2022 HIGH RISE

Presented By

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Section 1 - Introduction

1.1 Overview

OCCRA (Oakland County Competitive Robotics Association) is a county-wide association of students, teachers and volunteers providing opportunities in science, technology, engineering, and mathematics (STEM) disciplines for students in grades 6-12. Each year, school-based teams of students and mentors participate in a competitive robotics tournament, challenged to display their technical and collaboration skills through intense and fast-paced gameplay.

OCCRA is supported by the Oakland Schools Education Foundation (OSEF), whose support is made possible through the generosity and support of area businesses and individuals.

OCCRA's Mission

The Oakland County Competitive Robotics Association (OCCRA) shall organize and administer a high school competitive robotics league in Oakland County for the purpose of:

1. Generating enthusiasm for technical and academic disciplines such as design, engineering, science, mathematics, and technology through student-designed and student-built robots.
2. Providing a format for integrating and applying diverse scientific, technical, and other areas of study within the high school curriculum.
3. Providing recognition and encouragement for students who devote their energies to these technical, scientific, and other areas of study.
4. Promoting team and workplace skills, and good sportsmanship.
5. Raising awareness within high schools of the diverse technical career options available in our county and state.
6. Creating partnerships with corporations and the educational community that will enrich the high school experience for our students by providing greater access to individuals in scientific and technical careers.

1.2 OCCRA High Rise: A Primer

OCCRA High Rise is played on a *Field* which is a twenty-four (24) foot x thirty (30) foot carpeted area, surrounded by a metal pipe *Field Perimeter*. Each *Match* consists of two (2) *Alliances* - one "red" and one "blue" - which are each composed of two (2) *Drive Teams* with one (1) *Robot* each. A *Match* lasts one-hundred and twenty (120) seconds, during which *Drivers* control the *Robots*.

There is a central *High Rise Goal* structure located in the center of the Field.
The *High Rise Goal* contains four (4) scoring levels on each of it's six (6) faces.

There are also two (2) *Human Player Stations* and two (2) *Loading Zones* on each end of the *Field*. There are Sixty (60) *Balls* that can be *Scored* in different ways:

- *One-Point Goal Scored* when a *Ball* is scored in the *Alliance's Level 1 or Level 2 Goal Shelf ;* worth one (1) *Match Point* per *Ball*.

- *Two-Point Goal Scored* when a *Ball* is placed in the *Alliance's Level 3 or Level 4 Goal Shelf*; worth two (2) *Match Points* per *Ball*.

Robots may carry or control up to two (2) *Balls* at a time.

Attached to the central *Goal* are two (2) *Elevation Bars* extending to the sides of the Field Perimeter. Robots are allowed to attached to these *Elevation Bars* in the final thirty (30) seconds of each *Match*. Robots which are fully suspended from these bars, not touching the field carpet, will receive five (5) *Match Points* each

The *Alliance* that has more *Match Points* at the end of the *Match* is declared the winner, and receives a *Win Bonus* of ten (10) *Match Points* added to their *Match* score, or if both *Alliances* have the same amount of *Match Points*, a *Tie Bonus* of five (5) *Match Points* is added to both *Alliances'* scores. All *Match Points* are scored once the *Match* ends and all objects have come to rest.

For more details and specific gameplay rules, please see Section 2 - The Game.

For more information about OCCRA, visit the OCCRA Website, follow Oakland Schools on Twitter @OaklandSchools, or visit Oakland Schools Facebook page at Oakland Schools - Michigan.

Section 2 - The Game

2.1 Overview

This section describes the 2022 OCCRA game entitled *OCCRA High Rise*. It also lists the game definitions, scoring amounts, and game rules.

2.2 Game Description

Matches are played on a *Field* set up as illustrated in the figures and described throughout. Two *Alliances* - one “red” and one “blue” - composed of two (2) *Drive Teams* and *Robots* each, compete in each *Match*. The object of the game is to attain more *Match Points* than the opposing *Alliance* by scoring *Balls* in various ways, and by *Elevating Robots* at the end of the *Match*.

A *Win Bonus* is awarded to the *Alliance* that has the most *Match Points* at the end of the *Match*, or a *Tie Bonus* is awarded to both *Alliances* if the *Match Points* are tied.

