2 Default LINEUP

T709 ***LINEUPS due 2 minutes before the MATCH.** The ALLIANCE CAPTAIN must submit their LINEUP in writing to the Head REFEREE (or their designee) 2 minutes before their expected MATCH start time.

Violation: Late LINEUPS are denied, and the ALLIANCE'S most recent LINEUP is applied.

If the Head REFEREE is busy, and there is no designee, the ALLIANCE CAPTAIN remains in the Question Box to report the LINEUP.

If no previous LINEUP exists, the ALLIANCE Lead is assigned DRIVER STATION 2, 1st team selected is assigned DRIVER STATION 1, and the 2nd team selected is assigned DRIVER STATION 3. If any of these 3 ROBOTS are unable to play, the ALLIANCE must play the MATCH with only 2 (or even 1) ROBOT(s).

Example: 3 teams, A, B, and C form an ALLIANCE going into the Playoff MATCHES. During one of the Playoff MATCHES, Team C's ROBOT becomes inoperable. The ALLIANCE decides to bring in Team D to replace Team C. Team C repairs their ROBOT and may play in any subsequent Playoff MATCHES replacing Team A, B, or D

If a BACKUP TEAM Coupon is accepted and the LINEUP for the next MATCH is not submitted or it omits the BACKUP TEAM, then the ALLIANCE'S most recent LINEUP is used with the BACKUP team in the position populated by the team for whom they're substituting.

Team Update 05

GENERAL

No updates.

GAME MANUAL

Section 5.9.2 AprilTags

All markers are from the 16h5 tag family, IDs 1-8. AprilTags are mounted to and centered on a 10½ in. (~27 cm) square piece of polycarbonate. The 8 in. (~20 cm) tag is centered on the polycarbonate panel, such that the bottom of the central black square region is 2¼ in. (~6 cm) from the bottom of the panel, and the bottom of the 8 in. (~20 cm.) tag is located 1 ¼ in. (~3 cm) from the bottom of the panel as shown in Figure 5-32. Each marker has an identifying text label.

AprilTags are likely to experience wear and marking during MATCHES and are repaired with gaffers tape.

Section 8.3 Before/After the MATCH

H303 ***You can't bring/use anything you want.** The only equipment that may be brought to the ARENA and used by DRIVE TEAMS during a MATCH is listed below. Regardless of if equipment fits criteria below, it may not be employed in a way that breaks any other rules, introduces a safety hazard, blocks visibility for FIELD STAFF or audience members, or jams or interferes with the remote sensing capabilities of another team or the FIELD.

A. the OPERATOR CONSOLE,
B. non-powered signaling devices,
C. reasonable decorative items,
D. special clothing and/or equipment required due to a disability,
E. devices used solely for planning, ~~or~~ tracking ~~strategy~~, and communicating strategy within the same designated area (e.g. ALLIANCE AREA),
F. devices used solely to record gameplay, and
G. non-powered Personal Protective Equipment (examples include, but aren't limited to, gloves, eye protection, and hearing protection)

Section 9.4 BUMPER Rules

Please accept our apologies for the edit to the blue box in R408 rolled out via Team Update 04. The change had unintended consequences which we regret. This edit reverses the change and errs toward a more permissive interpretation of cloth/fabric (which includes pleather).

R408 ***BUMPER construction.** BUMPERS must be constructed as follows (see Figure 9-7):

D. be covered with a rugged, smooth cloth with no additional coating applied by the team except for BUMPER markings permitted per R405 (multiple layers of cloth and seams are permitted if needed to accommodate R405 and/or R406, provided the cross section in Figure 9-7 is not significantly altered).

Silk and bedding are not considered rugged cloths, however 1000D Cordura is. Tape (e.g. gaffer's tape) matching the BUMPER color is allowed to patch small holes on a temporary basis.

It is expected that there may be multiple layers of cloth as fabric is folded to accommodate the corners and seams of BUMPERS.

~~Fabrics laminated with plastic (e.g. pleather) are not compliant with this rule.~~

The cloth must completely enclose all exterior surfaces of the wood and pool noodle material when the BUMPER is installed on the ROBOT. The fabric covering the BUMPERS must be solid in color.

Team Update 04

GENERAL

Event Manual, Section 7 Ceremonies

E701 *If in the pits during Ceremonies, shhhhhh. During Ceremonies outside of Playoff MATCHES, team members may not:

A. use power tools
B. use loud hand tools (hammers, saws, etc.)
C. shout, yell, or use loud voices, unless as a demonstration of approval during a ceremonial activity.

E702 *Pit person limit during Ceremonies is 5. No more than 5 team members may be in the pits during Ceremonies outside of Playoff MATCHES.

Q&A

The answer to Q49 is updated as follows:

> The MATCH will only start if there is a GAME PIECE covering or surrounding the center of each STAGING MARK. If an ALLIANCE does not place a GAME PIECE on a STAGING MARK, the appropriate GAME PIECE will be placed on that STAGING MARK as detailed in Section 6.1.1.

GAME MANUAL

Section 5.5 GRIDS

CUBE NODES are surrounded by 3 in. (~~5~~ 8 cm) tall vertical walls, with the exception of the rear wall of the top ROW CUBE NODE which is angled.

Section 6.4 Scoring

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

A. assessment of CHARGE STATION scoring occurs 3 seconds after the ARENA timer displays 0 following AUTO
B. GAME PIECES scored in the GRID continues for up to 3 seconds after the ARENA timer displays 0 following AUTO.
C. assessment of PARKING and CHARGE STATION scoring occurs 3 seconds after the ARENA timer displays 0 following TELEOP

D. GAME PIECES scored in the GRID continues for up to 3 seconds after the ARENA timer displays 0 following TELEOP.

Section 7.2 ROBOT to ROBOT Interaction

G205 ***This isn't combat robotics.** A ROBOT may not damage or functionally impair an opponent ROBOT in either of the following ways:

A. deliberately, as perceived by a REFEREE.
B. regardless of intent, by initiating contact inside the vertical projection of an opponent ROBOT'S FRAME PERIMETER. Contact between the ROBOT'S BUMPERS or COMPONENTS inside the ROBOT'S FRAME PERIMETER and COMPONENTS inside an opening of an opponent's BUMPERS is an exception to this rule.

Violation: TECH FOUL and YELLOW CARD. If opponent ROBOT is unable to drive, TECH FOUL and RED CARD

FIRST Robotics Competition can be a full-contact competition and may include rigorous game play. While this rule aims to limit severe damage to ROBOTS, teams should design their ROBOTS to be robust.

The exception in G205-B effectively means that ROBOTS with BUMPER gaps are at their own risk regarding damaging contact in these areas.

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

a. A ROBOT leaves an arm extended, spins around to change course, and unintentionally hits and damages a COMPONENT inside the FRAME PERIMETER of a nearby opponent ROBOT.
b. A ROBOT, in the process of trying to quickly reverse direction, tips up on a single pair of wheels, lands atop an opponent ROBOT, and damages a COMPONENT inside that opponent's FRAME PERIMETER.
c. A ROBOT high-speed rams and/or REPEATEDLY smashes an opponent ROBOT and causes damage. The REFEREE infers that the ROBOT was deliberately trying to the damage the opponent's ROBOT.

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

d. opening an opponent's relief valve such that the opponent's air pressure drops and
e. powering off an opponent's ROBOT (this example also clearly results in a RED CARD because the ROBOT is no longer able to drive).

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

For the purposes of this rule, "initiating contact" requires movement towards an opponent ROBOT.

In a collision, it's possible for both ROBOTS to initiate contact.

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

Section 9.4 BUMPER Rules

R408 ***BUMPER construction.** BUMPERS must be constructed as follows (see Figure 9-7):

...

D. be covered with a rugged, smooth cloth with no additional coating applied by the team except for BUMPER markings permitted per R405 (multiple layers of cloth and seams are permitted if needed to accommodate R405 and/or R406, provided the cross section in Figure 9-7 is not significantly altered).

