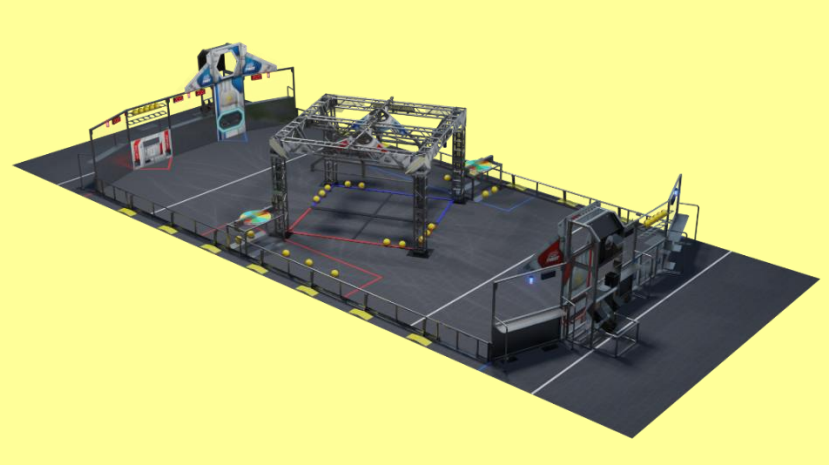
Team Update 01

GENERAL

- **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

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.

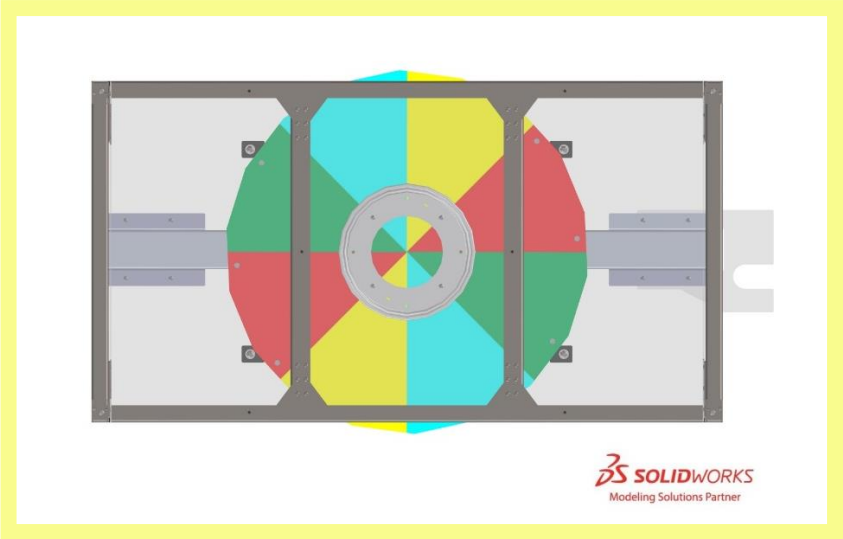


Figure 0-1 TRENCH bottom view

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~~ is in ~~each Black Tote of the~~ 2020 Kickoff Kit *FIRST* Choice.

