

Team Update 09

General

No changes.

Rules & Expectations for *FIRST* Robotics Competition Events

No changes.

Game and Season Manual

Section 8.5 BUMPER Rules

R23. ROBOTS are required to use BUMPERS to protect all outside corners of the FRAME PERIMETER. For adequate protection, at least 6 in. (~16 cm) of BUMPER must be placed on each side of each outside corner (see Figure 8-2) and must extend to within $\frac{1}{4}$ in. of the FRAME PERIMETER corner. If a FRAME PERIMETER side is shorter than 6 in. (~16 cm), that entire side must be protected by BUMPER (see Figure 8-3). A round or circular FRAME PERIMETER, or segment of the FRAME PERIMETER, is considered to have an infinite number of corners, therefore the entire frame or frame segment must be completely protected by BUMPER(S).



Team Update 08

General

- [Inspection Checklist](#): Published!
- [ROBOT Lockup Form](#): Published!
- [POWER CUBE Cover DIY Instructions](#): Published!

Rules & Expectations for *FIRST* Robotics Competition Events

No changes.

Game and Season Manual

Section 8.4 Budget Constraints & Fabrication Schedule

R11. The total cost of all items on the ROBOT shall not exceed \$4000 USD. All costs are to be determined as explained in [Section 8.4 Budget Constraints & Fabrication Schedule](#). Exceptions are as follows:

- A. individual items that are less than \$5 USD each, as ~~purchased~~ purchasable from a VENDOR, and
- B. KOP items

Section 8.8 Control, Command & Signals System

R63. ROBOTS must be controlled via one (1) programmable National Instruments roboRIO (P/N: am3000), with image version FRC_2018_v16 or later.



Team Update 07

General

- **Software Update:** An optional update to the NI FRC 2018 Update Suite (2018.1.0) has been released. This update contains a new roboRIO image, 2018v17, which fixes a bug for C++ and Java teams where the roboRIO would lock up when printing to the console while running rioLog. This update also contains a fix to a minor memory leak in the Driver Station.

Rules & Expectations for *FIRST* Robotics Competition Events

Check-In

E33. An adult team member must check in no later than ~~noon on the first competition day of the event~~ ninety (90) minutes before Qualification Matches are scheduled to start.

Game and Season Manual

Section 7.5 AUTO Period Rules

A03. Disconnect or set down controllers. During AUTO, any control devices worn or held by the DRIVERS and/or HUMAN PLAYERS must be disconnected from the OPERATOR CONSOLE.

Violation: FOUL.

For the purposes of the *FIRST* Robotics Competition, any device connected to the OPERATOR CONSOLE is considered a control device because REFEREES are not expected to differentiate between devices that can or cannot control the ROBOT.

Section 7.6 Human Action Rules

H08. TECHNICIANS, no coaching. Don't abuse ARCADE access. TECHNICIANS Team members (except DRIVERS, HUMAN PLAYERS, and COACHES) who are granted access to restricted areas in and around the ARCADE (e.g. via TECHNICIAN button, event issued Media badges, etc.) may not verbally coach or use ~~non-powered~~ signaling devices during the MATCH. Exceptions will be granted for inconsequential infractions and in cases concerning safety.

Violation: YELLOW CARD



Team Update 06

General

- **Q&A Update:** [Q116](#) has been updated per edits made in [Team Update 5](#).

Rules & Expectations for *FIRST* Robotics Competition Events

No changes.

Game and Season Manual

Section 3.10 The FIELD Management System

FMS alerts participants to milestones in the MATCH using audio cues. Please note that audio cues are intended to be a courtesy to participants and not intended as official MATCH markers. If there is a discrepancy between an audio cue and the FIELD timers, the FIELD timers are the authority.

- **MATCH Start & PLATES randomized:** "Startup Sound"
- **MATCH-AUTO Start:** "Cavalry Charge"
- T=0 for AUTO: Buzzer
- Start of TELEOP: Three (3) Bells
- T-30 seconds in TELEOP: Train Whistle
- T=0 for TELEOP/MATCH end: Buzzer
- MATCH stopped: Foghorn
- POWER UP activated: "Linear Popping"

Section 6 Conduct Rules

C07. Don't expect to gain by doing others harm. Strategies clearly aimed at forcing the opposing 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 egregious or repeated, TECH FOUL and YELLOW CARD.

C07 does not apply for strategies consistent with standard gameplay, **for example:** ~~e.g. contacting an opponent during the ENDGAME while in your PLATFORM ZONE and attempting to CLIMB.~~

- contacting an opponent during the ENDGAME while in your PLATFORM ZONE and attempting to CLIMB.**
- placing a POWER CUBE on a SCALE PLATE resulting in the opposite PLATE moving upwards into an opponent ROBOT such that the opponent ROBOT ends up violating G25.**

C07 requires an intentional act with limited or no opportunity for the TEAM being acted on to avoid the penalty, such as:

- placing a POWER CUBE on/in an opponent who's already controlling a POWER CUBE such that they cannot help but violate G22.**

- D. forcing an opposing ALLIANCE ROBOT to become wedged under a SCALE PLATE such that they cannot help but violate G16 and/or G25.

Section 7.3 ROBOT to ROBOT Interaction

G10. Don't tear others down to lift yourself up. Strategies aimed at the destruction or inhibition of ROBOTS via attachment, damage, tipping, or entanglements are not allowed.

Violation: FOUL and YELLOW CARD. If harm or incapacitation occurs as a result of the strategy, YELLOW CARD is elevated to a RED CARD

For example, use of a wedge-like MECHANISM to tip ROBOTS is a violation of G10.

MECHANISMS outside the FRAME PERIMETER are particularly susceptible to causing such damage, drawing this penalty, and/or drawing penalties associated with violations of G11.

Teams are encouraged to be cautious in their use of such MECHANISMS when engaging in ROBOT to ROBOT MATCH play.

G14. There's a 5-count on pins. ROBOTS may not pin an opponent's ROBOT for more than five (5) seconds. A ROBOT will be considered pinned until the ROBOTS have separated by at least six (6) feet. The pinning ROBOT(s) must then wait for at least three (3) seconds before attempting to pin the same ROBOT again. Pinning is transitive through other objects. If the pinned ROBOT chases the pinning ROBOT upon retreat, the pinning ROBOT will not be penalized, and the pin will be considered complete.