Silk and bedding are not considered rugged cloths, however 1000D Cordura is. Tape (e.g. gaffer's tape) matching the BUMPER color is allowed to patch small holes on a temporary basis.

It is expected that there may be multiple layers of cloth as fabric is folded to accommodate the corners and seams of BUMPERS.

Plastic coated fabrics (e.g. pleather) are not compliant with this rule.

The cloth must completely enclose all exterior surfaces of the wood and pool noodle material when the BUMPER is installed on the ROBOT. The fabric covering the BUMPERS must be solid in color.

...

Section 12 Glossary

Term	Definition
PARK	the state of a ROBOT whose BUMPERS are completely contained within its COMMUNITY but does not meet the criteria for DOCKED

Team Update 03

GENERAL

Playing Field

Team Versions

- TE-23000-Setof3Grids-Dwg has been updated to include all pages.
- TE-23004-CubeShelf-ReadMe has been updated to correct part number errors in the plywood cut sheet.

GAME MANUAL

Section 7.1 ROBOT Restrictions

G109 **Don't extend in multiple directions**. ROBOTS may not extend beyond their FRAME PERIMETER in more than one direction (i.e. over 1 side of the ROBOT) at a time. The extension may not reach outside the projection of that side of the FRAME PERIMETER. For the purposes of this rule, a round or circular section of FRAME PERIMETER is considered to have an infinite number of sides. Exceptions to this rule are:

A. MOMENTARY and inconsequential extensions in multiple directions,
B. A ROBOT fully contained within its LOADING ZONE or COMMUNITY~~.~~ , and
C. MOMENTARY movement of a MECHANISM from 1 FRAME PERIMETER side to an adjacent FRAME PERIMETER side.

Violation: FOUL. TECH FOUL if extending in multiple directions scores a GAME PIECE. If extending in multiple directions results in the ROBOT blocking all access to a FIELD ELEMENT, RED CARD

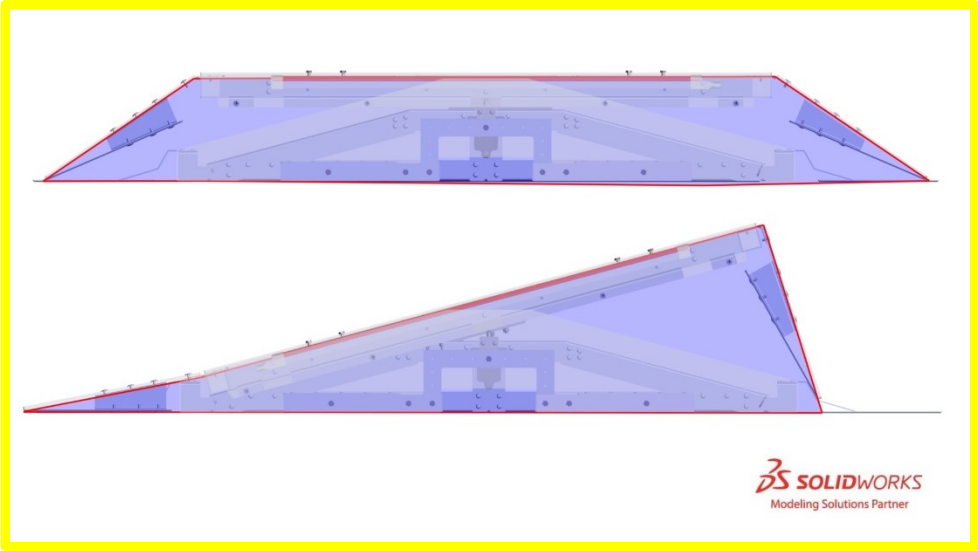
Section 7.3 FIELD Interaction

The response to Q51 has been edited to add "and G306 as added in Team Update 03."

G306 **Don't jam the CHARGE STATION.** A ROBOT may not place any part of itself inside the CHARGE STATION assembly (i.e. within the volume defined by its ramps and top surface, as shown in Figure 7-5) in an attempt to inhibit CHARGE STATION functionality.

Violation: RED CARD

Figure 7-5 The volume inside the CHARGE STATION



Section 8.1 General

H111 **Don't violate rules for Ranking Points.** 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 ALLIANCES are ineligible for SUSTAINAIBLITY and ACTIVATION BONUSES.

> For example, if Team A on the blue ALLIANCE agrees with Team F on the red ALLIANCE that they will both remove GAME PIECES from an opposing NODE, violating G405, to incur only a FOUL and each gain a SUSTAINABILITY BONUS Ranking Point.

Section 8.3 Before/After the MATCH

H309 **Know your ROBOT setup.** When placed on the FIELD for a MATCH, each ROBOT must be:

A. in compliance with all ROBOT rules, i.e. has passed inspection (for exceptions regarding Practice MATCHES, see Section 10 Inspection & Eligibility Rules),
B. the only team-provided item left on the FIELD by the DRIVE TEAM,
C. confined to its STARTING CONFIGURATION (reference R102 and R104),
D. positioned such that it is fully contained within its COMMUNITY
E. not in contact with the CHARGE STATION
F. fully supported by FIELD carpet, gaffers tape, and/or cable protector, and
G. fully and solely supporting not more than 1 GAME PIECE (as described in Section 6.1 Setup).

Section 9.4 BUMPER Rules

R408 ***BUMPER construction.** BUMPERS must be constructed as follows (see Figure 9-7):

…

D. be covered with a rugged, smooth cloth with no additional coating applied by the team except for BUMPER markings permitted per R405 (multiple layers of cloth and seams are permitted if needed to accommodate R405 and/or R406, provided the cross section in Figure 9-7 is not significantly altered).

Silk and bedding are not considered rugged cloths, however 1000D Cordura is. Tape (e.g. gaffer's tape) matching the BUMPER color is allowed to patch small holes on a temporary basis.

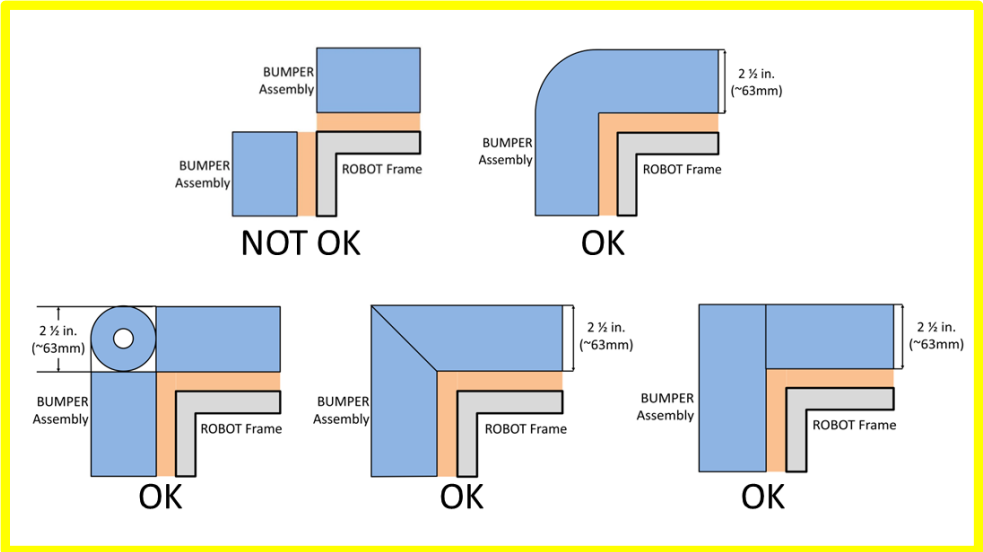
It is expected that there may be multiple layers of cloth as fabric is folded to accommodate the corners and seams of BUMPERS.

The cloth must completely enclose all exterior surfaces of the wood and pool noodle material when the BUMPER is installed on the ROBOT. The fabric covering the BUMPERS must be solid in color.