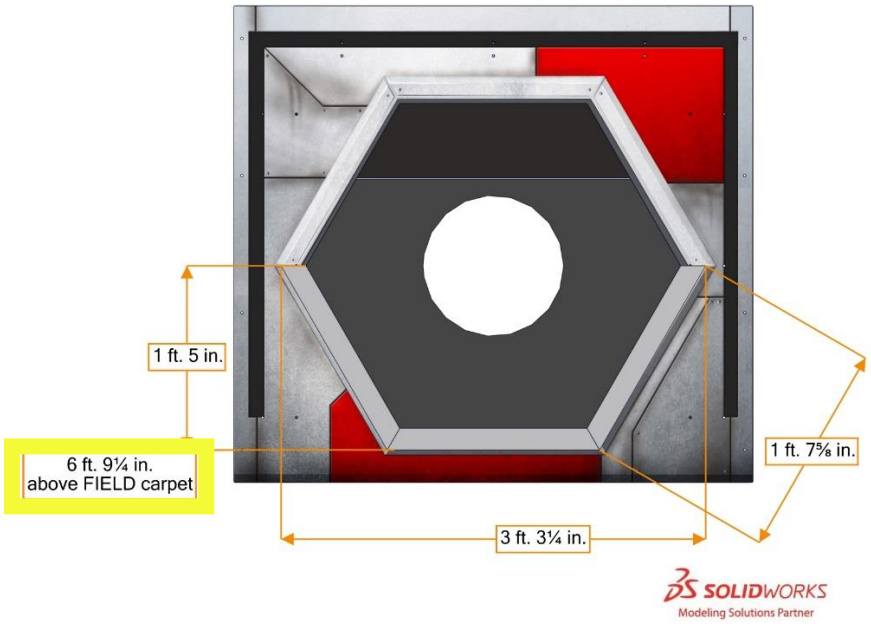


Figure 0-2 POWER PORT Vision Target

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

CONTROL	~~E. Manipulating a POWER CELL such that the POWER CELL is fully supported by the ROBOT,~~ ~~F. the POWER CELL travels across the FIELD such that when the ROBOT changes direction, the POWER CELL travels with the ROBOT, or~~ ~~the ROBOT is holding a POWER CELL against a FIELD element in attempt to guard or shield it.~~ A ROBOT is in CONTROL of a POWER CELL if: **A.** the POWER CELL is fully supported by the ROBOT, **B.** the POWER CELL travels across the FIELD such that when the ROBOT changes direction, the POWER CELL travels with the ROBOT, or **C.** the ROBOT is holding a POWER CELL against a FIELD element in attempt to guard or shield it.

Team Update 02

GENERAL

- 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
- 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

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

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

- 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

No changes.

GAME AND SEASON MANUAL

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.

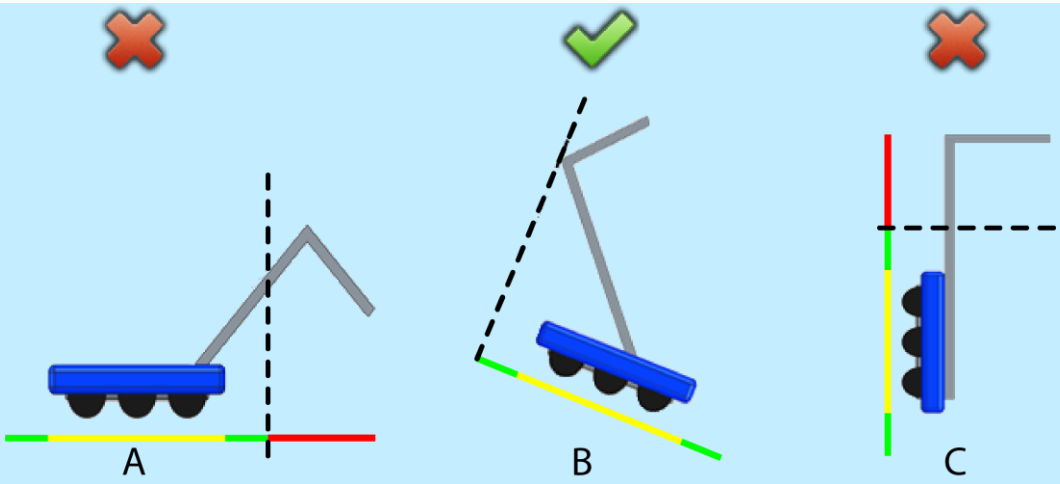


Figure 7-4 Examples of G18 compliance and non-compliance

Egregious examples of G18 violations include:

a. extending more than 12 inches (~30cm) beyond the FRAME PERIMETER to score a POWER CELL
b. extending more than 12 inches (~30cm) beyond the FRAME PERIMETER to score a HANG
c. expanding to block opponent access to a FIELD element, e.g. GENERATOR SWITCH or POWER PORT
d. 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:

a. an assembly used to manipulate a game piece
b. an assembly used to position a ROBOT for an end game task
c. an assembly used to manipulate a FIELD element
d. 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. a gearbox assembly
b. a COMPONENT or MECHANISM that's part of a MAJOR MECHANISM
c. 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

- **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

No changes.

GAME AND SEASON MANUAL

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

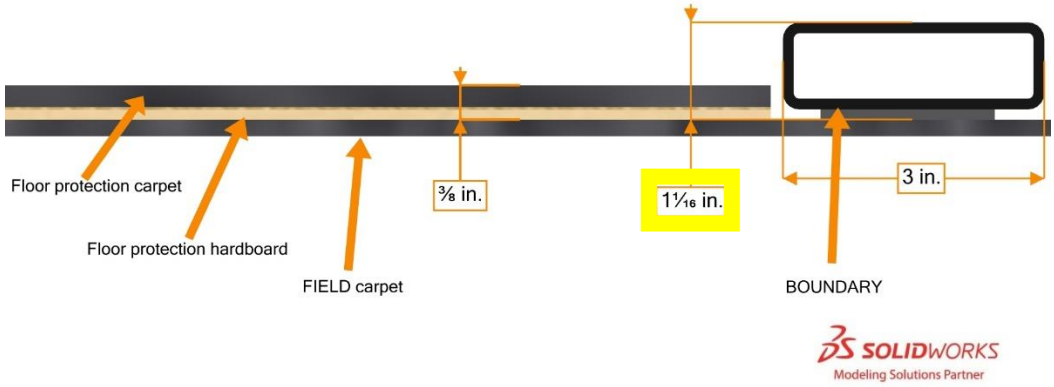


Figure 3-11 Floor protection cross-section

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:

a. Inappropriate behavior as outlined in the blue box of C2
b. Jumping over the FIELD border
c. Sitting on the SHIELD GENERATOR
d. PINNING in excess of fifteen (15) seconds
e. 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.

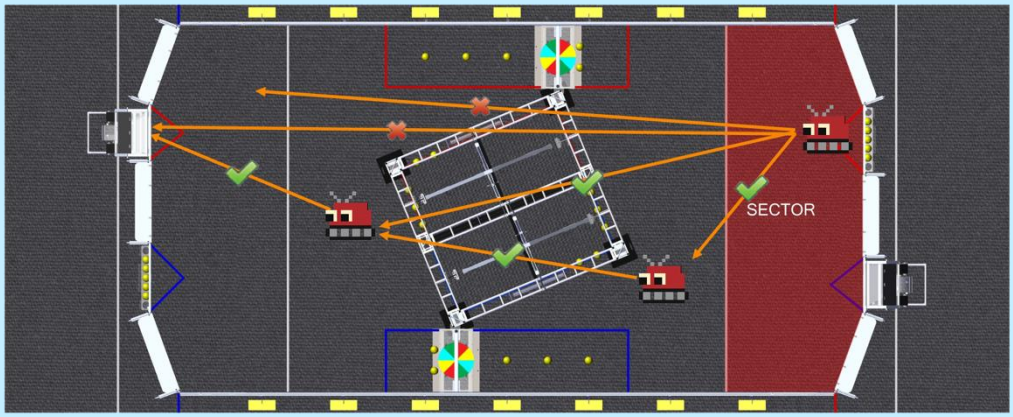


Figure 0-1 POWER CELL movement limitations

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

No changes.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

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:

- **A.** Exceptions listed in R14, other than R14-E iii
- **B.** Software development
- **C.** 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:

a. Working on the ROBOT at the team's shop after Load-in for the event has begun
b. 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).

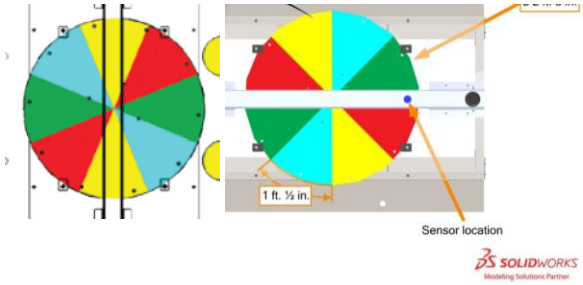


Image from the laminated field layout on left, image from actual field on right

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

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

No changes.

GAME AND SEASON MANUAL

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).

Team Update 09

GENERAL

No changes.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

9.6 Motors & Actuators

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 electrical ~~input~~ leads may be trimmed to length as necessary and connectors or splices to additional wiring may be added.

Team Update 10

GENERAL

A new assembly, GE-20028, has been added to the drawings and SOLIDWORKS files. During each MATCH, the assemblies will be secured to the hard stops, as shown in the drawings and SOLIDWORKS model. After the MATCH completes, the assembly will be lowered by FIELD STAFF to aid in the FIELD reset procedure of locking the GENERATOR SWITCH. The complete details are outlined below:

- The Field Drawings – season specific drawing package has been updated with the following changes:
  - GE-20000 has been modified to update the tolerances in title block, tolerances in provided dimensions, and include the use of the GE-20028 assembly
  - GE-20026 - Generator Switch Lock Out – Daisy Chain has been added
  - GE-20027 - Generator Switch Lock Out – Magnet has been added
  - GE-20028 - Generator Switch Lock Out – Field Attachment has been added
- The Layout and Marking Diagram drawing package has been updated with the following changes:
  - GE-20000 updated per above notes
  - Updated tolerances
- The *FIRST* Official CAD Models SOLIDWORKS version has been updated with the following change:
  - GE-20028, which includes GE-20026 and GE-20027, has been added to the GE-20000 assembly.