Violation: FOUL, plus an additional FOUL for every five (5) seconds in which the situation is not corrected. If extended and egregious, RED CARD.

There is no *FIRST*® Robotics Competition specific definition of pin, so a general definition applies; "to prevent or stop something from moving." As a result, contact is not required for pinning to occur. For example, a ROBOT parked right behind an opponent that is against its PORTAL wall could be considered pinning because the wall and the parked ROBOT prevent the opponent from moving.

Generally, pins that exceed fifteen (15) seconds are considered extended and egregious, regardless of a pinning ROBOT's mobility; however circumstances vary and the assessment is open to REFEREE discretion.

Section 7.4 FIELD Interaction

G20. POWER CUBES: use as directed. With the exception of placing a POWER CUBES on PLATES, ROBOTS may not deliberately use POWER CUBES in an attempt to ease or amplify the challenge associated with FIELD elements.

Violation: TECH FOUL per additional POWER CUBE. Repeated or egregious violations of this rule are likely to escalate rapidly to YELLOW or RED CARDS.

Examples include, but are not limited to:

- A. stacking POWER CUBES underneath a PLATE
- B. climbing on POWER CUBES
- C. using POWER CUBES to explicitly impede opponent mobility
- D. Placing a POWER CUBE on the top of the SCALE to block the opponent ALLIANCE RUNGS is an egregious violation of G20.

G21. Keep POWER CUBES in bounds. With the exception of feeding POWER CUBES through the lower opening of the EXCHANGE, ROBOTS may not intentionally eject POWER CUBES from the FIELD.

Violation: FOUL per POWER CUBE. Repeated or extended violations of this rule are likely to escalate rapidly to YELLOW or RED CARDS.

G25. PLATES are moved by POWER CUBES, not ROBOTS. Except via the placement of the weight of placed POWER CUBES, ROBOTS may not affect directly or transitively cause or prevent the movement of PLATES. Incidental contact that does not result in PLATES changing scoring state Movement, or prevention of movement, of PLATES because of momentary ROBOT action resulting in minimal PLATE displacement is not a violation of this rule. A ROBOT forced to affect the position of a PLATE because of contact by an opponent ROBOT either directly or transitively through a POWER CUBE or other ROBOT (e.g. a ROBOT wedged underneath the SCALE by the opposing ALLIANCE either intentionally or accidentally) is not a violation of this rule.

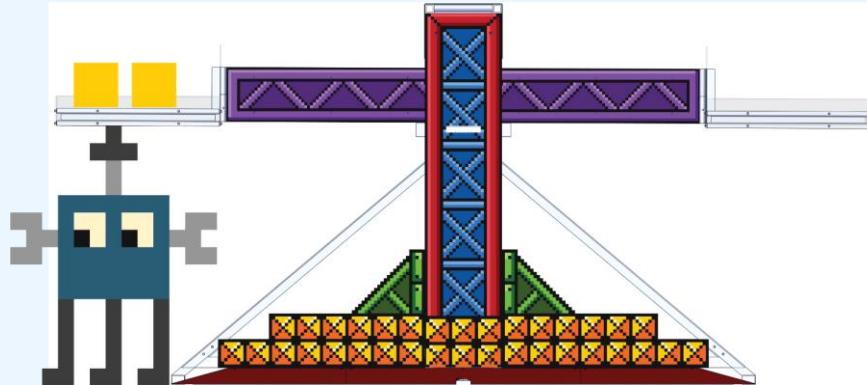
Violation: FOUL per instance plus an additional TECH FOUL for every five (5) seconds in which the situation is not corrected. Repeated or extended violations of this rule are likely to escalate rapidly to YELLOW or RED CARDS.

The intent of G25 is to make it clear that PLATES are to move solely because of POWER CUBE weight and not because of a ROBOT deliberately trying to move PLATES (either by using its own manipulator, or a POWER CUBE as an extension of the ROBOT, to push or hold a PLATE).

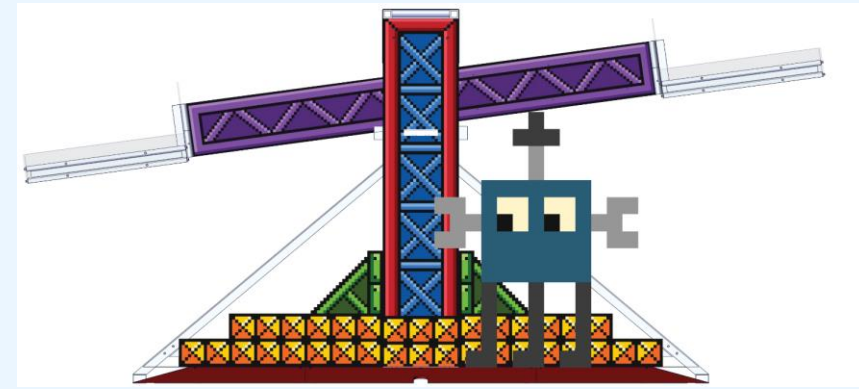
The “momentary” and “minimal” language in G25 is subjective but necessary because ROBOTS may cause PLATE movement (or prevent PLATE movement) as they place POWER CUBES and bump PLATES, get hit, etc.

Generally, “momentary” means near instantaneous, or in other words, contact for less than approximately one (1) second and “minimal” means a displacement of fewer than approximately three (3) in. However, REFEREES are not expected to measure, and be accountable to, real-time PLATE displacement or precise timing from their vantage points.

Example 1: A ROBOT may not hold the SCALE PLATE in a “balanced” state.



Example 2: A ROBOT may not hold a plate up.



Section 8.4 Budget Constraints & Fabrication Schedule

R11. The total cost of all items on the ROBOT shall not exceed \$4000 USD. All costs are to be determined as explained in Section 8.4 Budget Constraints & Fabrication Schedule. Exceptions are as follows:


- A. individual items that are less than \$5 USD each, as purchased from a VENDOR, and
- B. KOP items



Team Update 05

General

- **Cost Accounting Worksheet (CAW) Template Published:** An example [CAW Template](#) is now linked from the [FIRST POWER UP Game & Season Materials page](#).
- **Crate Sizes:** The manufacturer of the POWER CUBE crate employs two different molds to make the standard crate for general distribution which vary in size by $\sim\frac{1}{4}$ in. The crates shipped in/with Kickoff Kits, distributed via *FIRST* Choice, being sold by AndyMark, Innovation First, and Rev Robotics, that will be used at official *FIRST* events were all made with the smaller of the two molds. If the size variance matters to your team and you're placing an order with Farm Plast directly, please reference "for *FIRST* Robotics" in the comment section upon checkout or, if ordering over the phone (973-287-6070), let them know that the order is "for *FIRST* Robotics."
- **Kickoff Kit Checklist Update:** The [Black Tote Checklist](#) has been updated with the following edit.