…

R409 *Figure 9-8 has been edited to reposition leader lines to remove visual implication that they could be pool noodle ends.*

Figure 9-8 Soft parts of BUMPER corners



Team Update 02

GENERAL

Playing Field Assets

Team Elements

- Rev A of TE-23000-Setof3Grids-Dwg corrects an error in item 3 quantity.
- The following documents are updated to remedy cut list typos and omissions:
  - TE-23000-Setof3Grids-ReadMe
  - TE-23001-GRID-ReadMe
  - TE-23002-EndConeRamp-ReadMe
  - TE-23003-MidConeRamp-ReadMe
  - TE-23004-CubeShelf-ReadMe

GAME MANUAL

Section 6.1.1 GAME PIECES

B. each ALLIANCE may stage 4 GAME PIECES of their choice ~~on the STAGING MARKS~~, 1 per any of the STAGING MARKS between their COMMUNITY and the CENTER LINE, such that each GAME PIECE covers or surrounds the center of its STAGING MARK (as viewed from above) ~~as~~ comparable to staging shown in Figure 6-1,

Section 6.4 GRID Scoring

The edit to Table 6-1 is to ensure that the corner of the BARRIER that extends into the adjacent HYBRID NODE (highlighted below in green) is inconsequential in the assessment of GAME PIECES scored in that HYBRID NODE.

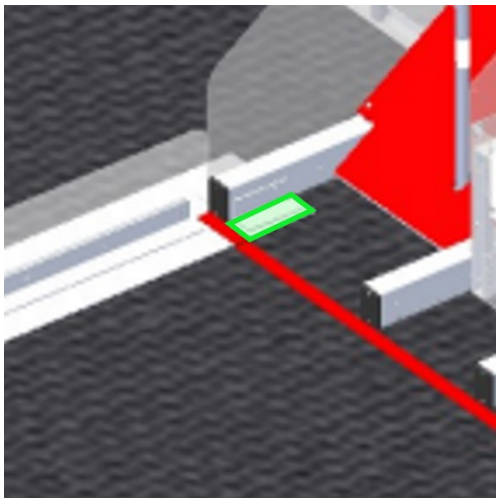


Table 6-1 GAME PIECE Scoring Criteria

ROW	GAME PIECE	Scoring Criteria
Bottom	CONE or CUBE	Touching FIELD carpet and/or BARRIER in only 1 HYBRID NODE and fully contained in GRIDS.
Middle or Top	CONE	The top of the CONE NODE is contained within the volume defined by the conical surface of the CONE
Middle or Top	CUBE	partially or completely (regardless of inflation state) supported by a CUBE NODE.

Section 7.1 ROBOT Restrictions

G109 **Don't extend in multiple directions**. ROBOTS may not extend beyond their FRAME PERIMETER in more than one direction (i.e. over 1 side of the ROBOT) at a time. The extension may not reach outside the projection of that side of the FRAME PERIMETER. For the purposes of this rule, a round or circular section of FRAME PERIMETER is considered to have an infinite number of sides. Exceptions to this rule are:

A. MOMENTARY and inconsequential extensions in multiple directions
B. A ROBOT fully contained within its LOADING ZONE or COMMUNITY.

Violation: FOUL. TECH FOUL if extending in multiple directions scores a GAME PIECE. If extending in multiple directions results in the ROBOT blocking all access to a FIELD ELEMENT, RED CARD

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

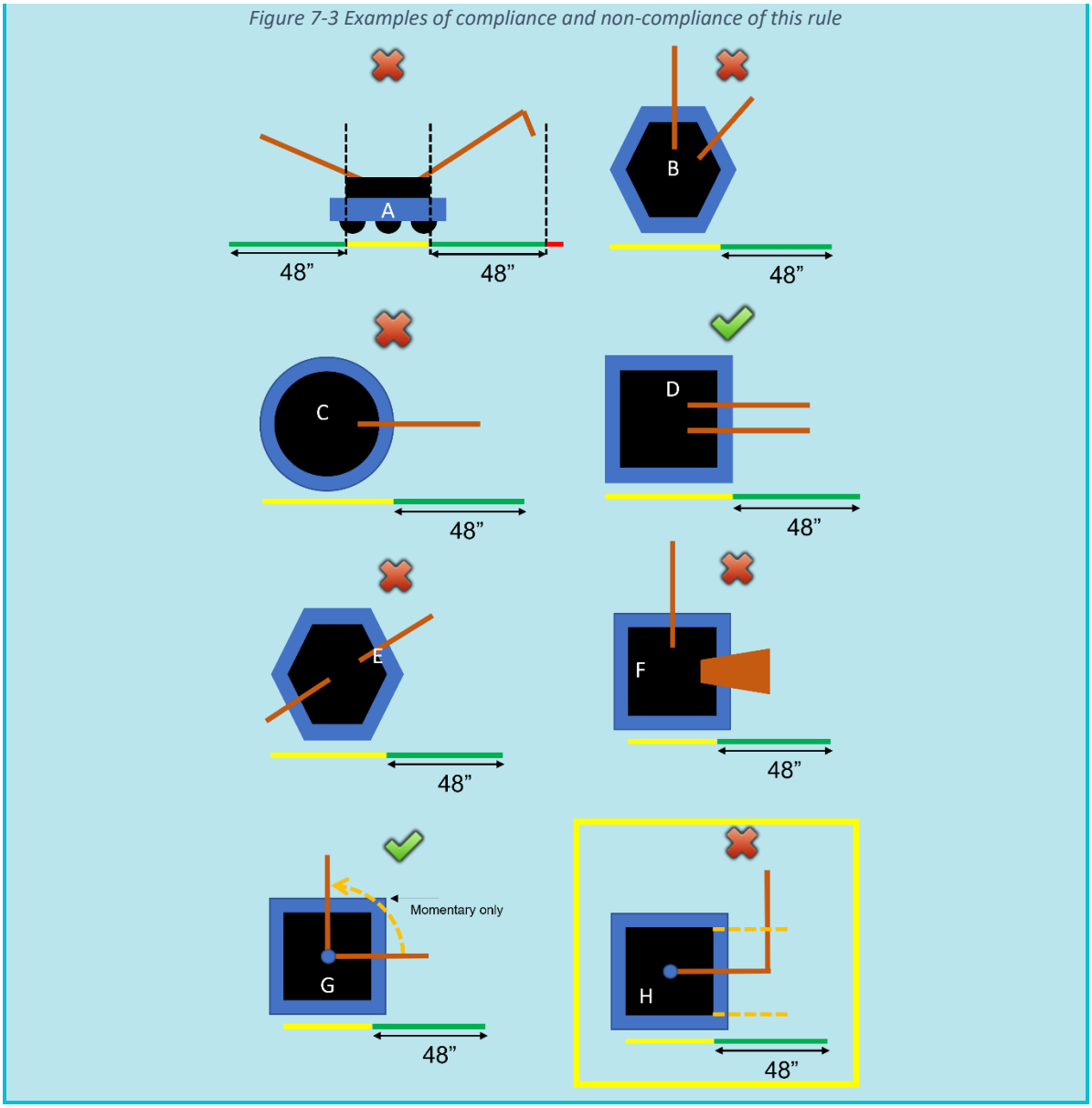
Examples of compliance and non-compliance of this rule are shown in Figure .

Yellow bars represent the limits of the FRAME PERIMETER and are drawn in the same orientation of the ROBOT'S FRAME PERIMETER. Green bars represent a measured extension from the FRAME PERIMETER that does not exceed the limit defined in this rule. Red bars represent a measured extension from the FRAME PERIMETER that exceeds the limit in this rule.

All following examples are legal in ROBOT'S LOADING ZONE and COMMUNITY.

- ROBOT A violates this rule for extending in more than one direction
- ROBOT B violates this rule for extending in more than one direction
- ROBOT C violates this rule for extending beyond an infinite number of sides and therefore any extension over an arc extends over multiple sides
- ROBOT D does not violate this rule
- ROBOT E violates this rule for extending in more than one direction
- ROBOT F violates this rule for extending in more than one direction
- ROBOT G does not violate this rule as long as the extension does not exceed the definition of MOMENTARY when positioned over the BUMPER corner.
- ROBOT H violates this rule for reaching outside the projection of the FRAME PERIMETER side.