EVENT MANUAL

No changes.

3.5.1 CONTROL PANEL

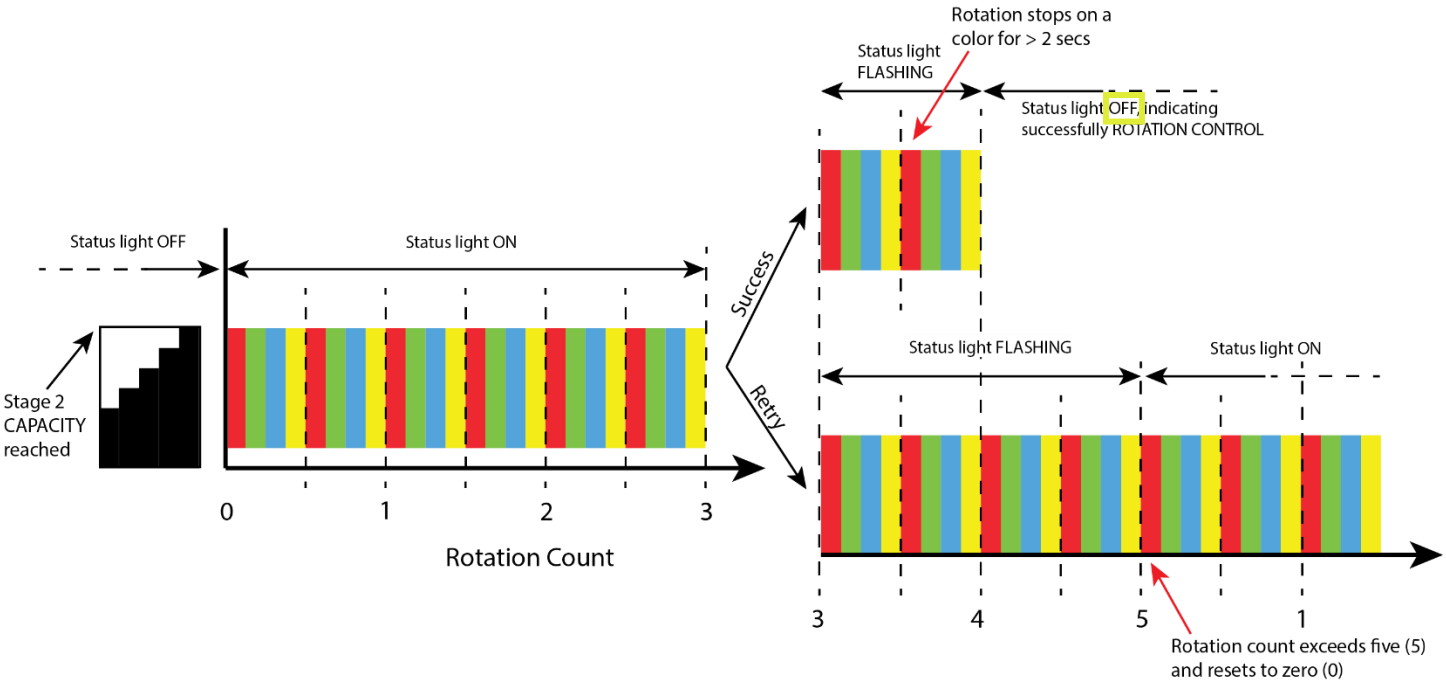


Figure 3-24 CONTROL PANEL ROTATION CONTROL example

4.4.1 POWER PORT Scoring

The final assessment of POWER CELLS scored in POWER PORTS is made five (5) seconds after the ARENA timer displays zero (0) following the AUTO and TELEOP, respectively.

> POWER CELLS scored during the five (5) seconds after the ARENA timer displays zero (0) following AUTO earn AUTO points and, if STAGE 1 has been ACTIVATED, count towards STAGE 2 CAPACITY.

9.2 General ROBOT Design

R5. The ROBOT weight must not exceed 125 lbs.(~56 kg).When determining weight, the basic ROBOT structure and all elements of all additional MECHANISMS that might be used in a single configuration of the ROBOT shall be weighed together (see I3). For the purposes of determining compliance with the weight limitations, the following items are excluded:

- **A.** ROBOT BUMPERS
- **B.** ROBOT battery and its associated half of the Anderson cable quick connect/disconnect pair (including no more than 12 in. (~30 cm) of cable per leg, the associated cable lugs, connecting bolts, and insulation)
- **C.** tags used for location detection systems if provided by the event.