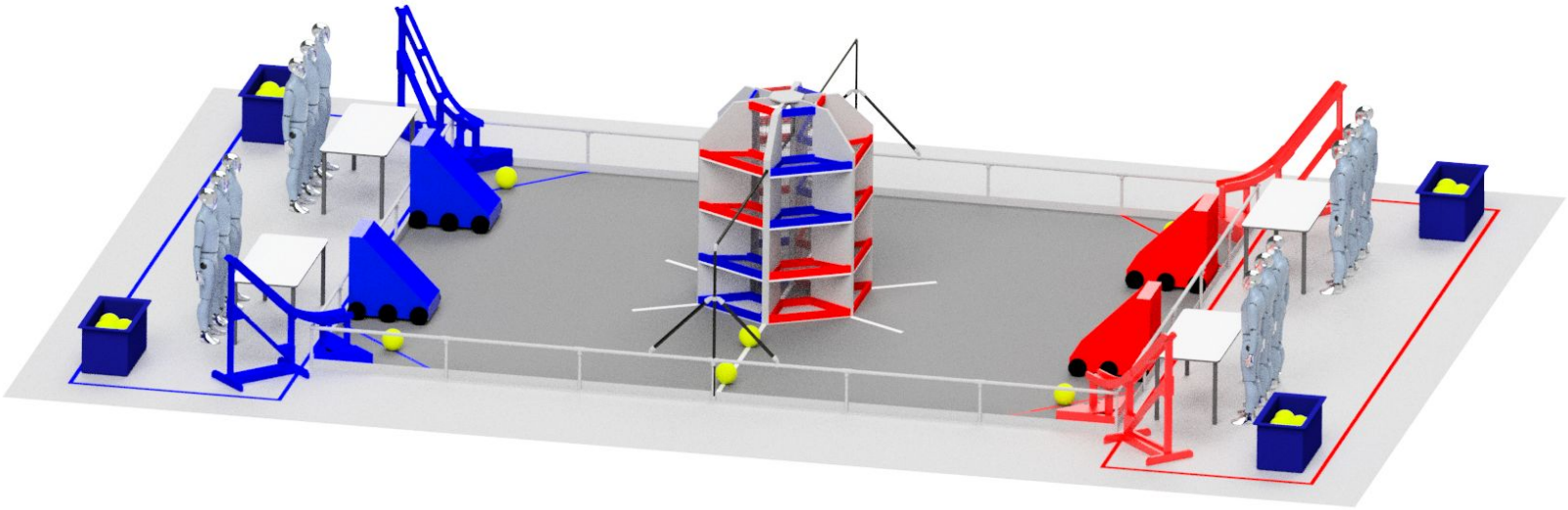


Figure 1: *Iso view of the Field in its initial setup configuration.*

Note: The illustrations in this section of the manual are intended to provide a general visual understanding of the game. Teams should refer to official field specifications, found in Appendix A, for exact field dimensions, and details of field construction.

Each *OCCRA High Rise Match* includes the following:

- One (1) *High Rise Goal Structure* - Consisting of six (6) *Goal Sections*,
  - *The High Rise Goal Structure is* located at the center of the *Field*. Each Goal Section contains four (4) scoring Levels, designated red or blue to correspond to the *Alliance which owns each Level in each Section*.
- Two (2) *Elevation Bars*
  - *Elevation Bars* located above the *Center Line* on each side of the *Field*.
- Two (2) *Alliance Station Zones* and four (4) *Driver Stations*
  - One (1) *Alliance Station Zone* located at either end of the *Field* designated red or blue.
  - Two (2) *Driver Stations* located at each end of the *Field* designated red or blue to correspond with the *Alliance Station Zone* it is within.
- Four (4) *Human Player Stations* and four (4) *Loading Zones*
  - One (1) *Human Player Station* located in each corner of the *Field* designated red or blue to correspond to the *Alliance Station Zone* on the same end of the *Field*.
  - One (1) *Loading Zone* located in each corner of the *Field* designated red or blue to correspond to the nearest *Human Player Station*.
- Sixty (60) *Balls* -
  - Four(4) Balls that start on the carpet along the *Center Line* on the *Field*
  - Four(4) *Balls, one each located centered on each Loading Zone line.*
  - Twelve (12) *Balls* that start in each *Human Player Station*. A Large Plastic Bin contains these balls at the beginning of the match
  - One (1) *Ball* that is available for each *Robot* to have as a preload at the beginning of the *Match*. If not used as a preload, then the *Ball shall be placed on the field, touching the Robot. If a Robot does not take the field, then the preload ball shall be removed from play.*
- One (1) *Center Line*
  - Marked with white tape located along the center of the *Field* under both *Crossbars* and across the *Ramp,* with crosshair markings designating the starting location of *Ball* on the *Field*.

