

# Team Update 01

## GENERAL

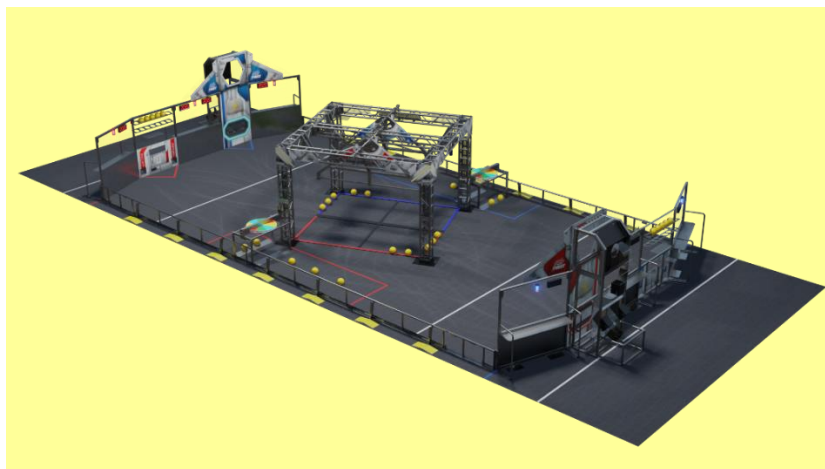
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- **Please note:** The following documents were updated after they were originally posted pre-Kickoff. Please check that your team is using the correct version of each of the following documents:
  - *FIRST* Official CAD Models, updated at 5pm on 1/2/2020
    - Updated location of TRENCH
  - Layout and Marking Diagram, updated at 5pm on 1/2/2020
    - Updated location and dimensions associated with TRENCH
- **Drawing Updates:**
  - The [Field Drawings – season specific](#) drawing package has been updated with the following changes:
    - GE-20100 has been updated to fix CONTROL PANEL color pattern
    - GE-20104 has been updated to fix CONTROL PANEL color pattern and fix some item callouts
  - The [Team Version drawing packages](#) have been updated with the following changes:
    - TE-20000 has been updated to add a drawing for TE-20000-10
    - TE-20001 has been updated to fix hole quantity callouts for TE-20001-01 and to update the description of TE-20001-03 to match the part dimension.
    - TE-20004-23 has been updated with proper material callouts for TE-20004-25 and TE-20004-26
    - TE-20005 has been updated to correct the material list and update a BOM callout.
- An additional photo album has been added to the [Playing Field](#) page. Thanks for the WPI staff and Brad Miller for providing these photos.
- The following link has been updated on the [Playing Field](#) page:
  - [Autodesk Inventor](#)

## MANUAL

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### Section 2 Game Overview



### Section 3.5.1 Control Panel

- Figure 3-23 has been updated to correct the appearance of the color pattern on the CONTROL PANEL.