9.4 Budget Constraints & Fabrication Schedule

R11. The total cost of all items on the ROBOT (i.e all items presented at Inspection per I3: MECHANISMS, configurations, and decorations that will be used on the ROBOT in MATCHES without re-inspection) including software, shall not exceed $5000 USD. All costs are to be determined as explained in Budget Constraints & Fabrication Schedule. Exceptions are as follows:

- **A.** individual items that are less than $5 USD each, as purchasable from a VENDOR,
- **B.** items from the team's current year's KOP (identical functional replacements may be used to meet this criteria), up to the KOP quantity (including the rookie KOP items), and
- **C.** Specific exempt items:
  - i. One (1) Inertial Measurement Unit (Note that R12 still applies)
  - ii. Rockwell Automation sensors available through *FIRST* Choice in any season
  - iii. tags used for location detection systems if provided by the event.

9.8 Control, Command, & Signals System

R63. No form of wireless communication shall be used to communicate to, from, or within the ROBOT, except those required per R58, ~~and~~ R62, and tags used for location detection systems if provided by the event.

Team Update 11

GENERAL

No changes.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

7.2.6 FIELD Interaction

G26. Be careful what you interact with. ROBOTS and OPERATOR CONSOLES are prohibited from the following actions with regards to interaction with ARENA elements. Items A – C exclude POWER CELLS, HANDLE, and the ALLIANCE'S CONTROL PANEL. Item G excludes the HANDLE.

- **A.** Grabbing
- **B.** Grasping
- **C.** Attaching (including the use of a vacuum or hook tape to anchor to the FIELD carpet and excluding use of the PLAYER STATION hook-and-loop tape, plugging in to the provided power outlet, and plugging the provided Ethernet cable into the OPERATOR CONSOLE)
- **D.** Deforming
- **E.** Becoming entangled
- **F.** Damaged
- **G.** Suspending from

9.5 BUMPER Rules

R24. BUMPERS must be constructed as follows (see Figure 9-6):

- **A.** …
- **B.** …
- **C.** …
- **D.** be covered with a rugged, smooth cloth. (multiple layers of cloth and seams are permitted if needed to accommodate R21 and/or R22, provided the cross section in Figure 9-6 is not significantly altered).

Silk and bedding are not considered rugged cloths, however 1000D Cordura is. Tape (e.g. gaffer's tape) matching 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.

Section 10 Inspection

I3. Bring it all to Inspection. At the time of Inspection, the OPERATOR CONSOLE and the ROBOT must be presented with all MECHANISMS(including all COMPONENTS of each MECHANISM), configurations, and decorations that will be used on the ROBOT in MATCHES without re-inspection (per I4) and may not exceed 150 lbs. (~68kg) (note that while up to 150 lbs. of ROBOT MECHANISMS may be inspected together, the ROBOT configuration used in a MATCH may not violate R5). The OPERATOR CONSOLE and exceptions listed in R5 are not included in this weight.

Team Update 12

GENERAL

The 2020 Inspection Checklist has been added to the Game & Season Materials page.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

9.6 BUMPER Rules

R24. BUMPERS must be constructed as follows (see Figure 9-6):

A. …
B. …
C. use a stacked pair of approximately 2½ in. (nominal, ~63mm) round, petal, or hex "pool noodles" (solid or hollow) as the BUMPER cushion material (see Figure 9-6). All pool noodles used in a BUMPER set (e.g. Red set of BUMPERS) may not be modified (with the exception of cutting to length or ~~beveling ends~~ cutting to facilitate mating pool noodles at the corners as required by R25) or deformed and must be the same diameter, cross-section, and density (e.g. all round hollow or all hex solid). Cushion material may extend up to 2½ in. (~63 mm) beyond the end of the plywood (see Figure 9-7). To assist in applying the fabric covering, soft fasteners may be used to attach the pool noodles to the wood backing, so long as the cross section in Figure 9-6 is not significantly altered (e.g. tape compressing the pool noodles).

11.4 Measurement

T1. Freeze, ROBOT. During the period when the ARENA is open for measurement, ROBOTS can be enabled, but cannot move (i.e. neither the ROBOT, nor anything on the ROBOT, can move), nor can they interact with (e.g. shoot, push, pickup, etc.) POWER CELLS, POWER PORTS, GENERATOR SWITCHES, CONTROL PANELS, or other FIELD elements.