Figure 2: *Front view of the Field in its initial setup configuration.*

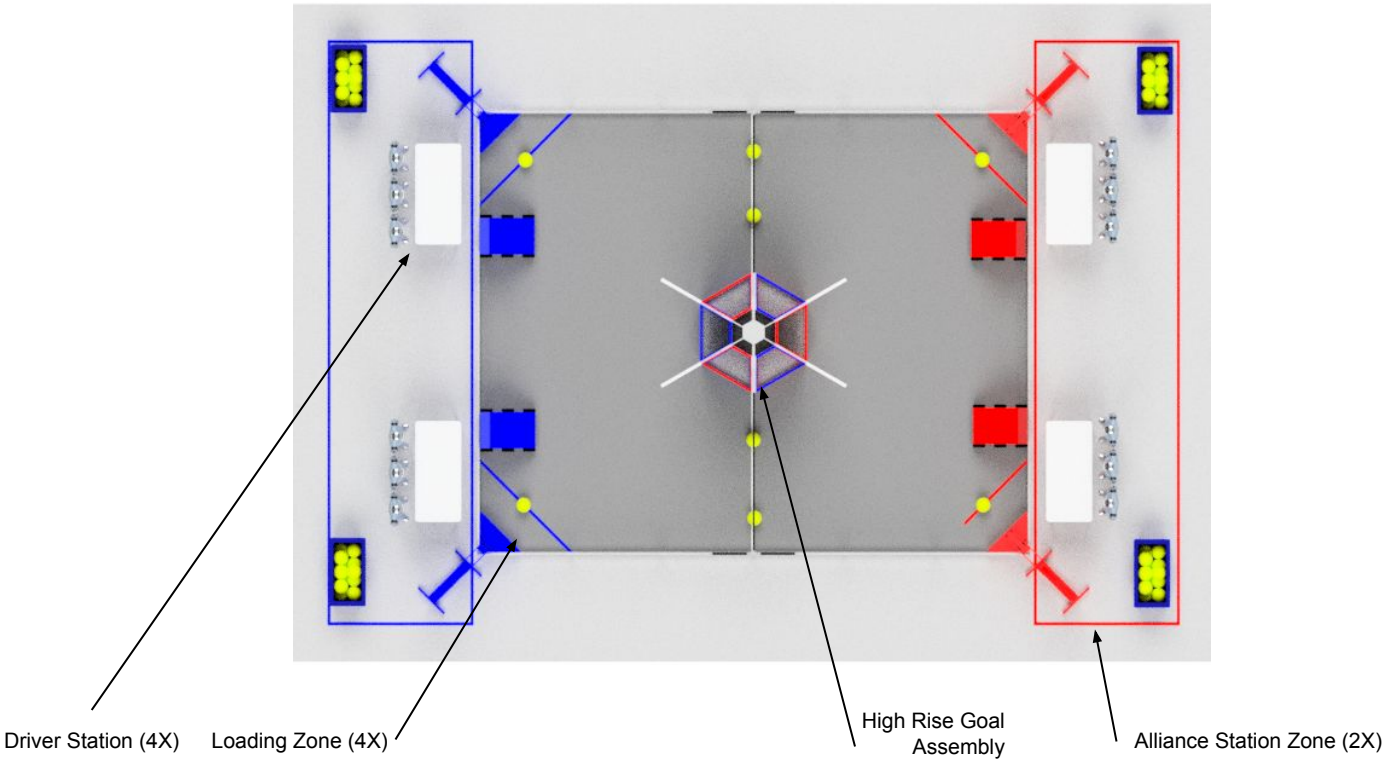


Figure 3: *Top view of the Field in its initial setup configuration; annotated Balls, Goals, Human Player Stations, Driver Stations*