Figure 7-3 Examples of compliance and non-compliance of this rule



Section 8.5 During the MATCH

H502 ***No wandering.** DRIVE TEAMS may not contact anything outside the area in which they started the MATCH (i.e. the ALLIANCE AREA, the SUBSTATION AREA, or the designated TECHNICIAN space). Exceptions are granted for a HUMAN PLAYER whose feet are partially outside the SUBSTATION AREA (but not in the opponent ALLIANCE AREA), in cases concerning safety, and for actions that are inadvertent, MOMENTARY, and inconsequential.

Violation: FOUL.

Section 9 ROBOT Construction Rules

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

…

C. should maintain sufficient stock or production capability so they are ~~must be~~ able to ship any general (i.e., non-*FIRST* unique) product within 5 business days of receiving a valid purchase request. It is recognized that certain unusual circumstances (such as a global supply chain disruption and/or 1,000 *FIRST* teams all ordering the same part at once from the same VENDOR) may cause atypical delays in shipping due to backorders for even the largest VENDORS. Such delays due to higher-than-normal order rates are excused. This criterion may not apply to custom-built items from a source that is both a VENDOR and a fabricator.

~~D. should maintain sufficient stock or production capability to fill teams' orders within a reasonable period during the season (less than 1 week). This criterion may not apply to custom-built items from a source that is both a VENDOR and a fabricator.~~

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

…

Section 9.5 Motors & Actuators

R501 ***Allowable motors.** The only motors and actuators permitted include the following (in any quantity):

Table 9-1 Motor allowances

Motor Name	Part Numbers Available
REV Robotics NEO Brushless	REV-21-1650 (v1.0 or v1.1)
	~~am-5258~~ am-4258
	am-4258a

Section 10 Inspection & Eligibility Rules

> An Inspection Checklist (not yet published) is available to help teams self-inspect their ROBOT before their event. Teams are strongly encouraged to self-inspect prior to their event.

Section 11.6.2 MATCH Assignment

The edit below is not a change to how the match schedule algorithm works, it's just an edit to fix an error in the description of the how the algorithm works.

FMS assigns each team 2 ALLIANCE partners for each Qualification MATCH using a predefined algorithm, and teams may not switch Qualification MATCH assignments. The algorithm employs the following criteria, listed in order of priority:

1. maximize time between each MATCH played for all teams
2. ~~minimize the number of times a team plays opposite any team~~ minimize the number of times a team is allied with any team
3. ~~minimize the number of times a team is allied with any team~~ minimize the number of times a team plays opposite any team
4. minimize the use of SURROGATES (teams randomly assigned by the FMS to play an extra Qualification MATCH)
5. provide even distribution of MATCHES played on blue and red ALLIANCE
6. provide even distribution of MATCHES played in each DRIVER STATION number

> For more information about the MATCH scheduling algorithm, please see Idle Loop software's website.

Section 11.8.1.6 Regional Participation

District teams ~~do not~~ neither earn points for their actions at any Regionals ~~they may attend~~, nor are eligible for any *FIRST* Championship qualifying ~~judged awards~~ benefits at ~~those events~~ that Regional (awards, Wild Cards, etc.). ~~However, if~~ If a District team ~~does earn a slot at the FIRST Championship while attending a Regional event~~ is on the winning ALLIANCE, ~~that slot does count as part of the total Championship allocation the District is receiving for the season~~ a Wild Card is awarded to the next qualifying team. If they are on the finalist ALLIANCE and would be awarded a Wild Card, they are skipped.

Section 11.8.2 District Championship Eligibility

Table 11-9 2023 District Championship Capacities

District Championship	Capacity
***FIRST* North Carolina State Championship**	~~36~~ 40

Section 12 Glossary

Term	Definition
LOADING ZONE	an 8 ft. 3 in. (~252 cm) wide by 11 ft. ¼ in. (~336 cm) to 22 ft. ¼ in. (~671 cm) deep infinitely tall volume formed by the DOUBLE SUBSTATION, the plane defined by the BARRIER plastic, the guardrail, and ALLIANCE colored tape. The LOADING ZONE includes the tape.

Team Update 01

GENERAL

Playing Field Assets

- The Playing Field webpage has been updated to include links to Synthesis by Autodesk and draft CNC files from REV Robotics. Note that these assets were neither developed or validated by *FIRST*, and differences between fields represented in these tools and the official field may exists.
- **Official Field**
  - GE-23318 has been updated to include a note for sourcing an equivalent COTS part.
  - Drawings and CAD files (Solidworks & STEP) for the CONE (GE-23700), CUBE (GE-23701), and the CUBE measuring jig (GE-23702, GE-23703, & GE-23704) have been added as standalone downloads.
  - The AprilTag coordinate table on page 4 of the Layout & Marking Diagram has been updated as follows:

ID	X	Y	Z	Z-rotation
1	610.77 in.	42.19 in.	18.22 in.	180°
2	610.77 in.	108.19 in.	18.22 in.	180°
3	610.77 in.	~~147.19~~ 174.19	18.22 in.	180°
4	636.96 in.	265.74 in.	27.38 in.	180°
5	14.25 in.	265.74 in.	27.38 in.	0°
6	40.45 in.	~~147.19~~ 174.19	18.22 in.	0°
7	40.45 in.	108.19 in.	18.22 in.	0°
8	40.45 in.	42.19 in.	18.22 in.	0°

- **Team Elements**
  - TE-23020 (*CUBE Shelf Rear Vertical*, used in the *CUBE Shelf*, *GRID*, and *Set of 3 GRIDS* assemblies) has been updated to correct the location of a hole in B4.
  - TE-23038 (*CUBE Shelf Upper Panel*, used in used in the *CUBE Shelf*, *GRID*, and *Set of 3 GRIDS* assemblies) has been updated to correct the location of a hole in A2.
  - The following documents are updated to include part descriptions and quantities alongside the plywood Example Cut Sheets:
    - TE-23000-Setof3Grids-ReadMe
      - This document also includes the following edit in regard to the quantity of plywood needed: ~~Slightly More than~~ 4 Sheets
    - TE-23001-GRID-ReadMe
    - TE-23002-EndConeRamp-ReadMe
    - TE-23003-MidConeRamp-ReadMe
    - TE-23004-CubeShelf-ReadMe

Kit of Parts

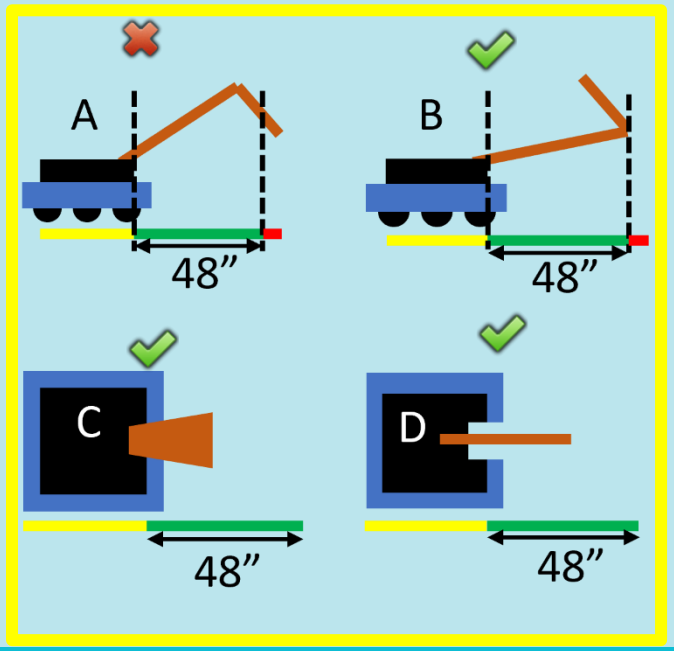
- ***FIRST* Choice:** A steel adapter for the PLG (Power Lift Gate) motor from Johnson Electric was added to *FIRST* Choice Round 2 (inventory is 260 pieces).
- **Kickoff Kit:** The User Guide for the drive base chassis kit has been updated to correct errors in gear tooth counts and part numbers on page 10, steps 5 and 8. These errors also existed in the Gearbox assembly video and are corrected.