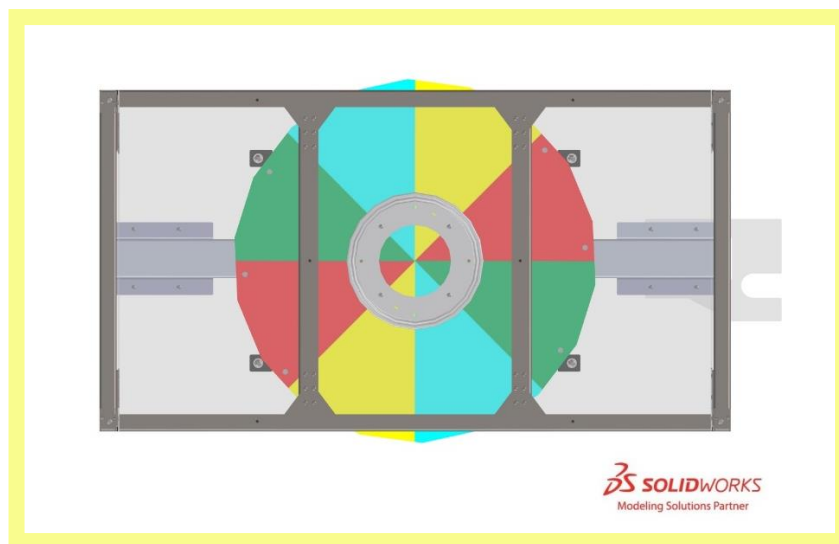


Figure 0-1 TRENCH bottom view

### Section 3.7 Vision Targets

Vision targets made from 2 in. (~5 cm) wide strips of 3M 8830 Scotchlite™ Reflective Material are located on the POWER PORTS and LOADING BAYS. On the POWER PORT, they target the location of the INNER and OUTER PORTS and trace the bottom perimeter of the OUTER PORT. The target has an overall height of 1 ft. 5 in. (~43 cm), and a width of 3 ft. 3¼ in. (~100 cm). The bottom of the target is 6 ft. 9¼ in. (~206 cm) above the carpet. A strip of 3M 8830 Scotchlite™ Reflective Material is in each Black Tote of the [2020 Kickoff Kit](#) **FIRST Choice**.

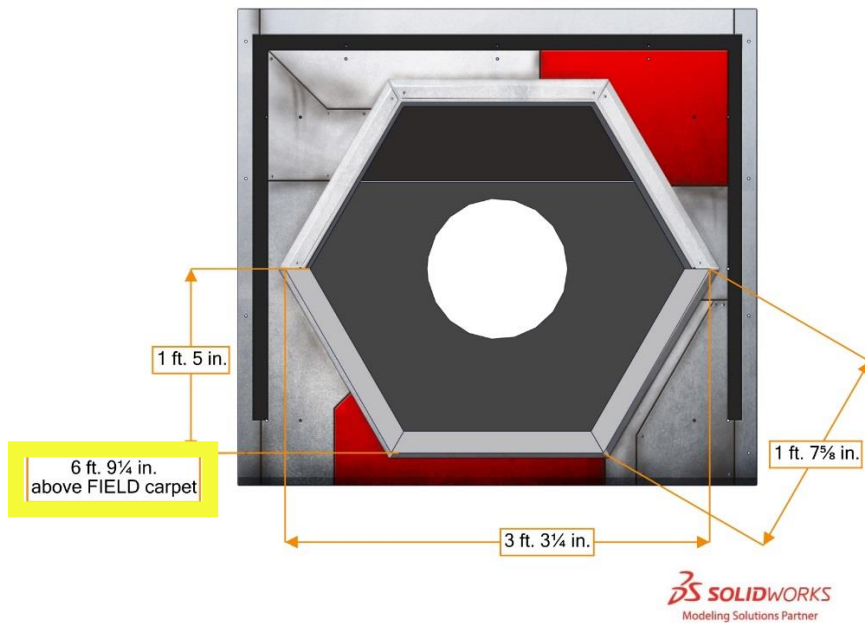


Figure 0-2 POWER PORT Vision Target

Section 7.2.1 During AUTO Only

**G3. During AUTO, no defense.** During AUTO, no part of a ROBOT’s BUMPERS may not break the plane of the opponent’s their ALLIANCE’s SECTOR (see Figure 3-3.)

*Violation: FOUL. If contact with an opponent ROBOT, either directly or transitively through another ROBOT or POWER CELL, TECH FOUL per instance.*

Section 12 Glossary

<p><b>CONTROL</b></p>	<p><del>E. Manipulating a POWER CELL such that the POWER CELL is fully supported by the ROBOT,</del>  <del>F. the POWER CELL travels across the FIELD such that when the ROBOT changes direction, the POWER CELL travels with the ROBOT, or</del></p> <p>the ROBOT is holding a POWER CELL against a FIELD element in attempt to guard or shield it.</p> <p>A ROBOT is in CONTROL of a POWER CELL if:</p> <ul style="list-style-type: none"> <li>A. the POWER CELL is fully supported by the ROBOT,</li> <li>B. the POWER CELL travels across the FIELD such that when the ROBOT changes direction, the POWER CELL travels with the ROBOT, or</li> <li>C. the ROBOT is holding a POWER CELL against a FIELD element in attempt to guard or shield it.</li> </ul>
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# Team Update 02