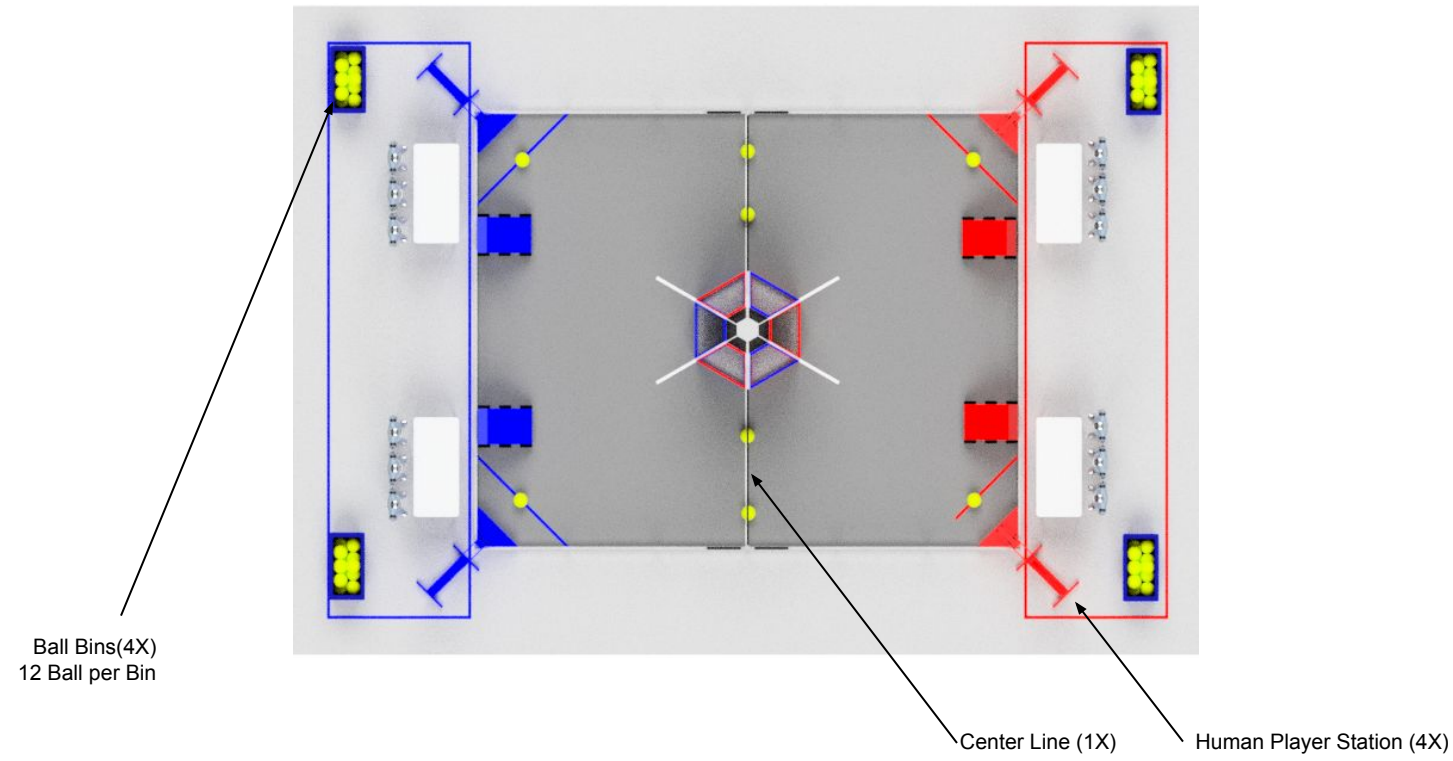


Figure 4: *Top view of the Field in its initial setup configuration; annotated Zones and Lines*

2.3 Game Definitions

Alliance - A pre-assigned grouping of two *Teams* that are paired together during a given *Match*.

Alliance Station Zone - A zone marked with red or blue tape. Each zone is located at either end of the *Field*, and all *Drive Team* members of the corresponding *Alliance* must remain in this zone during the *Match*.