<input checked="" type="checkbox"/>	Item Description	Supplier	Part Number	Qty	Where to get more?	Photo
	Power Cube: crate White, square, HDPE, 13 in. x 13 in. x 11 in.	Farm Plast LLC	Cubecrate	1	http://www.milkcratesdirect.com/square-milk-crates-4-gallon-16-quart/white-square-milk-crate (specify "for <i>FIRST</i> Robotics" in comments at checkout or verbally if via phone) www.andymark.com www.revrobotics.com www.vexrobotics.com	

- **Team Drawings Update:** TE-18001 has been corrected to fix the orientation of the TE-18001-01 piece.

Rules & Expectations for *FIRST* Robotics Competition Events

No changes.

Game and Season Manual

Section 8.4 Budget Constraints & Fabrication Schedule

R11. The total cost of all items on the ROBOT shall not exceed \$4000 USD. All costs are to be determined as explained in [Section 8.4 Budget Constraints & Fabrication Schedule](#). Exceptions are as follows:

- individual COTS items that are less than \$5 USD each, as purchased, and
- KOP items

Section 8.5 BUMPER Rules

R28. 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:

- consist of Arabic numerals at least 4 in. (~ 11 cm) high, at least $\frac{1}{2}$ in. (~ 12.7 mm) in stroke width, and be either white in color or outlined in white with a minimum $\frac{1}{16}$ in. (~ 1.6 mm) outline

The $\frac{1}{2}$ in. stroke width requirement applies to the majority of the stroke. Font elements less than $\frac{1}{2}$ in. such as serifs, rounded edges, small

hairlines or gaps, etc. are permitted as long as the majority of the stroke meets the sizing requirement and the numbers are unambiguous.

Section 8.10 OPERATOR CONSOLE

R100. The OPERATOR CONSOLE must not

- B.** be longer than 60 in. (~152 cm)
- C.** be deeper than 14 in. (~35 cm) (excluding any items that are held or worn by the DRIVERS during the MATCH)
- D.** extend more than 6 ft. 6 in. (~198 cm) above the floor
- E.** attach to the FIELD ARCADE (except as permitted by G19)



Team Update 04

General

WPILib C++\Java Update: An optional C++\Java WPILib update has been released (2018.2.1) containing a number of minor bug fixes. A full changelog can be found [here](#).

Q&A Updates: The responses to questions [5](#) (to be consistent with changes made in [Team Update 3](#)) and [77](#) (original response was incorrect) have been revised (with changes noted).

Rules & Expectations for *FIRST* Robotics Competition Events

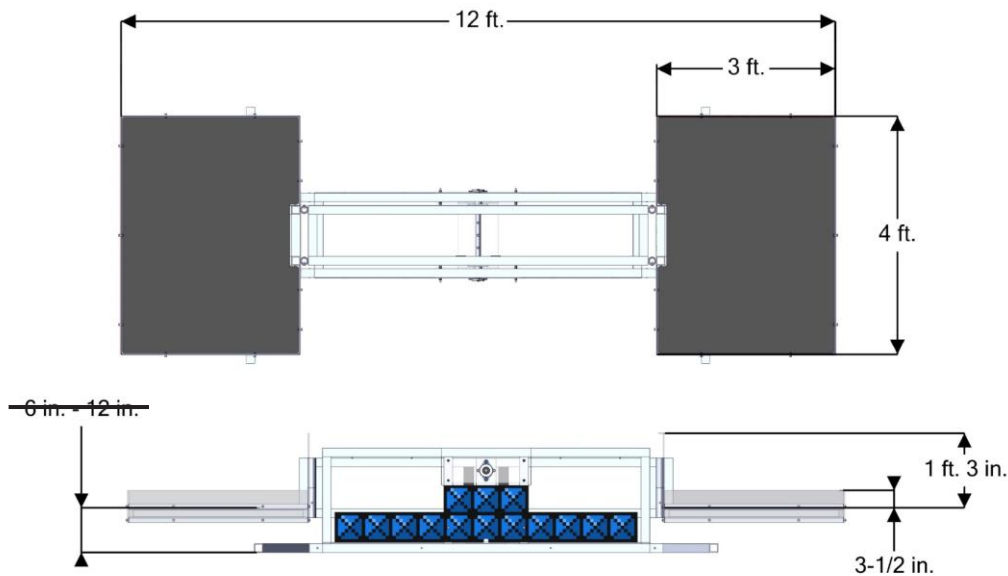
No changes.

Game and Season Manual

Section 3.4.1 SWITCH PLATES

Figure 3-14 has been updated to remove the lower left dimension, which doesn't add value.

Figure 3-14: SWITCH PLATE dimensions



SOLIDWORKS
Modeling Solutions Partner

Section 6 Conduct Rules

C10. No work outside your pit. Throughout the event, from load-in to load-out, Teams may only produce FABRICATED ITEMS during pit hours, and:

- in their pit area, or
- in other Teams' pit areas with permission from that team, or
- while Queued for a MATCH or Practice Field,

Please note that given likely tight quarters, extra scrutiny regarding safety is required.

- d. any area designated by Event Staff (e.g. Playoff Pit Area, etc.), or
- e. as permitted at provided machine shops that are available to all teams.

Violation: Verbal warning. Repeated or egregious violations will be addressed by the Head REFEREE, the Lead ROBOT Inspector and/or Event Management.

Section 8.9 Pneumatic System

R83. The only pneumatic system items permitted on ROBOTS include the items listed below.