## GENERAL

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- Drawing Updates:
  - The Field Drawings – season specific drawing package has been updated with the following changes:
    - GE-20150 has been updated to correct the referenced manufacturer part number.
- The Kit Of Parts Checklist for the Black Tote has been updated:
  - Color Swatch for Control Panel is now available from TurnOne Graphics: [www.turnonegraphics.com](http://www.turnonegraphics.com)
- In addition to formatting and aesthetic edits to the Playing Field, content has been updated as follows:
  - [SOLIDWORKS' Visualize tool](#) now includes a link to a walkthrough video (and the 4k hotspot video has been deleted)
  - Added content to [SOLIDWORKS' SimInsights tool](#) describing how to import your robot in to the VR experience

## EVENT MANUAL

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We renumbered the rules in the Event Manual, as follows, because there were several references to these rule numbers in other documentation:

- E15 was changed to E14-A.
- All rules after E15 are now 1 less (e.g. E16 is now E15).

**E16. No wireless communication.** Teams may not set up their own 802.11a/b/g/n/ac/ax (2.4GHz or 5GHz) wireless communication (e.g access points or ad-hoc networks) in the venue

A wireless hot spot created by a cellular device, camera, smart TV, etc. is considered an access point.

Some smart TVs have access points enabled by factory default. Please make sure that functionality is disabled for any TVs brought to the event.

## GAME AND SEASON MANUAL

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### Section 4.4.3 CONTROL PANEL Scoring

CONTROL PANELS ACTIVATE SHIELD GENERATOR stages two (2) and three (3) as described in CONTROL PANEL. CONTROL PANEL requirements (i.e. ROTATION CONTROL and POSITION CONTROL) are not evaluated until the respective stage is at CAPACITY. A stage may be ACTIVATED once it reaches CAPACITY, and a stage must be ACTIVATED before the next stage can begin charging.

## Section 7.2.4 ROBOT Restrictions

**G16. Keep your bumpers low.** BUMPERS must be in the BUMPER ZONE (see R18) during the MATCH, unless during the **ENDGAME** and

- A. a ROBOT's BUMPERS are intersecting its RENDEZVOUS POINT or
- B. a ROBOT is supported by a partner ROBOT whose BUMPERS are intersecting its RENDEZVOUS POINT.

*Violation: FOUL. If strategic, RED CARD.*

An example of a strategic violation of G16 includes, but is not limited to, hitting other ROBOTS with the ROBOT frame.

## 9.6 Motor & Actuator

**R28.** The integral mechanical and electrical system of any motor must not be modified. Motors, servos, and electric solenoids used on the ROBOT shall not be modified in any way, except as follows:

- A. The mounting brackets and/or output shaft/interface may be modified to facilitate the physical connection of the motor to the ROBOT and actuated part.
- B. The electrical input leads may be trimmed to length as necessary and connectors or splices to additional wiring may be added.
- C. The locking pins on the window motors (P/N:262100-3030 and 262100-3040) may be removed.
- D. The connector housings on the KOP Automotive motors listed in Table 9-1 may be modified to facilitate lead connections.
- E. Servos may be modified as specified by the manufacturer (e.g re-programming or modification for continuous rotation).
- F. The wiring harness of the Nidec Dynamo BLDC Motor may be modified as document by FIRST in the "Nidec Dynamo BLDC Motor with Controller" article.
- G. Minimal labeling applied to indicate device purpose, connectivity, functional performance, etc.
- H. Any number of #10-32 plug screws may be removed from the Falcon 500.

The intent of this rule is to allow teams to modify mounting tabs and the like, not to gain a weight reduction by potentially compromising the structural integrity of any motor.

## Section 10 Inspection and Eligibility Rules

**I1. It's your team's ROBOT.** The ROBOT and its MAJOR MECHANISMS must be built by the FIRST Robotics Competition team.

A MAJOR MECHANISM is a group of COMPONENTS and/or MECHANISMS assembled together to address at least one (1) game challenge: robot movement, game piece control, field element manipulation, or performance of a scorable task without the assistance of another ROBOT.

## Section 12 Glossary

### MAJOR MECHANISM

a group of COMPONENTS and/or MECHANISMS assembled together to address at least one (1) game challenge: robot movement game piece control, field element manipulation, or performance of a scorable task without the assistance of another ROBOT.