Ball - An 9.5" inflated yellow ball resembling a tennis ball, weighing approximately 9.5 ounces (0.6 pounds) . Balls available at: https://www.amazon.com/gp/product/B0187IGRB2/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1 Also note that these balls are dimensionally identical to "Cargo" balls used in the 2022 FRC *Rapid React Game*



Figure 5: *Iso view of a Ball*

Bypassed - A *Robot* that is unable or ineligible to compete in a *Match* as determined by the *Head Referee* and *Field Technical Advisor* resulting in a *Robot* being *Disabled*.

Center Line - A line marked with white tape. This line spans the width of the *Field* centered along the length of the *Field*. There are crosshair marks along the *Center Line* to designate where *Balls* start on the *Field*.

Coach - A *Student* that is on the *Drive Team* and coaches the *Drivers* for their *Team*.

Disablement - A penalty that may be applied to a *Team* if either the *Drive Team* or *Robot* associated with the *Drive Team* is acting in an unsafe or egregious manner. A *Referee* or *Field Technical Advisor* may ask a *Drive Team* to disable their *Robot* in certain cases.

Disqualification - A penalty applied to a *Team* after a *Match* for certain rule violations. A team that is *Disqualified* in a *Qualifying Match* receives zero (0) *Match Points*. When a *Team* is *Disqualified* in an *Elimination Match*, the entire *Alliance* is *Disqualified* and receives a loss for the *Match*. At the *Head Referee's* discretion, repeated violations and *Disqualifications* for a *Team* may lead to its *Disqualification* for the entire event.

Drive Team - A group of *Students* from a single *Team* that participate in a *Match*. A *Drive Team* consists of up to two (2) *Drivers*, a *Coach*, and a *Human Player*.

Driver - Up to two (2) *Students* that are part of the *Drive Team* and control the *Robot* for their *Team*. Only the *Drivers* may control their *Robot*.

Driver Station - A table for *Drivers* from a single *Team* to operate their *Robot* from.

Elevated - A Robot Status, indicating that a robot is fully supported by an *Elevation Bar*, and is not touching the field carpet. Robots must remain not touching the field carpet and fully supported by an *Elevation Bar* for 5 seconds or more after the *Match* ends to be awarded the *Elevation Bonus*.

Elevation Bars - Two (2) Steel Bars which are located above the centerline of the field, at an elevation of 72" above the carpet surface, bridging between the High Rise Goal and the field perimeter.

Entanglement - A *Robot* status. A *Robot* is entangled if it has gripped, hooked, or attached to an opposing *Robot* or a *Field Element*, at the *Head Referee*'s discretion.

Field - A twenty-four (24) foot wide x thirty (30) foot long carpeted area surrounded by a *Field Perimeter*.

Field Element - The carpet, *Field Perimeter*, *Zones*, *Goals, Human Player Station,* and all supporting structures.

Field Fault - An error in *Field* operation that causes a *Match* to be disrupted enough that the outcome of the *Match* is effected, as determined by the *Head Referee*.

Field Perimeter - A roughly twenty inch (~20") tall structure constructed of metal pipes that surround the *Field*.

Field Technical Advisors - Event staff that assist *Teams* in getting *Robots* ready to play a *Match* on the *Field*. They can, along with the *Head Referee*, decide to *Bypass* and *Disable Robots* in a *Match* depending on circumstances.

Foul - A penalty assessed by a *Referee* upon a rule violation that calls for it. Each *Foul* results in three (3) *Match Points* awarded to the opposing *Alliance*, and repeated *Fouls* could result in *Disablement* or *Disqualification* as decided by the *Head Referee*.

Head Referee - The leader of the *Referees* who officiates each *Match*. The *Head Referee* makes any and all final decisions on *Match* play.

Hoarding - A *Robot* status. A *Robot* is *Hoarding* if it is actively blocking opposing *Robot* access to two (2) or more *Balls*.

Human Player - A *Student* that is part of the *Drive Team* and loads *Balls* into the *Field* from the *Human Player Station*. *Human Players* are the only ones on the *Drive Team* allowed to handle *Balls*.

Human Player Station - A structure designed to allow *Human Players* to either load a *Ball* into one of the *Robots* on their *Alliance*, or to roll a *Ball* into the *Field*. Only *Human Players* may operate a *Human Player Station*. The *Human Player* must release *Balls* at the top of the structure such that they gain speed as they roll off the *Human Player Station*. The height of the front of the *Human Player Station* is approximately twenty-three and a half (23.5) inches above the carpet.