GAME MANUAL

Section 7.1 ROBOT Restrictions

G107 **Don't overextend yourself.** *Figure 7-2 is updated to show the green 48 in. extension limits in examples C and D originating at the FRAME PERIMETER instead of the BUMPERS.*

Figure 7-2 Examples of compliance and non-compliance of this rule



Section 7.4 GAME PIECES

G403 **1 GAME PIECE at a time (except in LOADING ZONE and COMMUNITY).** ROBOTS completely outside their LOADING ZONE or COMMUNITY may not have ~~greater-than-MOMENTARY~~ CONTROL of more than 1 GAME PIECE, either directly or transitively through other objects.

A ROBOT is in CONTROL of a GAME PIECE if:

A. the GAME PIECE is fully supported by the ROBOT, or
B. the ROBOT is intentionally moving a GAME PIECE to a desired location or in a preferred direction

Violation: FOUL per additional GAME PIECES. If egregious, YELLOW CARD.

Section 9.5 Motors & Actuators

R501 ***Allowable motors.** The only motors and actuators permitted include the following (in any quantity):

Table 9-1 Motor allowances

Motor Name	Part Numbers Available	
REV Robotics NEO Brushless	REV-21-1650 (v1.0 or v1.1)	am-5258 am-4258a
REV Robotics NEO 550	REV-21-1651	am-4259

R503 ***Power (most) actuators off of approved devices.** With the exception of servos, fans, or motors integral to sensors of COTS computing devices permitted in R501, each actuator must be controlled by a power regulating device. The only power regulating devices for actuators permitted on the ROBOT include:

A. motor controllers,

…

e. Spark Motor Controller (P/N REV-11-1200, am-4260),
f. Spark MAX Motor Controller (P/N REV-11-2158, am-4261),

…

Section 11.7.2 Playoff MATCH Bracket

Table 11-3 Typical Playoff MATCH Schedule

MATCH	Blue	Red	Blue Gap (minutes)	Red Gap (minutes)	Winner moves to	Loser moves to
Lower Bracket – Round 4 - MATCH 12	Winner of MATCH ~~10~~ 9	Winner of MATCH ~~9~~ 10	~~17m~~ 24m	~~24m~~ 17m	Blue – MATCH 13	

Section 11.8.1 District Events

Table 11-8 District Playoff Round Performance

ALLIANCE Finish	ALLIANCE Advancement Points
Winner	30
Finalist	20
3rd Place (loser of MATCH 13)	13
4th Place (loser of MATCH ~~11~~12)	7

Team Update 00

GENERAL

Kit of Parts

The Voucher Book has been updated to include the following edits. We encourage teams to mark up the hard copy distributed in the Season Specific container as part of the Kickoff Kit.

- Monday.com had to suspend their support, so teams should make sure to cross them off the checklist on page 3 and x-out pages 24 and 25 (also cross off on the "Kickoff Checklist Poster").
- Please make the following markup on pages 28, 50, and 52: Access Codes: ~~Visit Team Registration Account (Lead Mentor 1 or 2)~~ n/a

EVENT RULES

V4 of the Event Rules document includes the following edits.

Section 1: General Rules

FIRST is committed to Equity, Diversity, and Inclusion and as such, *FIRST* makes reasonable accommodations for persons with disabilities that request accommodation. If a participant needs an accommodation for an event, please talk to a volunteer at the event or contact your local leadership before the event so they can help ensure the accommodation is provided. Local leadership may make exceptions to event rules to allow for reasonable accommodations given the exceptions do not create an undue hardship or cause safety concerns.

Section 7: Ceremonies

At every event, there are Opening and Closing Ceremonies to show honor and respect for represented countries, sponsors, teams, mentors, volunteers, and award winners. Ceremonies provide everyone with the opportunity to collectively applaud the successes of all participants. They also give teams a chance to "meet" the volunteers and other people and sponsors involved with the event. Closing Ceremony elements at the end of the event are integrated into and presented between Playoff Matches.

Section 8: In the Stands

E801 ***No saving seats.** Teams are not permitted to save or designate seats for team members that are not present.

> Teams may not hang banners or ribbons or otherwise designate seating. (Event staff will remove and discard any banners, roping, etc., used to designate seating.) Please take turns sitting in the bleachers/stands if seating is limited. If there is a crowding problem, we ask that you kindly leave after your team's MATCH and return later, if possible.
>
> Event management may reserve seats for attendees who require accommodations.

GAME MANUAL

The Game Manual has been updated for the 2023 season of CHARGED UP℠ presented by Haas. All changes captured in this document are compared to the last published 2022 Game Manual (updated on April 12, 2022 [Team Update 21]). 2023 updates not detailed in Team Update 00 include:

- Styled to match the 2023 season
- Season specific references updated (e.g. game name, field & game piece names, blue box examples, etc.)
- Minor typos/formatting errors in Evergreen rules
- The Tournament Section (Section 11) has been rewritten to reflect the new double elimination tournament, removal of timeouts, reorganizing content, and adding Evergreen rules. Any changes that are derivative of the new playoff model have also been updated.
- For instances where a rule is referenced within itself, the rule number is replaced with “this rule."

Changes to Evergreen content are detailed below.

Section 1.5 Coopertition

Includes the name of the most recent Woodie Flowers Award recipient.

Section 1.6 Spirit of Volunteering

Updated with a new message for 2023 and includes the names of our new Chief FTAs.

Section 1.7 This Document & Its Conventions

Imperial dimensions are followed by comparable metric dimensions in parentheses to provide metric users with the approximate size, ~~weight~~ mass, etc.

Rules include colloquial language, also called headlines, in an effort to convey an abbreviated ~~intent~~ version of the rule or rule set.

Section 1.10 Question and Answer System

Questions from “FRC ~~9999~~0” represent content asked by key volunteers (e.g., REFEREES, INSPECTORS, etc.), answered by *FIRST*, and are considered relevant to teams.

Section 6.5 Rule Violations

Upon any instance of a rule violation, unless otherwise noted, 1 or more of the penalties listed in Table 6-3 are assessed.

Section 7.2 ROBOT to ROBOT Interaction

G206 ***Don’t tip or entangle.** A ROBOT may not deliberately, as perceived by a REFEREE, attach to, tip, or entangle with an opponent ROBOT.

Violation: TECH FOUL and YELLOW CARD. If continuous or opponent ROBOT is unable to drive, TECH FOUL and RED CARD.

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

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

Tipping as an unintended consequence of normal ROBOT to ROBOT interaction, as perceived by the REFEREE, is not a violation of this rule

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

Section 7.4 GAME PIECES

G401 ***Keep GAME PIECES in bounds.** ROBOTS may not intentionally eject opponent GAME PIECES from the FIELD (either directly or by bouncing off a FIELD element or other ROBOT).

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

Section 8.1 General

Note the addition of H107 increments the subsequent rule numbers.

H107 ***Throwing your own MATCH is bad.** A team may not intentionally lose a MATCH or sacrifice ranking points in an effort to lower their own ranking or manipulate the rankings of other teams.

Violation: 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.)

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

H109 ***Be careful what you interact with.** Team members are prohibited from the following actions with regards to interaction with ARENA elements. Temporary deformation of a GAME PIECE (e.g.to pre-load a ROBOT) is an exception to this rule.

A. climbing on or inside,
B. hanging from,
C. deforming, and
D. damaging.

Violation: Verbal warning. If subsequent violations at any point during the event, YELLOW CARD.

Section 8.2 REFEREE Interaction

H202 ***1 STUDENT, 1 Head REFEREE.** A team may only ~~send 1 STUDENT from its DRIVE TEAM to~~ address the Head REFEREE with 1 STUDENT. The STUDENT may not be accompanied by more than 1 silent observer.