- E. Additional pneumatic tubing, with a maximum ¼ in. (nominal, ~6 mm) outside diameter,

Section 10.5 Playoff MATCHES

Table 10-2: Quarterfinal, Semifinal, and Overtime Tiebreaker Criteria

Order Sort	Criteria
1 st	Fewer FOUL and TECH FOUL points awarded to the other ALLIANCE (i.e. the ALLIANCE that played the cleaner MATCH)
2 nd	Cumulative PARKING and CLIMBING score
3 rd	Cumulative sum of AUTO points
4 th	Cumulative sum of OWNERSHIP points
5 th	Cumulative sum of VAULT points
6 th	MATCH is replayed

Section 10.8 MATCH Replays

If, in the judgment of the Head REFEREE, an ARCADE FAULT occurs that affects the outcome of the MATCH and any team on the affected ALLIANCE desires a replay, the MATCH will be replayed.

The outcome of the MATCH is affected if an error occurs that, in the judgment of the Head REFEREE changes which ALLIANCE would have won the MATCH and/or the assignment of Ranking Points.



Team Update 03

General

- **Game Data Details:** The [2018 Game Data Details](#) article has been updated with additional information about initial states and to match the game updates below.
- **Drawing Updates:** [The Layout and Marking Diagram](#) has been updated with the following changes:
 - FE-00041-02 has been added.
 - FE-00041-03 has been added.
- **3D CAD Models Updates:** Field Graphics have been added to the [CAD Models](#) download.

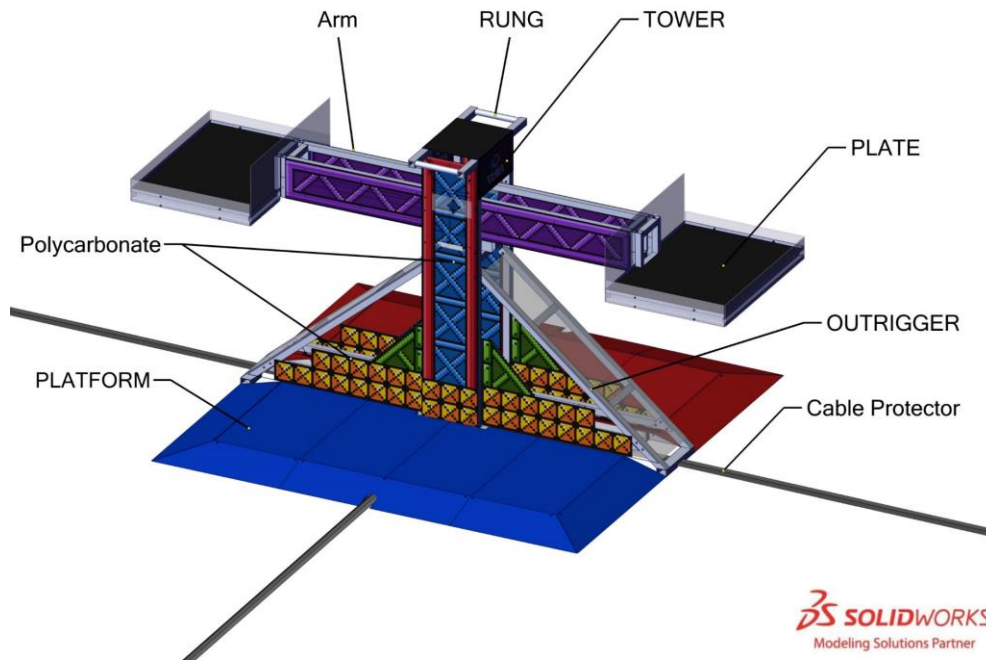
Rules & Expectations for *FIRST* Robotics Competition Events

No changes.

Game and Season Manual

Section 3.3 SCALE

Figure 3-4: The SCALE (Note, cable protectors are shown, but are not part of the SCALE)

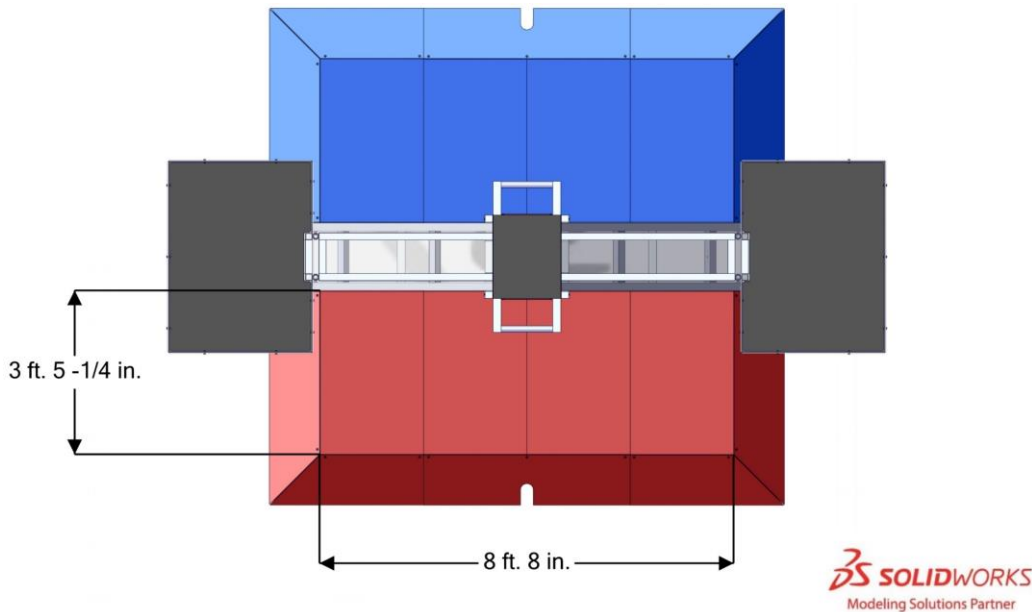


The BRICKS are graphics depicting golden squares surrounded by a black outline that extends 12 in. (~30cm) above the **horizontal** surface of the PLATFORM.

Section 3.3.5 PLATFORM

Located at the base of the SCALE, on each side, is a PLATFORM covered with ALLIANCE colored HDPE. The TOWER and OUTRIGGERS separate one PLATFORM from the other. Each PLATFORM top is 8 ft. 8 in. (~264 cm) wide by 3 ft. 5 ¼ in. (~105 cm) deep and 3 ½ in. (~9 cm) tall. The ramps leading to the PLATFORM includes ramps with a run of 1 ft. 4 ¾ in. (~33 32 cm) and long with a 15.35 deg. angle. The ALLIANCE colored tape that abuts the PLATFORM ramps is part of the PLATFORM.