Note: This is a minor adaptation of 2021 HPS design

Figure 8: *Iso view of a Red Alliance Human Player Station*

Loading Zone - Any of the four (4) zones in the corners of the Field marked with either red or blue tape. These zones are 24 inches deep as measured from the front face of the Human Player Station, extending to the field perimeter and is a diagonal line across the corner.

Match - A *Match* consists of one hundred and twenty (120) seconds of driver-controlled time. There is no autonomous mode in *OCCRA High Rise*.

Match Points - Any points that an *Alliance* earns by *Scoring* and gaining a *Win* or *Tie Bonus* during a *Match*.

Match Point Total - The total amount of *Match Points* a *Team* has gained out of its twelve (12) highest scoring *Qualifying Matches*.

Placebo - A basic *Robot* supplied by the event that a *Team* can elect to use and drive in place of their own *Robot* during a *Match*. If at least one *Team* from each *Alliance* in a *Match* requests to use the *Placebo*, then neither *Team* is allowed to use it.

Possession - A *Robot* has *Possession* of a *Ball* if it is carrying, holding, or surrounding it. A *Robot* must be surrounding the *Ball* on more than two (2) contact points to be considered as possession.

Referee - Event staff in charge of officiating *Match* play.

Referee Flag - A stick with a red flag on one end and a blue flag on the other. *Referees* will use this to announce *Fouls* being called during a *Match*, with the red side displayed to announce a *Foul* committed by the red *Alliance*, and the blue side for the blue *Alliance*.

Robot - Any machine which has passed inspection that a *Team* places on the *Field* prior to the start of a *Match*.

Scored - One of two *Ball* statuses, or a *Robot* status. Check section 2.4 for more details about when game objects are considered *Scored*.

> ***One-Point Goal Scored*** - a *Ball* status. A *Ball* is *One-Point Scored* when the *Ball* is fully supported by a *Level 1* or *Level 2 Goal Shelf,* and remains within the *High Rise Goal*. *Match Points* for a *One-Point Scored Ball* are awarded to the *Alliance* color that the *Shelf* corresponds with. If a *Ball* is placed on or in a shelf, but bounces back through the opening not remaining supported by the *Shelf* at the end of the *Match* then the *Ball* will not count as *Scored*.
>
> ***Two-Point Goal Scored*** - a *Ball* status. A *Ball* is *Two-Point Scored* when the *Ball* is fully supported by a *Level 3* or *Level 4 Goal Shelf,* and remains within the *High Rise Goal*. *Match Points* for a Two-*Point Scored Ball* are awarded to the *Alliance* color that the *Shelf* corresponds with. If a *Ball* is placed on or in a shelf, but bounces back through the opening not remaining supported by the *Shelf* at the end of the *Match* then the *Ball* will not count as *Scored*.
>
> ***Elevation Scored*** - a *Robot* status. A *Robot* is *Elevation Scored* when the *Robot* is fully supported by Elevation Bar, and is not touching the carpet, and is not touching any same color *Alliance* robot which not also *Elevated*.

Starting Configuration - The twenty-eight inch (28”) width by thirty-eight inch (38”) length by forty-eight inch (48”) height size limitation that a *Robot* must fit within at the beginning of a *Match* to be eligible to play.

Starting Position - Where *Robots* must be placed to start a *Match*. All *Robots* must start touching the *Field Perimeter* in front of the *Drivers Stations* of their own *Alliance Color a*nd must be outside of the *Loading Zones*.

Student - Anyone enrolled in a pre-college school or who is home-schooled as part of a pre-college educational curriculum located in Oakland County, Michigan. Eligibility may also be granted based on a disability, or other merits, and final decision of eligibility for all students will be decided by the OCCRA administrators.

Team - One or more *Students* make up a *Team*. *Teams* are associated with different high schools in Oakland County, Michigan.

Tie Bonus - The five (5) *Match Point* bonus added to the *Match* score of the Alliances in a *Match* that has ended with both *Alliances* having the same amount of *Match Points* when the *Match* ends. No Tie Bonus will be awarded in a match which ends in a 0-0 tie.