Violation: The Head REFEREE will not address additional, non-compliant team members or peripheral conversations.

> Please see Section 8.2 REFEREE Interaction for more information about process and expectations. Note that some events may restrict ARENA access to members of the DRIVE TEAM.

Section 8.3 Before/After the MATCH

H301 ***Be prompt~~/safe when coming to and going from the FIELD~~.** DRIVE TEAMS may not cause significant ~~or multiple~~ delays ~~during the event~~ to the start of a MATCH.~~, the FIELD reset after a MATCH, or continuation of MATCHES after a TIMEOUT.~~ 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 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.

A. The DRIVE TEAM 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 H305 or have 1 DRIVE TEAM member present and have informed event staff that their ROBOT will not be participating in the MATCH are considered MATCH ready and not in violation of this rule.

~~Violation: If prior to the MATCH, the offending DRIVE TEAM'S ROBOT will be DISABLED. If after the MATCH, YELLOW CARD.~~

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.

> The intent of this rule is to provide an equitable amount of time for both ALLIANCES to prepare for each MATCH and give DRIVE TEAMS grace given extenuating circumstances that causes them to be late.
>
> Once a verbal warning/TECH FOUL is issued, the Head REFEREE starts a 2-minute timer and makes a good faith effort to share the timer's status with the delaying DRIVE TEAM.

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

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

a. walking safely towards the FIELD with a ROBOT that a team is not actively modifying,
b. applying quick fixes such as tape or cable ties to make the ROBOT compliant with STARTING CONFIGURATION requirements,
c. waiting for an OPERATOR CONSOLE computer to boot, and
d. working with FIELD STAFF to get the ROBOT connected to the FIELD.

~~DRIVE TEAMS are expected to stage their ROBOTS for a MATCH, and remove it from the FIELD afterwards, safely and swiftly. Examples of violations include, but are not limited to:~~ Examples that are not considered good faith efforts to quickly become MATCH ready include but are not limited to:

e. a ROBOT not moving to the FIELD,
f. a ROBOT moving to the FIELD but being actively modified while doing so,
~~g. late arrival to the FIELD (including across different MATCHES and after a FIELD or ALLIANCE TIMEOUT),~~

g. ~~failing to exit the FIELD~~ a DRIVE TEAM member remaining on the FIELD once a MATCH is ready to begin (indicated by the green LEDs having turned off),

h. installing BUMPERS, charging pneumatic systems, or any other ROBOT maintenance not considered a quick fix as described in item b above once on the FIELD, and
i. time-consuming use of alignment devices that are external to the ROBOT (e.g. a DRIVE TEAM could bring and use a measuring tape, as long as there is no delay to the MATCH by doing so)~~, and~~
~~j. failing to remove OPERATOR CONSOLES from the DRIVER STATIONS in a timely manner.~~

~~At the conclusion of a TIMEOUT, ROBOTS are expected to be staged on the FIELD prior to the timer displaying 0 and ready for the MATCH to start.~~

There are no rules that prohibit use of hand tools (including battery operated tools) while setting up ~~and/or removing~~ ROBOTS from the FIELD provided they do not cause significant delay or cause safety concerns.

H302 ***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: YELLOW CARD

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

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

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 ~~once~~ before or after the MATCH ~~has concluded~~.

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.

H303 ***You can't bring/use anything you want.** The only equipment that may be brought to the ARENA and used by DRIVE TEAMS during a MATCH is listed below. Regardless of if equipment fits criteria below, it may not be employed in a way that breaks any other rules, introduces a safety hazard, blocks visibility for FIELD STAFF or audience members, or jams or interferes with the remote sensing capabilities of another team or the FIELD.

A. the OPERATOR CONSOLE,
B. non-powered signaling devices,
C. reasonable decorative items,
D. special clothing and/or equipment required due to a disability,
E. devices used solely for planning or tracking strategy,
F. devices used solely to record gameplay, and
G. non-powered Personal Protective Equipment (examples include, but aren't limited to, gloves, eye protection, and hearing protection)

Items brought to the ARENA under allowances B-G must meet all following conditions:

I. do not connect or attach to the OPERATOR CONSOLE, FIELD, or ARENA,
II. do not connect or attach to another ALLIANCE member (other than items in category G),
III. do not communicate with anything or anyone outside of the ARENA,
IV. do not communicate with the TECHNICIAN,
V. do not include any form of enabled wireless electronic communication with the exception of medically required equipment, and
VI. do not in any way affect the outcome of a MATCH, other than by allowing the drive team to
    a. plan or track strategy for the purposes of communication of that strategy to other ALLIANCE members or
    b. use items allowed per B to communicate with the ROBOT.

Section 8.5 During the MATCH

H502 ***No wandering.** ~~DRIVERS, COACHES, and HUMAN PLAYERS~~ DRIVE TEAMS may not contact anything outside the area in which they started the MATCH (i.e. the ALLIANCE AREA, the SUBSTATION AREA, or the ~~TERMINAL AREA~~ designated TECHNICIAN space). ~~TECHNICIANS may not contact anything outside their designated area.~~ Exceptions are granted in cases concerning safety and for actions that are inadvertent, MOMENTARY, and inconsequential.

Section 9 ROBOT Construction Rules

R202 ***No exposed sharp edges.** Protrusions from the ROBOT and exposed surfaces on the ROBOT shall not pose hazards to the ARENA elements (including ~~CARGO~~ GAME PIECES) or people.

R206 ***Don't damage GAME PIECES.** ROBOT elements likely to come in contact with a GAME PIECE shall not pose a significant hazard to the GAME PIECE.

GAME PIECES are expected to undergo a reasonable amount of wear and tear as they are handled by ROBOTS, such as scratching or marking. Gouging, tearing off pieces, or routinely marking GAME PIECES are violations of this rule.

R302 ***Custom parts, generally from this year only.** FABRICATED ITEMS created before Kickoff are not permitted. Exceptions are:

A. OPERATOR CONSOLE,
B. BUMPERS,
C. battery assemblies as described in R103-B,
D. FABRICATED ITEMS consisting of 1 COTS electrical device (e.g. a motor or motor controller) and attached COMPONENTS associated with any of the following modifications:
   a. wires modified to facilitate connection to a ROBOT (including removal of existing connectors),
   b. connectors and any materials to secure and insulate those connectors added (note: passive PCBs such as those used to adapt motor terminals to connectors are considered connectors),
   c. motor shafts modified and/or gears, pulleys, or sprockets added, and
   d. motors modified with a filtering capacitor as described in the blue box below R625.
E. COTS items, or functional equivalents, with any of the following modifications:
   a. non-functional decoration or labeling,
   b. assembly of COTS items per manufacturer specs, unless the result constitutes a MAJOR MECHANISM as defined in I101, and
   c. work that could be reasonably accomplished in fewer than 30 minutes with the use of handheld tools (e.g. drilling a small number of holes in a COTS part).

Please note that this means FABRICATED ITEMS from ROBOTS entered in previous *FIRST* competitions may not be used on ROBOTS in the CHARGED UP *FIRST* Robotics Competition (other than those allowed per R302-B through -E. Before the formal start of the build season, teams are encouraged to think as much as they please about their ROBOTS. They may develop prototypes, create proof-of-concept models, and conduct design exercises. Teams may gather all the raw stock materials and COTS COMPONENTS they want.

Functionally equivalent items are items that closely resemble a COTS item in both form and function. Functional equivalents should be made using similar materials to the COTS equivalents.

Parts with precision machined (mill, CNC, etc.) features may still meet part E.c of this rule if functionally equivalent features could reasonably be made within the restrictions specified.

Example 1: A team designs and builds a 2-speed shifting transmission during the fall as a training exercise. After Kickoff, they utilize all the design principles they learned in the fall to design their ROBOT. To optimize the transmission design for their ROBOT, they change the transmission gear ratios and reduce the size, and build 2 new transmissions, and place them on the ROBOT. All parts of this process are permitted activities.