Figure 3-11: PLATFORM top length and width dimensions



Section 3.9 Vision Targets

Vision targets are located on the SWITCH FENCE facing the ALLIANCE WALL using 2 in. (~5 cm) strips of 3M 8830 Scotchlite Reflective Material and are used to highlight the locations of the PLATES on the SWITCH.

Section 3.10 The FIELD Management System

FMS alerts participants to milestones in the MATCH using audio cues. Please note that audio cues are intended to be a courtesy to participants and not intended as official MATCH markers. If there is a discrepancy between an audio cue and the FIELD timers, the FIELD timers are the authority.

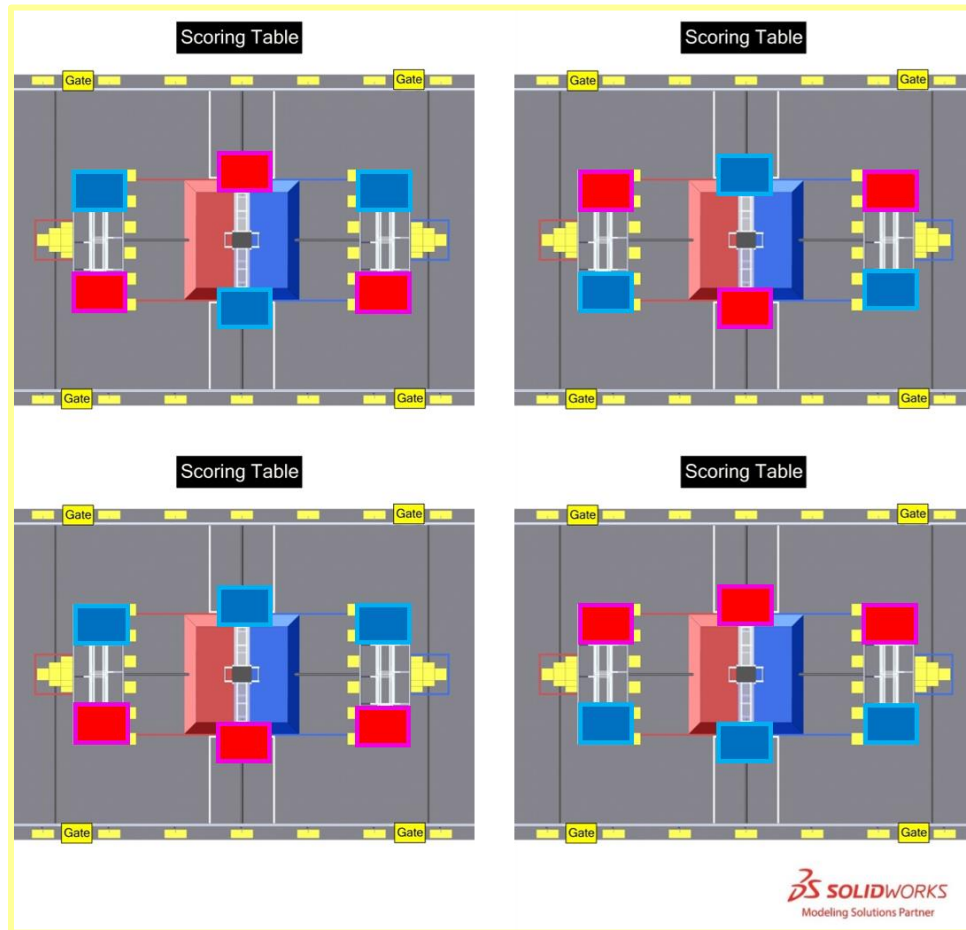
- MATCH Start: "Cavalry Charge"
- T=0 for AUTO: Buzzer
- Start of TELEOP: Three (3) Bells
- T-30 seconds in TELEOP: Train Whistle
- T=0 for TELEOP/MATCH end: Buzzer
- MATCH stopped: Foghorn
- POWER UP activated: "Linear Popping"

Section 4.1.1 Stages

Each MATCH is divided in to two stages. The first stage, called Autonomous (AUTO), is the first fifteen (0:15) seconds of a MATCH in which ROBOTS operate without any DRIVE TEAM control or input. Prior to the start of AUTO, the assignments of ALLIANCE colors for SWITCH and SCALE

PLATES are randomized among the four states in Figure 4-1 and transmitted to the OPERATOR CONSOLE by the Field Management System (FMS). During AUTO, ROBOTS attempt to deliver preloaded POWER CUBES to PLATES, retrieve additional POWER CUBES from around the FIELD, and cross their AUTO LINE any time before the end of the stage.

Figure 4-1 Possible PLATE assignments



Section 4.6 Logistics

There will not be an ARCADE FAULT called for MATCHES that accidentally begin with an incorrect number of, **incorrectly positioned**, or damaged POWER CUBES. Damaged POWER CUBES will not be replaced until the next FIELD reset period. DRIVE TEAMS should alert the FIELD STAFF to any missing or damaged POWER CUBES prior to the start of the MATCH.

Section 7.1 Before the MATCH

G04. Leave the POWER CUBES alone. Prior to the start of the MATCH, DRIVE TEAMS may not rearrange the POWER CUBES within a PORTAL, **staged on the FIELD** (that are not staged inside a ROBOT), or transfer POWER CUBES from one PORTAL to another.

Violation: MATCH will not start until the situation is corrected.

Section 8.4 Budget Constraints & Fabrication Schedule

R22. At an **each** Event, Teams may have access to a WITHHOLDING ALLOWANCE.

Section 8.5 BUMPER Rules

R28.

- A. consist of Arabic numerals at least 4 in. (~11 cm) high, at least ½ in. (~12.7 mm) in stroke width, and be either white in color or outlined in white with a minimum 1/16 in. (~1.6mm) outline

Section 8.8 Control, Command & Signals System

R65. The roboRIO Ethernet port must be connected to the Wireless Bridge port labeled “18-24 vPOE,” closest to the power connector (either directly, via a network switch, or via a CAT5 Ethernet pigtail).

Section 8.9 Pneumatic System

R83. The only pneumatic system items permitted on ROBOTS include the items listed below.

- E. Solenoid valves with a maximum ⅛ in. (nominal, ~6 mm) NPT, BSPP, or BSPT port diameter,

R89. Only the compressor, relief valve (P/N: 16-004-011 or 16-004-003), pressure switch, pressure vent plug, pressure gauge, storage tanks, tubing, pressure transducers, and connecting fittings may be in the high-pressure pneumatic circuit upstream from the regulator.