# Team Update 03

## GENERAL

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- Although there are no specifications for the compressibility of POWER CELLS, please be sure the vent hole is not plugged. For further reference, please watch [the LOADING BAY Field Tour video with Fiona and Malcolm here](#).
- The [Playing Field webpage](#) has updated VR experiences.
  - AutomationDirect.com created an [Oculus Quest experience](#), now added to the [Playing Field page](#).
  - [AutomationDirect.com's VR asset](#) was updated on 1/8/20. Changes include the following:
    - amber stacklights by the control panels can now be turned off and on using the same controls as everything else
    - shield generator stacklights turn off and on depending on whether or not the switches are level
    - ground texture replaced with concrete blocks
    - polishing tweaks (for example built lighting at “production” as opposed to medium and added a few reflection captures)
    - changed the application icon to the “AutomationDirect goathead”

## EVENT MANUAL

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No changes.

## GAME AND SEASON MANUAL

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### Section 7.2.4 ROBOT Restrictions

**G18. Don't overextend yourself.** ROBOTS may not extend more than 12 inches (~30 cm) beyond their FRAME PERIMETER.

*Violation: FOUL. If egregious, RED CARD.*

Examples of compliance and non-compliance of G18 are shown in Figure 7-4.

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 violate G18. Red bars represent a measured extension from the FRAME PERIMETER that exceeds the limit in G18). ROBOTS A and C violate G18, whereas ROBOT B does not.

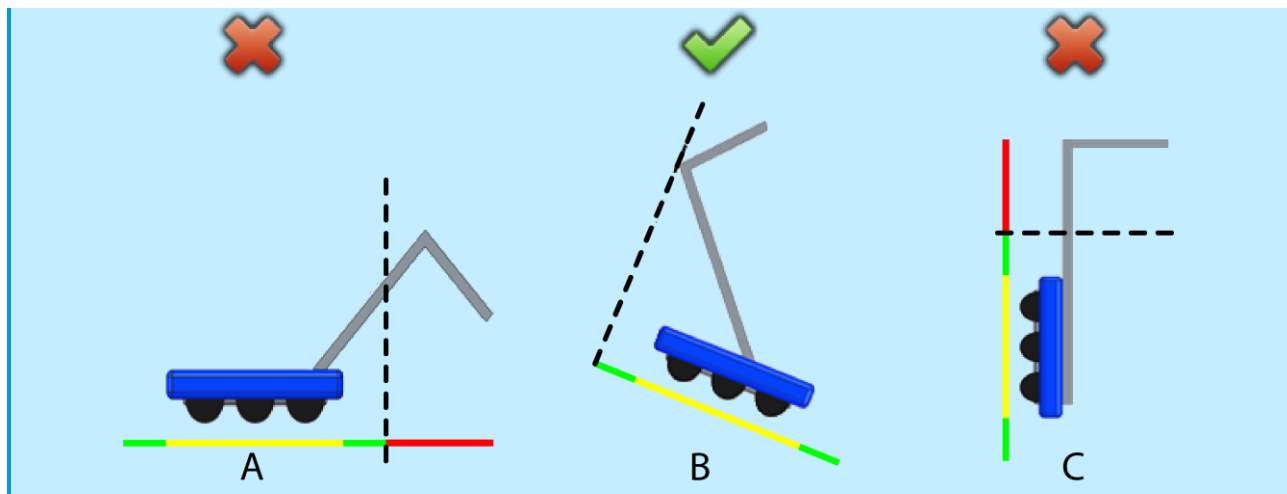


Figure 7-4 Examples of G18 compliance and non-compliance

Egregious examples of G18 violations include:

- extending more than 12 inches (~30cm) beyond the FRAME PERIMETER to score a POWER CELL
- extending more than 12 inches (~30cm) beyond the FRAME PERIMETER to score a HANG
- expanding to block opponent access to a FIELD element, e.g. GENERATOR SWITCH or POWER PORT
- expanding into the BOTTOM PORT to disrupt the scoring mechanism

## Section 10 Inspection and Eligibility Rules

**I1. It's your team's ROBOT.** The ROBOT and its MAJOR MECHANISMS must be built by the FIRST Robotics Competition team.

A MAJOR MECHANISM is a group of COMPONENTS and/or MECHANISMS assembled together to address at least one (1) game challenge: robot movement, game piece control, field element manipulation, or performance of a scorable task without the assistance of another ROBOT.