Violation: Verbal warning. If repeated at any point during the event or egregious YELLOW CARD

Team Update 13

GENERAL

No changes.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

7.2.3 Zone Specific Restrictions

G15. During the ENDGAME, don't mess with HANGING opponents. During the ENDGAME, a ROBOT may not contact, either directly or transitively through a POWER CELL, an opponent's ROBOT that is contacting its GENERATOR SWITCH and not in their opponent's RENDEZVOUS POINT.

Violation: The contacted opponent ROBOT, and any partners its supporting, will be considered HANGING, and the opponent's GENERATOR SWITCH will be considered LEVEL.

G15-A. During the ENDGAME, don't mess with the opponent's GENERATOR SWITCH. During the ENDGAME, a ROBOT may not contact, either directly or transitively through a POWER CELL, the opponent's GENERATOR SWITCH.

Violation: Any opponent ROBOTS contacting their GENERATOR SWITCH when the violation occurred will be considered HANGING, and the opponent's GENERATOR SWITCH will be considered LEVEL.

7.2.5 ROBOT to ROBOT Interaction

G22. Don't collude with your partners to shut down major parts of game play. Two or more ROBOTS that appear to a REFEREE to be working together may not isolate or close off any major component of MATCH play.

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

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

a. blocking an opponent's TRENCH
b. blocking all the opponent LOADING BAY Chutes
c. blocking the opponent BOTTOM PORT
d. shutting down access to all POWER CELLS ~~on the FIELD~~
e. quarantining all opponents to a small area of the FIELD

A single ROBOT blocking access to a particular area of the FIELD is not a violation of this rule.

Two ROBOTS independently playing defense on two opponent ROBOTS is not a violation of this rule.

8.2 In the ARENA

H14. Don't mess with the POWER CELLS. Teams may not modify POWER CELLS in any way. Temporary deformation to pre-load a ROBOT is an exception to this rule.

Violation: RED CARD.

Marking, cutting or standing on POWER CELLS are examples of violations.

11.2.1 YELLOW and RED CARDS

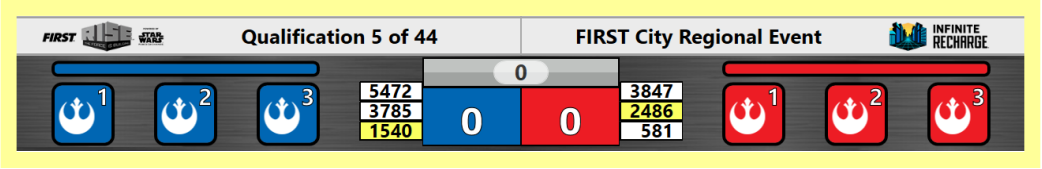


Figure 11-2 Audience Screen graphic showing YELLOW CARD Indicators

Team Update 14

GENERAL

WPILib update: A C++/Java WPILib update (2020.3.2) has been released which fixes bugs discovered since the previous release (2020.2.2 on 1/17/20). The download, and a complete changelog, is available on Github.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

3.2 Zones and Markings

FIELD Zones and markings of consequence are described below. Unless otherwise specified, the tape used to mark lines and zones throughout the FIELD is 2-in. (~5cm) 3M™ Premium Matte Cloth (Gaffers) Tape (GT2) or comparable gaffers tape.

11.7.4 TIMEOUTS

A TIMEOUT is a period of up to six (6) minutes between MATCHES which is used to pause Playoff MATCH progression.

During a TIMEOUT, the ARENA Timer displays the time remaining in the TIMEOUT. Both ALLIANCES enjoy the complete six (6) minute window. If an ALLIANCE completes their repairs before the ARENA Timer expires, the ALLIANCE CAPTAIN is encouraged to inform the Head REFEREE that they are ready to play. If both ALLIANCES are ready to play before the TIMEOUT expires, the next MATCH will start.

There are no TIMEOUTS for Practice or Qualification MATCHES.

If circumstances require an ALLIANCE to play in back-to-back MATCHES during the Playoff MATCHES, the Head REFEREE will issue a FIELD TIMEOUT to allow teams to prepare for the next MATCH. FIELD TIMEOUTS are the same time duration as TIMEOUTS.