Section 10.8 MATCH Replays

Over the course of the Tournament it may be necessary for a MATCH to be replayed. Typical causes for replays are MATCHES that end in a tie during the Playoffs or if there is an ARCADE FAULT. An ARCADE FAULT is an error in ARCADE operation that includes, but is not limited to:

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

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

- B. power failure to a portion of the FIELD (tripping the circuit breaker in the PLAYER STATION is not considered a power failure)
- C. improper activation by the FMS
- D. errors by FIELD staff (except those listed in Section 4.6)



Team Update 02

General

- **Drawing Updates:** The [Field Drawings - FIRST POWER UP specific](#) drawing package has been updated with the following changes:
 - GE-18020 has been updated to include a missing overall length dimension.
 - GE-18060 has been updated to fix a note with an incorrect item number called out.
 - GE-18126 has been updated to fix a note with an incorrect item number called out.
 - GE-18127 has been added. Please note the height of GE-18127 supplied by SolidWorks, Autodesk, and PTC is slightly taller than what is specified in [Section 3.6.2 EXCHANGE](#). We will be working with them to get those models updated.

The [Team Drawings](#) drawing package has been updated with the following changes:

- TE-18008 has been updated to fix BOM item number and part number agreement.
- TE-18007 has been updated to fix BOM item number and part number agreement, and to include changes to the following parts:
 - TE-18007-3 has been updated to correct overall length of part.
 - TE-18007-4 has been updated to correct overall length of part.
 - TE-18007-10 has been updated to correct overall length of part.
 - TE-18007-11 Has been updated to correct overall length of part.

The revisions to the Scale in the Team Drawings correct design mistakes that resulted in differences between the team version of the Scale and the official Scale. The width of the Rung is 1 ft. 1 in. (down from 1 ft. 2 in.), the width of the Tower is 1 ft. 5 in. (down from 1 ft. 6 in.), and the distance from the Rung to the face of the Tower is 8¼ in. (up from 6¼ in.)

While we try to ensure that critical dimensions in the wooden versions of Field elements match their official counterparts, there are always discrepancies caused from using different building materials. However, the discrepancies referenced above were due to design error and may impact Robot design. We apologize, especially if these corrections affect your Robot designs.

- **360° Images:** A link to 360° images of the *FIRST POWER UP* field taken during Field Tour filming is included on the [Game and Season webpage](#).
- **3D CAD Models:** A link to *FIRST POWER UP* DS SolidWorks models is now included on the [Game and Season webpage](#).
- **FIRST POWER UP Field images:** A link to field images taken during Field Tour filming is now included on the [Game and Season webpage](#).
- **Crate Construction:** Think you'll be shipping your Robot? The crate specifications are now posted [here](#).

Rules & Expectations for *FIRST* Robotics Competition Events

No changes.

Game and Season Manual

Section 3.6.3

Caution, there are **may be** orientations where all three (3) POWER CUBES will not fit in a VAULT column, but if HUMAN PLAYERS place POWER CUBES logo side up they'll fit **with room to spare**.

Section 3.8 POWER CUBES

Each POWER CUBE weighs $3\frac{1}{2}$ lbs (~1.6 kg) approximately $3\frac{1}{4}$ lbs (~1.5 kg). POWER CUBES may be purchased from AndyMark (am-3818 and am-3741), Innovation First (217-6188 and 217-6193), and Rev Robotics (REV-21-1217 and REV-21-1218).

Section 4.2 Scoring

Points are earned for establishing OWNERSHIP, with additional points earned for each additional second of OWNERSHIP. For example, a team that establishes OWNERSHIP of their SWITCH three (3) seconds after the start of AUTO and maintains OWNERSHIP for five (5) seconds earns two (2) points + ten (10) points, for a total of twelve (12) points.

The MATCH points listed in Table 4-1 for OWNERSHIP during the TELEOP stage are increased if the BOOST POWER UP is played. See Section 4.3 for details on BOOST.

AUTO-RUN and CLIMBING are both evaluated and scored by human REFEREES. Teams are encouraged to make these actions obvious and unambiguous.

Section 4.3 POWER UPS

An ALLIANCE plays a POWER UP by pressing the corresponding button on the VAULT. Only one (1) instance of the FORCE or BOOST POWER UP can be active at a time. If an ALLIANCE pushes the button for FORCE/BOOST while their other FORCE/BOOST is active, the button press is ignored. The LEVITATE POWER UP can be played at any time during the TELEOP stage.

Section 7.6 Human Action Rules

H07.

- 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,
- G. non-powered Personal Protective Equipment (examples include, but aren't limited to, gloves, eye protection, and hearing protection)

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

- i. do not connect or attach to the OPERATOR CONSOLE
- ii. do not connect or attach to the FIELD or ARCADE
- iii. do not connect or attach to another ALLIANCE member (other than items in category G)
- iv. do not communicate with anything or anyone outside of the ARCADE.
- v. do not communicate with the TECHNICIAN
- vi. do not include any form of enabled wireless electronic communication (e.g. radios, walkie-talkies, cell phones, Bluetooth communications, Wi-Fi, etc.)

- vii. 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 part B to communicate with the ROBOT (provided A02 is not violated).

Section 8.3 ROBOT Safety & Damage Prevention

R07.

If the ROBOT includes protrusions that form the “leading edge” of the ROBOT as it drives and the protrusions have a surface area of less than 1 in.² (~6 cm²), it will invite detailed Inspection. For example, forklifts, lifting arms, or grapples may be carefully inspected for these hazards.

Section 8.5 BUMPER Rules

A note about the edit to R24: The original BUMPER ZONE did not leave any tolerance for noodle alignment, wood alignment, fabric folds, etc., if using the BUMPER brackets that shipped with the Drive Base Kit.

R24. BUMPERS must be located entirely within the BUMPER ZONE, which is the volume contained between the floor and a virtual horizontal plane 7 in. (~17 cm) 7½ in. (~19 cm) above the floor in reference to the ROBOT standing normally on a flat floor. BUMPERS do not have to be parallel to the floor.

Section 8.9 Pneumatic System

R81.

Any pressure specification such as “working,” “operating,” “proof,” “maximum,” “burst,” etc. may be used to satisfy the requirements of R81.