I1 requires that the ROBOT and its MAJOR MECHANISMS were built by its team, but isn't intended to prohibit or discourage assistance from other teams (e.g. fabricating elements, supporting construction, writing software, developing game strategy, contributing COMPONENTS and/or MECHANISMS, etc.)

Examples of MAJOR MECHANISMS include, but are not limited to, assemblies listed below:

- an assembly used to manipulate a game piece
- an assembly used to position a ROBOT for an end game task
- an assembly used to manipulate a FIELD element
- an assembly used to move the ROBOT around the FIELD

Examples that would generally not be considered MAJOR MECHANISMS, and thus probably aren't subject to I1 include, but are not limited to, the following:

- a gearbox assembly
- a COMPONENT or MECHANISM that's part of a MAJOR MECHANISM
- COTS items

Neither I1 nor the language in its Blue Box define specific thresholds for how much of a MAJOR MECHANISM must be the result of the team's effort. I1 expects and requires the team's honest assessment of whether they built the MAJOR MECHANISMS of their ROBOT.



Attempts to exploit loopholes in the definition of MAJOR MECHANISM in order to bypass this requirement are not in the spirit of I1 or the *FIRST* Robotics Competition. Examples of exploitation include:

- a. assembling pieces of a MAJOR MECHANISM provided by another team, except COTS kits
- b. receiving a mostly complete MAJOR MECHANISM from another team and providing a small piece

# Team Update 04

## GENERAL

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- **WPILib update:** A C++/Java WPILib update (2020.2.2) has been released which fixes bugs discovered in the first two weeks of the season. [The download, and a complete changelog, is available on Github.](#)
- **Chairman's Award update:** The text for the Chairman's Documentation Form has been updated on the Chairman's Section of the awards [here](#):
  - Please note that teams **must are encouraged** to provide documentation during the interview to the Judges using the [Chairman's Documentation Form](#) (editable word doc [here](#)). Note this is not a required form (i.e. you can still be eligible without this form) but providing it shows the Judges that your activities are well planned and documented.

## EVENT MANUAL

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No changes.

## GAME AND SEASON MANUAL

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### Section 7.2.3 Zone Specific Restrictions

- G12. Leave the opponent's CONTROL PANEL alone.** A ROBOT may not contact the opponent's CONTROL PANEL, either directly, or transitively through a POWER CELL, if
- A. the opponent ROBOT is contacting that CONTROL PANEL, and
  - B. the opponent's POWER PORT has reached CAPACITY

*Violation: In Qualification MATCHES, opponents are awarded one (1) SHIELD GENERATOR ENERGIZED Ranking Point if not completed at the conclusion of the MATCH. In Playoff MATCHES, TECH FOUL.*

# Team Update 05

## GENERAL

No changes.

## EVENT MANUAL

No changes.

## GAME AND SEASON MANUAL

### Section 3.3.3 BOUNDARIES

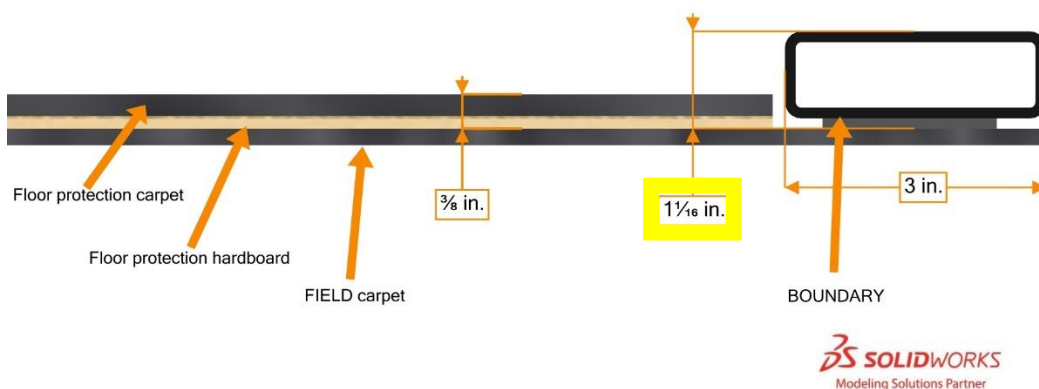


Figure 3-11 Floor protection cross-section

## Section 6 Conduct Rules

**C1. Egregious and exceptional violations.** Egregious behavior beyond what is listed in the rules or repeated violations of any rule or procedure during the event is prohibited.