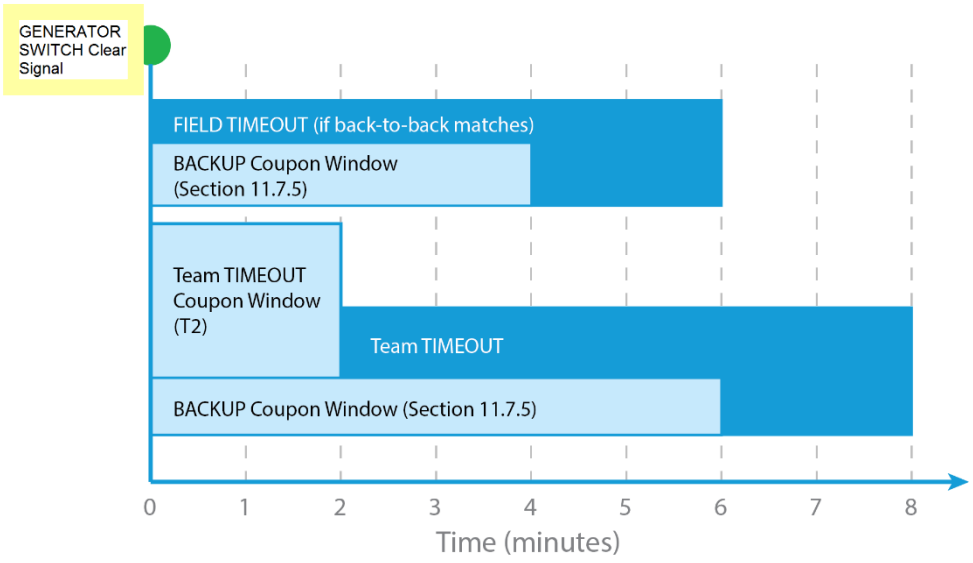


Figure 11-4 TIMEOUT Timeline

Each ALLIANCE in the Playoff tournament is issued (1) TIMEOUT.

Teams are expected to have their ROBOTS staged on the FIELD by the end of the TIMEOUT. Teams that cause a delay to the start of a MATCH after a TIMEOUT are at risk of being in violation of C7.

T1. If an ALLIANCE wishes to use their TIMEOUT, the ALLIANCE CAPTAIN must submit their TIMEOUT coupon to the Head REFEREE within two (2) minutes of the ~~ARENA reset~~ GENERATOR SWITCH Clear signal preceding their MATCH. If there is no preceding MATCH, the TIMEOUT coupon must be submitted no later than two (2) minutes before the scheduled MATCH time. The TIMEOUT will begin two (2) minutes after the ~~ARENA reset~~ GENERATOR SWITCH Clear signal (i.e. at the end of the Team TIMEOUT Coupon Window depicted in Figure 11-4.)

A request presented outside the defined parameters in T2 will be denied.

There are no cascading TIMEOUTS. If an ALLIANCE calls a TIMEOUT during a FIELD TIMEOUT, the FIELD TIMEOUT will expire two (2) minutes after the ~~ARENA reset~~ GENERATOR SWITCH Clear signal and the ALLIANCE'S TIMEOUT will begin.

If an ALLIANCE wishes to call a TIMEOUT during a FIELD TIMEOUT, it must still do so within two (2) minutes of the ~~ARENA reset~~ GENERATOR SWITCH Clear signal preceding their MATCH, per T2.

TIMEOUTS are not transferrable between ALLIANCES, meaning an ALLIANCE cannot hand their designated TIMEOUT coupon to another ALLIANCE to use, however an ALLIANCE may use their own coupon for any purpose they wish.

If a Playoff MATCH is replayed because of an ARENA FAULT which rendered a ROBOT inoperable, the Head REFEREE has the option of calling a FIELD TIMEOUT.

11.7.5 BACKUP TEAMS

Alternatively, an ALLIANCE CAPTAIN may choose to call up a BACKUP TEAM without using their TIMEOUT by informing the Head REFEREE directly within two (2) minutes of the Head REFEREE issuing the ~~ARENA reset~~ GENERATOR SWITCH Clear signal preceding their MATCH. If there is no preceding MATCH, the BACKUP TEAM coupon must be submitted no later than two (2) minutes before the scheduled MATCH time.

Team Update 15

GENERAL

No changes.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

Section 7.2.3

G9, Blue Box

> For the purposes of G9, "travel" means "to ~~cause movement~~ move through the air, bounce across the floor, or roll." A POWER CELL is no longer "travelling" once it stops, contacts an opponent ROBOT, or is CONTROLLED by a ROBOT on their ALLIANCE. The cause (i.e. responsibility for) a POWER CELL "travelling" may transfer from ROBOT to ROBOT as assessed by the REFEREE.

Section 8.1.1

H10, Blue Box

> 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.
>
> As G4 prohibits using the rack during AUTO, an ALLIANCE that removes POWER CELLS from the CORRAL during AUTO and waits to place them on the rack until the start of TELEOP is making a "concerted good-will effort."
>
> Teams are encouraged to make it clear to REFEREES that H10 is not violated.