Example 2: A team re-uses a CHARGED UP-legal motor from a previous ROBOT which has had connectors added to the wires. This is permitted, per exception D, because the motor is a COTS electrical COMPONENT.

Example 3: A team re-uses a piece of aluminum tubing from a previous ROBOT which has a precision machined bearing hole in it. On the current ROBOT, the bearing hole is not used. As the only function of the hole on the current ROBOT is material removal, which does not require precise tolerancing, a functionally equivalent hole could be made with a hand drill in under 30 minutes and the part is permitted per part E.c.

R304 ***During an event, only work during pit hours.** During an event a team is attending (regardless of whether the team is physically at the event location), the team may neither work on nor practice with their ROBOT or ROBOT elements outside of the hours that pits are open, with the following exceptions:

A. exceptions listed in R302, other than R302-E-c and
B. software development~~.~~, and
C. charging batteries.

For the purposes of this rule, official events begin as follows:

- Regionals, District Championships, and *FIRST* Championship: at the start of the first designated load-in period, according to the Public Schedule. If the Public Schedule is not available or there is no designated load-in period, the events begin at 4pm on the day prior to pits opening.
- District Events: when pits open

Examples of activity prohibited by this rule include:

a. working on the ROBOT at the team's shop after load-in for the event has begun and
b. working on ROBOT parts at night at the team's hotel~~.~~, and
c. running a 3D printer or other automated manufacturing process overnight producing ROBOT parts.

Note that E108 and E401 impose additional restrictions on work done on the ROBOT or ROBOT materials while attending an event.

This rule is intended to increase equity between teams with significant travel to an event and those nearby (close teams would otherwise have an advantage by being able to work on their ROBOT, in their shop, until it's time to go to the event).

Section 9.4 BUMPERS Rules

R406 ***Team number on BUMPERS.** Team numbers must be displayed and positioned on the BUMPERS such that an observer walking around the perimeter of the ROBOT can unambiguously tell the team's number from any point of view and meet the following additional criteria:

A. consist of only white Arabic numerals at least 4 in. (~11 cm) high, at least ½ in. (~13 mm) in stroke width~~, and be either white in color or outlined in white with a minimum $^{1}/_{16}$ in. (~2 mm) outline~~,

R901 **R408** ***BUMPER construction.** BUMPERS must be constructed as follows (see Figure 9-7 is updated to reflect a more common BUMPER fastening system.

Previous Figure 9-7 with less common fastening system highlighted

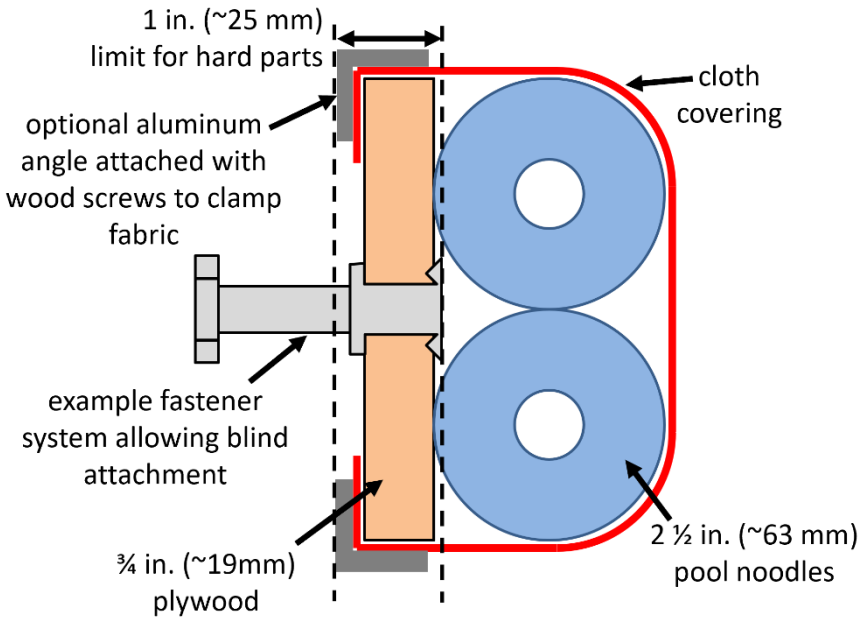


Figure 9-7):

A. be backed by ¾ in. thick (nominal, ~19mm) by 5 in. ± ½ in. (~127 mm ± 12.7 mm) tall plywood, Oriented Strand Board (OSB) or solid wood (with the exception of balsa). Small clearance pockets to accommodate minor protrusions permitted per R101 and/or access holes needed to access mounting hardware in the wood backing are permitted, as long as they do not significantly affect the structural integrity of the BUMPER.

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C. use a stacked pair of ~~approximately~~ 2½ in. ~~(nominal,~~ (~63 mm) round, petal, or hex "pool noodles" (solid or hollow) as the BUMPER cushion material (see Figure 9-7). 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). Per R409 cushion material may extend ~~up to 2½ in. (~63 mm)~~ beyond the end of the plywood in order to fill a corner (see Figure 9-8). 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 9-7 is not significantly altered (e.g. tape compressing the pool noodles).

"2½ in. (~63 mm) pool noodles" are pool noodles either sold as 2½ in. (~63 mm) diameter or that measure between 2¼ in. (~57 mm) pool noodles and 2¾ in. (~70 mm) diameter if not specified.

All pool noodles used on a ROBOT must be the same in order to maintain the desired interaction between ROBOTS in the cases of BUMPER-to-BUMPER contact. BUMPERS containing pool noodles of vastly different construction may cause a "ramp" effect when interacting with other BUMPERS.

Minor noodle compression as a result of smoothing BUMPER fabric or rounding a FRAME PERIMETER corner is not considered deformed. Any compression beyond that, e.g. for the purposes of flattening the pool noodle, is deformation and a violation of C.

D. be covered with a rugged, smooth cloth~~.~~ with no additional coating applied by the team (multiple layers of cloth and seams are permitted if needed to accommodate R405 and/or R406, provided the cross section in Figure 9-7 is not significantly altered).

Silk and bedding are not considered rugged cloths, however 1000D Cordura is. Tape (e.g. gaffer's tape) matching the BUMPER color is allowed to patch small holes on a temporary basis.

It is expected that there may be multiple layers of cloth as fabric is folded to accommodate the corners and seams of BUMPERS.

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Figure 9-7 is updated to reflect a more common BUMPER fastening system.