In addition to rule violations explicitly listed in this manual and witnessed by a REFEREE, the Head REFEREE may assign a YELLOW or RED CARD for egregious ROBOT actions or team member behavior at any time during the event. This includes violations of the event rules found on the [FIRST® Robotics Competition Event Experience web page](#).

Please see YELLOW and RED CARDS for additional detail.

*Violation: The Head REFEREE may assign a YELLOW or RED CARD.*

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

believe this behavior puts our community at risk. Those behaviors include, but are not limited to the list below:

- c. Inappropriate behavior as outlined in the blue box of C2
- d. Jumping over the FIELD border
- e. Sitting on the SHIELD GENERATOR
- f. PINNING in excess of fifteen (15) seconds
- g. Foregoing use of the LOADING BAY rack in a way that appears to be deliberate to a REFEREE (e.g. hiding POWER CELLS or violating H10 multiple times during an event).

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 violation.

Teams should be aware that any rule in this manual could escalate to a YELLOW or RED CARD. The Head REFEREE has final authority on all rules and violations at an event.

## Section 7.1 Before/After the MATCH

**G2. Teams may not enable their ROBOTS on the FIELD. ROBOTS must be removed from the FIELD by hand (i.e. no enabling, power, etc).** Teams may not tether to the ROBOT while on the FIELD. ROBOTS will not be re-enabled after the conclusion of the MATCH, nor will teams be permitted to tether to the ROBOT except in special circumstances (e.g. during TIMEOUTS, after Opening Ceremonies, before an immediate MATCH replay, etc.) and with the express permission from the FTA or a REFEREE.

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 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.

## Section 7.2.3 Zone Specific Violations

**G9. No full court shots.** A ROBOT whose BUMPERS are fully contained by their SECTOR may not cause POWER CELLS to travel into or through their opponent's SECTOR.