Section 9.5

R24.

E. optionally use metal angle, as shown in Figure 9-6 or other fasteners (e.g. staples, screws, adhesives, etc.) to clamp cloth.

F. optionally use metal brackets (i.e. angle or sheet metal) or other fasteners (e.g. staples, screws, adhesives, etc.) to attach BUMPER segments to each other (see Figure 9-5).

Section 10

I6, Blue Box

The optional BOM Template referenced in the Blue Box under I6 has been updated for the 2020 season.

Team Update 16

GENERAL

- **POWER CELLS:**
  - At some events, we are seeing significant damage to POWER CELLS. While every event is allotted spares for replacement, we have concerns that some events may struggle to keep up with demand. We are addressing this in a few ways. First, we have ordered more game pieces so we can have more replacements available overall. Also, we are providing events a visual reference to use in understanding when game pieces should be replaced and when they can be played. Finally, we are providing instructions for repairing game pieces at events using commonly available adhesives. The adhesive is used only internally to the game piece and will not modify surface characteristics. You can find the information we are providing events here.
    Teams can help in this effort. Please remedy any sharp corners or other characteristics of your robot that may be causing damage to game pieces. Think of the game pieces as a shared resource that your team borrows while your match is being played. Minimizing damage to game pieces is a friendly thing to do for the next teams coming up, and for yourself later in the event!
- **Drawing Updates:**
  - The Field Drawings – Season Specific drawing package has been updated with the following change:
    - GE-20336 has been updated to allow manual unjamming of the Inner Port.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

7.2.3 Zone Specific Restrictions

G15-A. During the ENDGAME, don't mess with the opponent's GENERATOR SWITCH. During the ENDGAME, a ROBOT may not contact, either directly or transitively through a POWER CELL, the opponent's GENERATOR SWITCH.

> *Violation: Any opponents ROBOTS contacting their GENERATOR SWITCH when the violation occurred, and any partners its supporting, will be considered HANGING, and the opponent's GENERATOR SWITCH will be considered LEVEL.*

Team Update 17

GENERAL

No changes.

EVENT MANUAL

No changes.

GAME AND SEASON MANUAL

4.4.4 GENERATOR SWITCH Scoring

ALLIANCES use their GENERATOR SWITCH to earn MATCH Points and make the SHIELD GENERATOR OPERATIONAL.

A ROBOT is considered PARKED if, ~~at the conclusion of the MATCH~~ five (5) seconds after the ARENA timer displays zero (0) following TELEOP, it is fully supported (either directly or transitively) by the SHIELD GENERATOR and not in contact with any carpet outside its ALLIANCE'S RENDEZVOUS POINT, but without having met the criteria for HANGING.

A ROBOT is considered HANGING if, five (5) seconds after the ARENA timer displays zero (0) following TELEOP, it is fully supported (either directly or transitively) by its GENERATOR SWITCH.

A GENERATOR SWITCH is considered LEVEL if, five (5) seconds after the ARENA timer displays zero (0) following TELEOP, both following criteria are met:

A. it is in the LEVEL range, and

B. all ALLIANCE ROBOTS contacting the GENERATOR SWITCH are HANGING.

The final assessment of a LEVEL GENERATOR SWITCH and HANGING or PARKED ROBOTS is made five (5) seconds after the ARENA timer displays zero (0) following TELEOP, at which point the Audience Display stops updating and the lights on the SHIELD GENERATOR flash three (3) times.

The SHIELD GENERATOR is considered to be OPERATIONAL when the ALLIANCE'S ENDGAME SCORE is ≥ 65 points.

7.2.5 ROBOT to ROBOT Interaction

G21. There's a 5-count on pins. ROBOTS may not PIN an opponent's ROBOT for more than five (5) seconds. A ROBOT is PINNING if it is preventing the movement of an opponent ROBOT by contact, either direct or transitive (such as against a FIELD element). A ROBOT is considered PINNED until the ROBOTS have separated by at least six feet from each other or either ROBOT has moved six feet from where the PIN initiated, whichever comes first. The PINNING ROBOT(S) must then wait for at least three (3) seconds before attempting to PIN the same ROBOT again.

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

G24. Stay out of other ROBOTS. A ROBOT with a COMPONENT(S) outside its FRAME PERIMETER, other than BUMPERS, may not initiate direct contact with an opponent ROBOT inside the vertical projection of its FRAME PERIMETER using that COMPONENT.

Violation: FOUL per contact.