Previous Figure 9-7 with less common fastening system highlighted

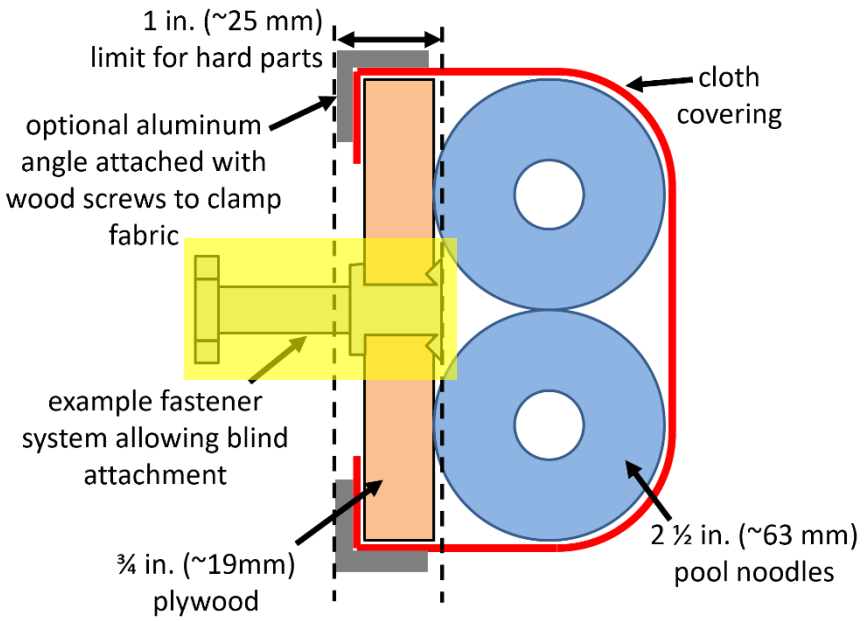
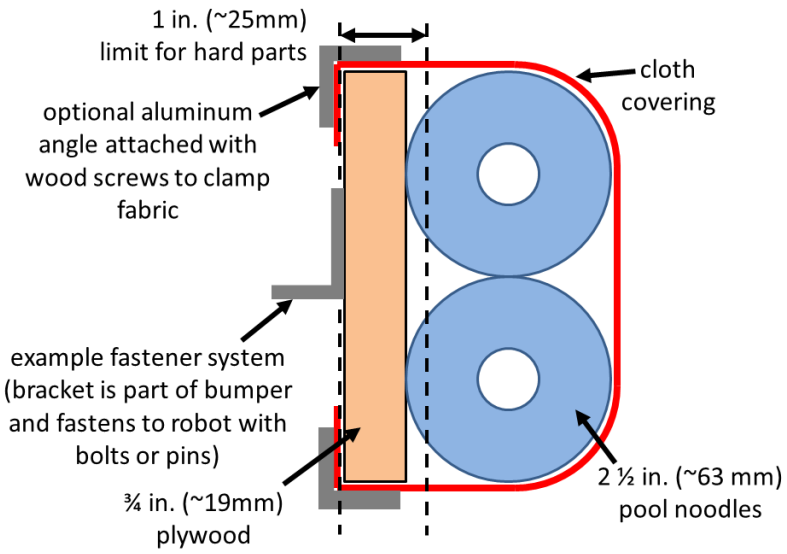


Figure 9-7 BUMPER vertical cross section



Section 9.5 Motors and Actuators

R501 ***Allowable motors.** The only motors and actuators permitted include the following (in any quantity):

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

R504 ***Don't overload controllers.** Each power regulating device may control electrical loads per Table 9-2. Unless otherwise noted, each power regulating device shall control 1 and only 1 electrical load.

Table 9-2 Power regulating device allotments

Electrical Load	Motor Controller	Relay Module	Pneumatics Controller
Linear Actuator	Yes (20A breaker max)	Yes (20A breaker max)	

Section 9.6 Power Distribution

R602 ***Other batteries for cameras or computers only.** COTS USB battery packs with a capacity of 100Wh or less (20000mAh at 5V) and 5V, 2.5 Amp max output per port, or batteries integral to and part of a COTS computing device or self-contained camera (e.g. laptop batteries, GoPro style camera, etc.) may be used to power COTS computing devices and any peripheral COTS input or output devices connected to the COTS computing device provided they are:

A. securely fastened to the ROBOT,
B. connected only using unmodified COTS cables, and
C. charged according to manufacturer recommendations.

A COTS computing device is a non-roboRIO device used to process or collect sensor information (e.g. a "smart flashlight" is not a COTS computing device).

R611 ***The ROBOT frame is not a wire.** All wiring and electrical devices shall be electrically isolated from the ROBOT frame. The ROBOT frame must not be used to carry electrical current.

Compliance with this rule is checked by observing a >~~3kΩ~~120Ω resistance between either the (+) or (-) post within the APP connector that is attached to the PDP/PDH and any point on the ROBOT.

All legal motor controllers with metal cases are electrically isolated. They may be mounted directly to ROBOT frame COMPONENTS.

Note that some cameras, decorative lights, and sensors (e.g. some encoders, some IR sensors, etc.) have grounded enclosures or are manufactured with conductive plastics. These devices must be electrically isolated from the ROBOT frame to ensure compliance with this rule.

R613 ***Electrical system must be inspectable.** The PDP/PDH, associated wiring, and all circuit breakers must be visible for inspection.

"Visible for inspection" does not require that the items be visible when the ROBOT is in STARTING CONFIGURATION, provided the team can make the items viewable the inspection process.

R622 ***Use appropriately sized wire.** All circuits shall be wired with appropriately sized insulated copper wire (SIGNAL LEVEL cables don't have to be copper):

Table 9-4 Breaker and wire sizing

Application	Minimum Wire Size
6 – 20A breaker protected circuit **11-20A fuse protected circuit** **Between the PDP dedicated terminals and the VRM/RPM or PCM/PH** **Compressor outputs from the PCM/PH** **Between the PDH and PCM/PH**	18 AWG (19 SWG or 1 mm^2)

Section 9.7 Control, Command & Signal Systems

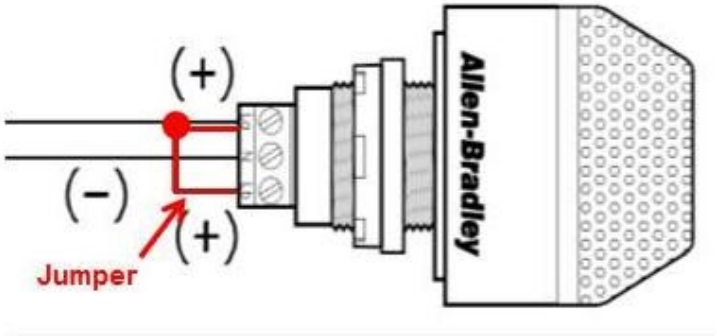
R709 ***ROBOTS must have a signal light.** ROBOTS must use at least 1, but no more than 2, diagnostic ROBOT Signal Light (RSL) (P/N 855PB-B12ME522 and/or am-3583).

Any RSL must be:

A. mounted on the ROBOT such that it is easily visible while standing 3 ft. (~ 100 cm) ~~in front~~ away from at least one side of the ROBOT,
B. connected to the "RSL" supply terminals on the roboRIO, and
C. if using the 855PB-B12ME522, wired for solid light operation, by placing a jumper between the "La" and "Lb" terminals on the light per Figure 9-16.

Please see How to Wire an FRC Robot for connection details.

Figure 9-16 ~~RSL~~ 855PB-B12ME522 jumper wiring



R714 ***Control CAN motor controllers from the roboRIO.** Each CAN motor controller must be controlled with signal inputs sourced from the roboRIO and passed via either a PWM (wired per R713) or CAN bus (either directly or daisy-chained via another CAN bus device) signal, but both shall not be wired simultaneously on the same device.

> As long as the CAN bus is wired legally so that the heartbeat from the roboRIO is maintained, all closed loop control features of the CAN motor controller may be used. (That is, commands originating from the roboRIO to configure, enable, and specify an operating point for all CAN motor controller closed loop modes fit the intent of R701).
>
> "Wired directly" includes via any series of PASSIVE CONDUCTORS (i.e. star or hub configurations using only PASSIVE CONDUCTORS are permitted.)

R715 ***Control PCM/PH(S) ~~and Servo Hubs~~ from roboRIO.** Each PCM/PH must be controlled with signal inputs sourced from the roboRIO and passed via a CAN bus connection from the built-in CAN on the roboRIO (either directly or daisy-chained via another CAN bus device).

Section 9.8 Pneumatic System

R812 ***Pressure switch requirements.** The pressure switch must be connected to the high-pressure side of the pneumatic circuit (i.e. prior to the pressure regulator) to sense the stored pressure of the circuit.

It must be either:

A. Nason P/N SM-2B-115R/443 (wired as described) and/or

   The 2 wires from the pressure switch must be connected directly to the pressure switch input of the PCM/PH controlling the compressor or, if controlled using the roboRIO and a relay, to the roboRIO. If connected to the roboRIO, the roboRIO must be programmed to sense the state of the switch and operate the relay module that powers the compressor to prevent over-pressuring the system.

B. REV Robotics P/N REV-11-1107 (wired as described)

   The analog output of the sensor must be connected directly to analog input 0 of the PH (with firmware version 22.0.2 or newer) controlling the compressor.

> The REV Robotics Analog Pressure Sensor may only be used with PH compressor control and may not be used with ~~roboRIO or~~ PCM compressor control.