*Violation: TECH FOUL per POWER CELL.*

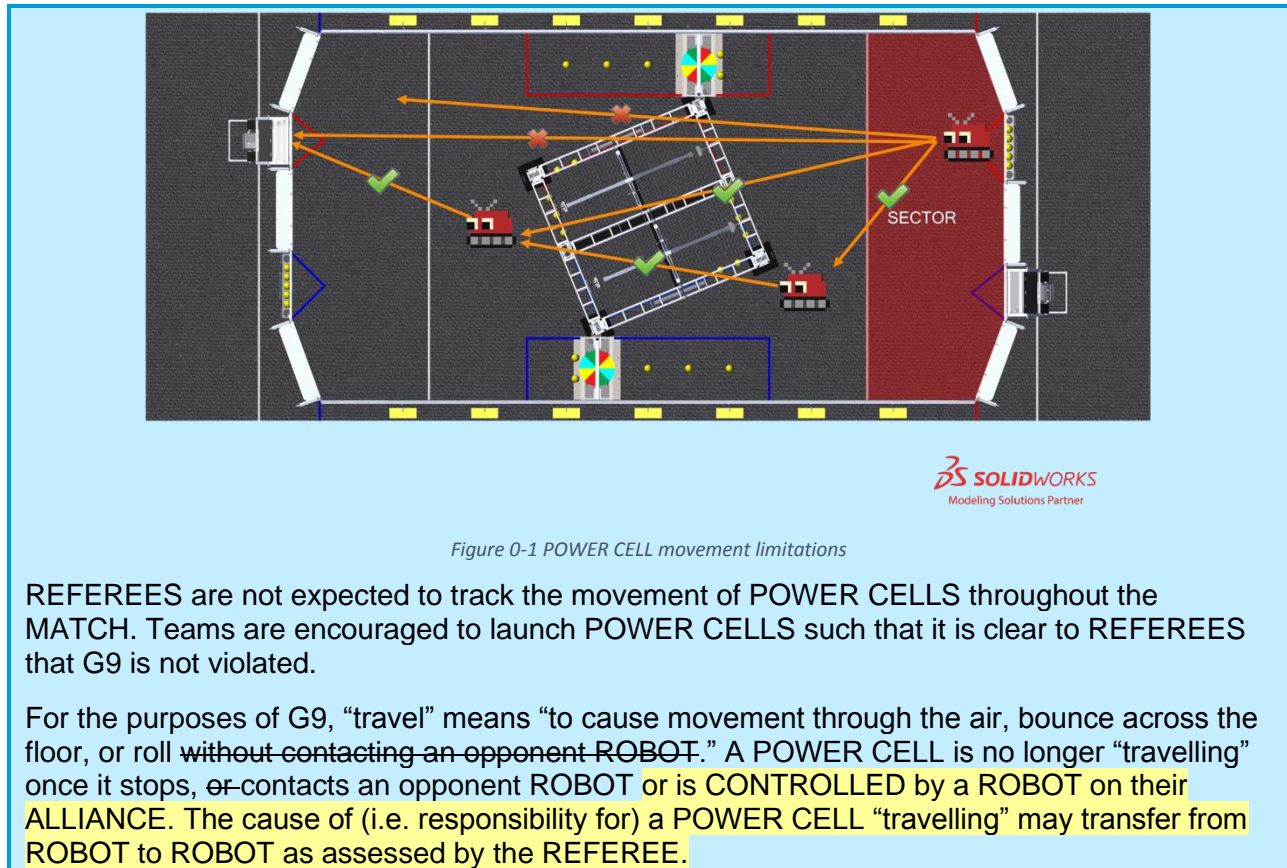


Figure 0-1 POWER CELL movement limitations

REFEREES are not expected to track the movement of POWER CELLS throughout the MATCH. Teams are encouraged to launch POWER CELLS such that it is clear to REFEREES that G9 is not violated.

For the purposes of G9, “travel” means “to cause movement through the air, bounce across the floor, or roll without contacting an opponent ROBOT.” A POWER CELL is no longer “travelling” once it stops, or contacts an opponent ROBOT or is CONTROLLED by a ROBOT on their ALLIANCE. The cause of (i.e. responsibility for) a POWER CELL “travelling” may transfer from ROBOT to ROBOT as assessed by the REFEREE.

## Section 8.1.1 During the MATCH

**H10. POWER CELLS go on the rack.** POWER CELLS must be stored on the LOADING BAY racks. An ALLIANCE making a concerted, good-will effort to transport POWER CELLS from the CORRAL to a rack or Chute is not in violation of this rule.

*VIOLATION: FOUL. If repeated, TECH FOUL.*

The LOADING BAY rack holds fourteen (14) POWER CELLS and enables teams and REFEREES to count POWER CELLS in an ALLIANCE STATION. An ALLIANCE holding the fifteenth POWER CELL is not in violation of H10.

H10 means that POWER CELLS may neither be stored in the CORRAL during the MATCH nor required to contact the LOADING BAY rack before entering the FIELD.

Teams are encouraged to make it clear to REFEREES that H10 is not violated.

# Team Update 06

## GENERAL

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No changes.

## EVENT MANUAL

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No changes.

## GAME AND SEASON MANUAL

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### Section 3.5.1 CONTROL PANEL

Specific details on the format of the data can be found on the [2020 FRC Control System website](#).

In the unlikely event that the sensor isn't reporting one (1) of the four (4) colors when Stage 3 reaches CAPACITY (e.g. the sensor is positioned where two (2) color wedges meet), FMS will randomly select the specified color from one (1) of the four (4) colors.

### 4.7 Other Logistics

Note that ROBOTS may not deliberately cause POWER CELLS to leave the FIELD (see ~~G6~~ G7).

### 9.4 Budget Constraints & Fabrication Schedule

**R16.** During an event a team is attending (regardless of whether the team is physically at the event location), the team may not ~~neither~~ work on ~~nor practice with~~ their ROBOT or ROBOT elements outside of the hours that pits are open, with the following exceptions:

- C. Exceptions listed in R14, other than R14-E iii
- D. Software development
- E. Batteries may be charged during the designated Load-in time

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 R16 include:

- h. Working on the ROBOT at the team's shop after Load-in for the event has begun
- i. Working on ROBOT parts at night at the team's hotel.