It is recommended that all pneumatic items be rated by their manufacturers for a working pressure of at least 60 psi (~414 kPa).



Team Update 01

General

Drawing Packages

The [Field Drawings – FIRST POWER UP specific](#) drawing package has been updated with the following changes:

- GE-18130 has been added
- GE-18101 and GE18025 have been updated to include GE-18130

Kickoff Kit Checklist: Black Tote

<input checked="" type="checkbox"/>	Item Description	Supplier	Part Number	Qty	Where to get more?	Photo
	Compliant Wheels 2 in., green	Triangle Mfg AndyMark	am-3462_35	2	www.andymark.com	

Safety Manual

Section 3.5.5 Charging and Handling

- Do not short out the battery terminals. If metal tools/parts contact the terminals simultaneously, it will create a direct short circuit. This may cause high heat to develop in the battery terminal/part/tool area and the battery could explode. To avoid the possibility of shorting out the battery terminals and creating a hazardous situation it is required to cover all exposed battery terminals and connections with appropriate non-insulating material such as electrical tape or tubing.

It surprises us that we feel the need to say this, please don't put the POWER CUBE cover on anyone's head and zip it closed; also, don't eat it.

Rules & Expectations for FIRST Robotics Competition Events

No changes.

Game and Season Manual

Section 1.8 Question and Answer System

The Q&A is not a resource for

- rulings on hypothetical strategies or vague situations,
- challenging decisions made at past events, or
- design reviews of a ROBOT system for legality.

The responses in the Q&A do not supersede the text in the manual, although every effort will be made to eliminate inconsistencies between the two. While responses provided in the Q&A may be used to aid discussion at each event, per Section 10.6 REFEREE Interaction and Section 9 Inspection & Eligibility Rules, REFEREES and Inspectors are the ultimate authority on rules. If you have concerns about enforcement trends by volunteer authorities, please notify FIRST at firstroboticscompetition@firstinspires.org.

Weak questions are overly broad, vague, and/or include no rule references. Some examples of questions that will not be answered in the Q&A are:

- Is this part/design legal?
- How would should the a REFEREE have ruled if when this specific, hypothetical game play happened?

Good questions ask generically about features of parts or designs, gameplay scenarios, or rules, and often reference one or more relevant rules within the question. Some examples of questions that will likely be answered in the Q&A are:

- A device we are considering using on the robot comes with purple AWG 40 wire, does this comply with R?? and R??
- We're not sure how to interpret how Rule G?? applies if Blue Robot A does X and Red Robot B does Y, can you please clarify?

Section 3.1 Zones and Marking

STARTING LINE: a line of 2 in. (~5 cm), white gaffers tape that runs the width of the carpet and is 2 ft. 6 in. (~76 cm) behind the ALLIANCE WALL diamond plate, which includes the tape.

Section 3.3 SCALE

A cable protector extends from the center of each side of the PLATFORM and is 2 ½ in. (~6 cm) wide and ¾ in. (~2 cm) high (Electriduct, Inc. CSX-3, black). The cable protector is attached to the field with hook fastener, increasing the height to approximately 1 ¼ in. (~2 cm). These cable protectors extend to the GUARDRAILS and the SWITCHES.

Section 3.4.1 SWITCH PLATES

The PLATES are 9 in. (~23 cm) above the carpet when the SWITCH is level. Like the SCALE, the SWITCH tilts and rests in different positions based on the placement of POWER CUBES. During the MATCH, the SWITCH is in one of ~~three (3)~~ two (2) states based on the magnitude of its tilt:

1. OWNERSHIP by the Red ~~its~~ ALLIANCE, or
2. ~~OWNERSHIP by the Blue ALLIANCE, or~~
3. neither ALLIANCE has OWNERSHIP

If the outside edge of an ALLIANCE'S colored PLATE is positioned between 3 in. (~8 cm) and 6 in. (~15 cm) above the FIELD carpet then the ALLIANCE has OWNERSHIP of the ~~its~~ SWITCH. If the outside edge of an ALLIANCE colored PLATE is positioned between ~~12 in. (~30 cm)~~ 6 in. (~15 cm) and 15 in. (~38 cm) above the FIELD carpet then ~~the opposing ALLIANCE has OWNERSHIP.~~ When neither ALLIANCE has OWNERSHIP of the SWITCH, ~~the outside edges of the PLATES are between 6 in. (~15 cm) and 12 in. (~30 cm) above the FIELD carpet.~~ See Figure 3-15. The time required to move between states is dependent on the weight difference and the distribution of the weight on the SWITCH PLATES. Details on OWNERSHIP can be found in Section 4.2 Scoring.

Section 3.5 PLATE Lighting

Table 3-1: PLATE Lighting

Color	Pre-MATCH	AUTO	TELEOP	Post-MATCH
Blue (pulsing) with solid red corners	N/A	Blue FORCE POWER UP is active N/A	Blue FORCE POWER UP is active	N/A

Red (pulsing)	N/A	Red OWNERSHIP of FORCE POWER UP is active	Red OWNERSHIP of FORCE POWER UP is active	N/A
Red (pulsing) with solid blue corners	N/A	Red FORCE POWER UP is active N/A	Red FORCE POWER UP is active	N/A

Section 3.8 POWER CUBE

POWER CUBES may be purchased from AndyMark (am-3818 and am-3741), Innovation First (217-6188 and 217-6193), and Rev Robotics (REV-21-1217 and REV-21-1218). Please note that due to the use of recycled material in the manufacturing process, the batches of crates will vary slightly in color, but not such that it's perceptible with the cover in place.

Section 4.1.2 MATCH Setup

Prior to the start of each MATCH, POWER CUBES, elements used to affect the position of the SCALE and SWITCHES and earn POWER UPS, are staged as shown in Figure 4-1. Staging details are as follows:

- A. Seven (7) in each PORTAL (on the carpet between the PORTAL wall and the STARTING LINE), minus any preloaded POWER CUBES,
- B. Six (6) next to each SWITCH. They are arranged approximately equidistant from each other along the face of the FENCE closest to the SCALE, *FIRST logo facing up*
- C. Ten (10) located in each ALLIANCE POWER CUBE PILE (in a pyramid formation, with six on the bottom, three in the middle, and one on top, justified toward the SWITCH, *FIRST logo facing up*)

Section 4.2: Scoring

The primary method of earning points in *FIRST*[®] POWER UPSM is by placing POWER CUBES on the PLATES of the SWITCH or SCALE to establish OWNERSHIP. OWNERSHIP is a state of the ALLIANCE'S SWITCH or SCALE where it is tilted in favor of an ALLIANCE colored PLATE, such that the outside edge of the ALLIANCE colored PLATE is at or less than a specified height above the carpet. ALLIANCES earn points when OWNERSHIP is established and additional points for each additional second of OWNERSHIP.