Trapping - A *Robot* status. A *Robot* is *Trapping* if it has restricted an opposing *Robot* into a small confined area of the *Field (limited mobility, limited access to Balls or Field Elements)*, or up against a *Field Element*, and has not provided an avenue for escape. *Trapping* can be direct (e.g. pinning an opposing *Robot* to a *Field Perimeter* wall) or indirect (e.g. preventing a *Robot* from escaping a corner of the *Field*.

Win Bonus - The ten (10) *Match Point* bonus added to the *Match* score of the *Alliance* in a *Match* that has more *Match Points* than the opponent when the *Match* ends.

2.4 Game Scoring

Match Action	Match Point Value
Level 1 or Level 2 Scored	1
Level 3 or Level 4 Scored	2
Robot Elevated	5
Foul	3 (Added to opponent's score)
Win Bonus	10
Tie Bonus	5

Figure 10: *Scoring matrix*

A *Ball* can only count as one (1) of two (2) *Scoring* statuses, either *Low Goal Scored* or *High Goal Scored*.

An *Alliance* can only earn either a *Win Bonus* or a *Tie Bonus* but not both in the same *Match*.

Balls and *Robots* are *Scored* once the *Match* is over and all objects have come to rest.

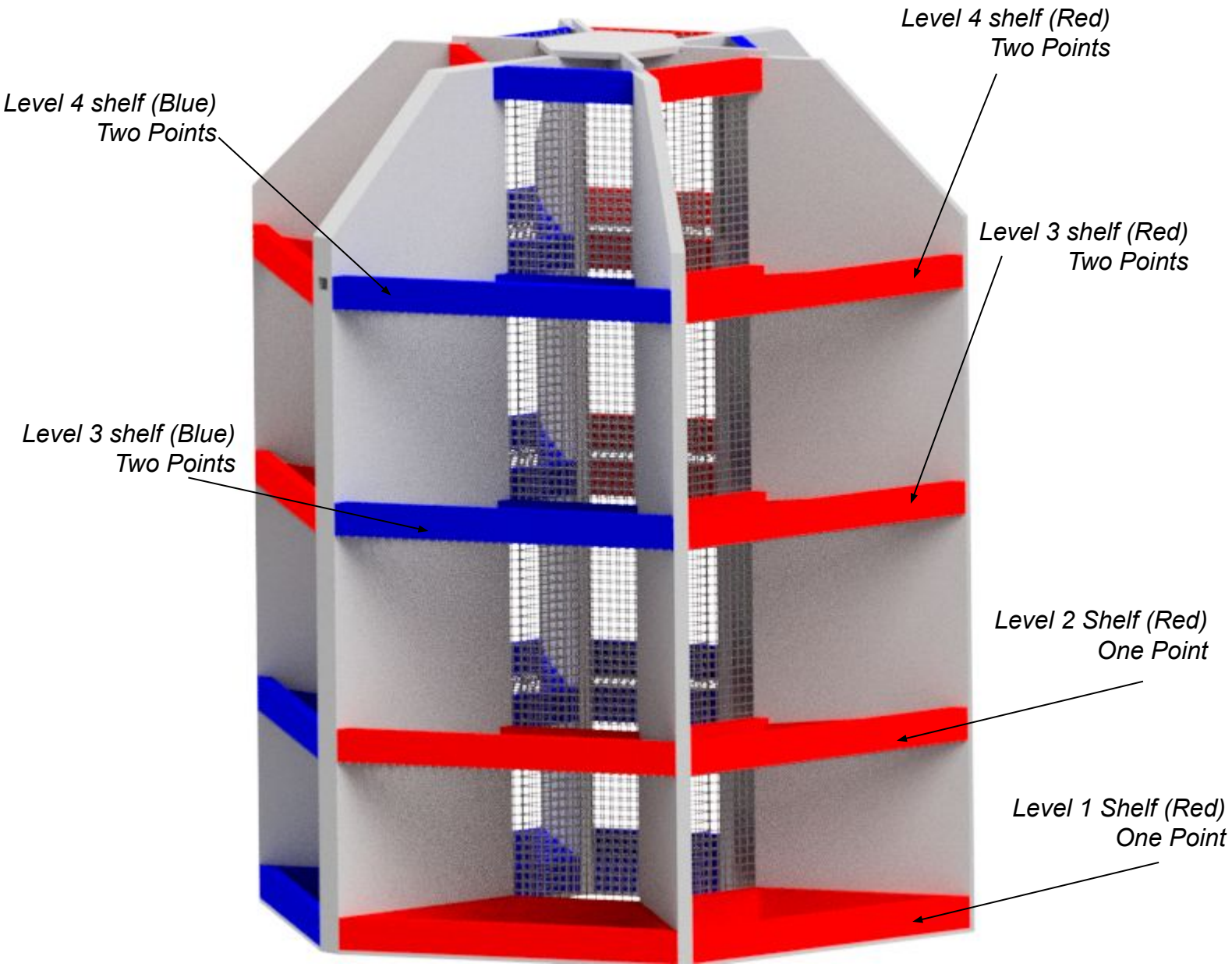


Figure 11: *Iso view of Red Alliance Goal, annotated to show Shelf designations*

2.5 General Game Rules

<G1> **Treat everyone with respect.** All *Teams* are expected to conduct themselves in a respectful manner while competing in OCCRA Competition events. If a *Team* or any of its members (*Students* or adults associated with the team) are disrespectful to event staff, volunteers, or fellow competitors, they may be *Disqualified* from a current or upcoming *Match. Team* conduct pertaining to <G1> may also impact a team's eligibility for judged awards. Repeated or extreme violations of <G1> may result in a *Team* being *Disqualified* from an entire event, depending on the severity of the situation, at the discretion of the *Head Referee* and other event staff.

Robotics competitions often induce intense, high stress situations. These are good opportunities to model and/or gain experience in handling these situations in a positive and productive manner. It is important that we all exhibit maturity and class when dealing with any difficult situations that may present themselves in both the OCCRA competition and our lives in general.

<G2> **Use common sense.** When reading and applying the various rules in this document during *Match* play and at events, please remember that common sense always applies in the OCCRA competition, and any and all rule decisions made by the *Head Referee* and the Game Design Committee are final.