Note that E8 and E20 impose additional restrictions on work done on the ROBOT or ROBOT materials while attending an event.

One purpose of R16 is 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).

# Team Update 07

## GENERAL

### FIRST Choice Bonus Item

FIRST Choice Round 2 orders continue to ship (we thank you for your patience!). For those of you who have received them, you've probably noticed a bonus item included in each shipment; a laminated field layout w/ dry erase marker. Thank you to Piedmont Plastics for the strategic donation. We want to let you know that the color pattern on these boards (shown on the left below, clockwise: Y, R, G, and B) are the opposite of the actual field (shown on the right below, clockwise: B, G, R, and Y).

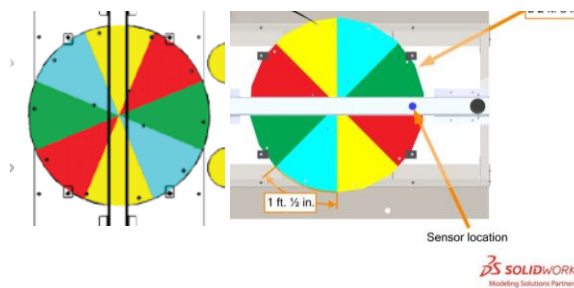


Image from the laminated field layout on left, image from actual field on right

## EVENT MANUAL

No changes.

## GAME AND SEASON MANUAL

### Section 8.1.1

**H10. POWER CELLS go on the rack.** POWER CELLS must be stored on the LOADING BAY racks. An ALLIANCE making a concerted, good-will effort to transport POWER CELLS from the CORRAL to a rack or Chute is not in violation of this rule.

*VIOLATION: FOUL. If repeated, TECH FOUL.*

The LOADING BAY rack holds fourteen (14) POWER CELLS and enables teams and REFEREES to count POWER CELLS in an ALLIANCE STATION. An ALLIANCE holding the fifteenth POWER CELL is not in violation of H10.

H10 means that POWER CELLS may neither be stored in the CORRAL during the MATCH nor **are they** required to contact the LOADING BAY rack before entering the FIELD.

Teams are encouraged to make it clear to REFEREES that H10 is not violated.



## Section 9.6

- R28.** The integral mechanical and electrical system of any motor must not be modified. Motors, servos, and electric solenoids used on the ROBOT shall not be modified in any way, except as follows:
- A.** The mounting brackets and/or output shaft/interface may be modified to facilitate the physical connection of the motor to the ROBOT and actuated part.
  - B.** The electrical input leads may be trimmed to length as necessary and connectors or splices to additional wiring may be added.
  - C.** The locking pins on the window motors (P/N: 262100-3030 and 262100-3040) may be removed.
  - D.** The connector housings on KOP Automotive motors listed in Table 9-1 may be modified to facilitate lead connections.
  - E.** Servos may be modified as specified by the manufacturer (e.g. re-programming or modification for continuous rotation).
  - 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" article](#).
  - G.** Minimal labeling applied to indicate device purpose, connectivity, functional performance, etc.
  - H.** Any number of #10-32 plug screws may be removed from the Falcon 500.
  - I.** Insulation may be applied to electrical terminals

The intent of this rule is to allow teams to modify mounting tabs and the like, not to gain a weight reduction by potentially compromising the structural integrity of any motor.

# Team Update 08

## GENERAL

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### Drawings

- The [Layout and Marking Diagram](#) has been updated as follows:
  - sheet 5 was added
  - truss base reference dimensions were added,
  - title block tolerance values were updated, and
  - a TRENCH RUN dimension was added.

## EVENT MANUAL

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No changes.

## GAME AND SEASON MANUAL

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### Section 4.4.1 POWER PORT Scoring

ALLIANCES generate energy by scoring POWER CELLS into one of three (3) openings of their POWER PORT. To be considered scored, the POWER CELL must pass through the BOTTOM, OUTER, or INNER PORTS and exit through the respective scoring sensors during the MATCH or within five (5) seconds after the MATCH (regardless of how many POWER CELLS are being processed after the end of the MATCH).