...

An ALLIANCE has OWNERSHIP of their SWITCH when:

- A. the SWITCH is tilted in favor of their ALLIANCE colored PLATE, such that the outside edge of the ALLIANCE colored PLATE is at or less than 6 in. (~15 cm) from the floor for at least one (1) second, or
- B. they have played the FORCE POWER UP at level 1 or 3 (see Section 4.3 POWER UPS)

The Blue ALLIANCE'S SWITCH accumulates points for the Blue ALLIANCE when the PLATE illuminated and pulsing with blue lights is down.

The SWITCH does not accumulate points for either ALLIANCE when the blue PLATE is above 6 in (~15 cm).

An ALLIANCE has OWNERSHIP of the SCALE when:

- A. the SCALE is tilted in favor of their ALLIANCE colored PLATE, such that the outside edge of the ALLIANCE'S colored PLATE is at or lower than 4 ft. 8 in. (~142 cm) from the floor for at least one (1) second and there isn't an active opponent's Level 2 or 3 FORCE, or
- B. they have played the FORCE POWER UP at level 2 or 3 (see Section 4.3 POWER UPS)

Note that points for the SWITCH and SCALE are accrued over time and not a direct function of the number of POWER CUBES placed on the SWITCH or SCALE.

Points are not taken away when OWNERSHIP changes, but rather stop accumulating (if balanced) or start accumulating for the opposite ALLIANCE if they take OWNERSHIP of the SCALE.

Note from the FRC Director on the edits to Table 4-1:

You will see we added a requirement in Table 4-1 requiring a ROBOT to not be in direct contact with their PLATFORM to be considered CLIMBING. We believe this was already a requirement, given our BUMPER rules, but adding the requirement in Table 4-1 was the most straightforward way of making this clear.

Table 4-1: FIRST® POWER UPSM rewards

Action	Criteria	MATCH Points		Ranking Points
		AUTO	TELEOP	
CLIMBING	For each ROBOT fully supported by the SCALE (either directly or transitively) with BUMPERS fully above the BRICKS at T=0, not in direct contact with their PLATFORM, and not at all in the opponent's PLATFORM ZONE	-	30	-

Section 4.3: POWER UPS

Note from the FRC Director on the edits to Table 4-2:

These changes are an attempt to clarify how BOOST works. They do not significantly change the points being earned under BOOST.

Table 4-2: POWER UPS

Name	# of POWER CUBES	Effect	Duration (seconds)
LEVITATE	3	An additional CLIMBING ROBOT, up to a maximum of three (3) ROBOTS, is credited to the ALLIANCE at the end of the MATCH	N/A
FORCE	1	ALLIANCE earns OWNERSHIP points from their SWITCH regardless of PLATE position	10
	2	ALLIANCE earns OWNERSHIP points from the SCALE regardless of PLATE position	10
	3	ALLIANCE earns OWNERSHIP points from the SWITCH and the SCALE regardless of PLATE position	10
BOOST	1	Increases the points for OWNERSHIP of the ALLIANCE'S SWITCH from one (1) point per second to two (2) points per second Doubles the points being earned by the ALLIANCE for OWNERSHIP of their SWITCH.	10
	2	Increases the points for OWNERSHIP of the SCALE from one (1) point per second to two (2) points per second Doubles the points being earned by the ALLIANCE for OWNERSHIP of the SCALE.	10
	3	Increases the points for OWNERSHIP of both the ALLIANCE'S SWITCH and the SCALE from one (1) point per second to two (2) points per second Doubles the points earned by the ALLIANCE for OWNERSHIP of a) their SWITCH and b) the SCALE.	10

Section 8.3 ROBOT Safety & Damage Prevention

R07. Protrusions from the ROBOT and exposed surfaces on the ROBOT shall not pose hazards to the ARCADE elements (including the POWER CUBES GAME PIECES) or people.

If the ROBOT includes protrusions that form the “leading edge” of the ROBOT as it drives and have a surface area of less than 1 in.² (~6 cm²), it will invite detailed Inspection. For example, forklifts, lifting arms, or grapples may be carefully inspected for these hazards.

Section 8.6 Motors & Actuators

R33.

For servos, note that the roboRIO is limited to a max current output of 2.2A on the 6V rail (12.4W of electrical input power). Teams should make sure that their total servo power usage remains below this limit at all times.

This is the total number of each motor a Team may use on their ROBOT, not the quantity per part number. For example, each team may use up to six (6) CIM motors on their ROBOT, regardless of the quantity or combination of each individual part number used.

Given the extensive amount of motors allowed on the ROBOT, Teams are encouraged to consider the total power available from the ROBOT

battery during the design and build of the ROBOT. Drawing large amounts of current from many motors at the same time could lead to drops in ROBOT battery voltage that may result in tripping the main breaker or trigger the brownout protection of the roboRIO. For more information about the roboRIO brownout protection and measuring current draw using the PDP, see [roboRIO Brownout and Understanding Current Draw](#).

R34.

- F. The wiring harness of the Nidec Dynamo BLDC Motor may be modified [as documented by FIRST in the "Nidec Dynamo BLDC Motor with Controller" Screensteps article](#).

Section 10.12 Advancement Between Tournaments

T17.

A FIRST® Robotics Competition Team listed in the [Championship Eligibility Criteria document](#) is pre-qualified for the FIRST Championship if the Team meets one of the following criteria:

- A. member of the FIRST® Hall of Fame
- B. an original and sustaining team since 1992
- C. a 2017 FIRST Championship winner
- D. a 2017 FIRST Championship Engineering Inspiration Award winner
- E. a 2017 FIRST Championship Chairman's Award Finalist

Section 11: GLOSSARY

Section 11: Glossary has been updated to include entries for ACTIVE DEVICE, CAW, FENCE, LRI, RSL, SCALE, SIGNAL LEVEL, SWITCH, and VENDOR.