<G3> **Robots begin the Match in the Starting Configuration.** At the beginning of a *Match*, each *Robot* must be smaller than a volume of twenty-eight inches (28") wide by thirty-eight inches (38") long by forty-eight inches (48") tall. Using *Field Elements*, such as the *Field Perimeter* wall, to maintain starting size is only acceptable if the *Robot* would still satisfy the constraints of <R4> and pass inspection without the *Field Element*. *Robots* in violation of this limit will be removed from the *Field* or *Disabled* prior to the start of the *Match*, at the *Head Referee* and *Field Technical Advisor's* discretion.

<G4> **Keep your Robots together.** *Robots* may not intentionally detach parts during the *Match* or leave mechanism(s) on the *Field*.

Minor violations of this rule that do not affect the *Match* will result in a warning. Violations that affect the outcome of the *Match* will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion. Multiple intentional infractions may result in *Disqualification* for the entire competition.

***<G5>* The Red Alliance robots set last. In Qualification *Matches and* in *Elimination Matches*, the *Red Alliance* may place or rearrange its *Robots' Starting Positions* on the *Field* after the *Blue Alliance* has completed placement.**

A. *Robots* must be placed on the *Field* promptly. Repeated failure to do so could result in a violation of <G1>. The exact definition of the term "promptly" is at the discretion of the *Head Referee* and the event coordinator, who will consider event schedule, previous warnings or delays, etc.

***<G6>* Operate your own Robot.** Each *Team* shall include up to four (4) *Drive Team* members. No *Drive Team* member may fulfill this role for more than one *Team*. Only the two (2) designated *Drivers* on a *Drive Team* may control the *Robot*; the *Coach* and *Human Player* may not operate the *Robot*.

A. Exceptions may be made in situations where a *Team* does not have enough available *Students* to have a complete *Drive Team*; for example, if a team does have three *Students* present at an event to fill all the needed roles of the Drive Team, they may request to have a *Student* from a different *Team* fill in to complete their *Drive Team*. These exceptions will be allowed at the discretion of the *Head Referee*.

***<G7>* Only Drive Team members in and around the Field.** During a *Match*, all *Drive Team* members other than the *Human Player* must remain in their *Alliance's Driver Station Zone*, and are the only members of a *Team* allowed in the *Field* area. *Drive Team* members are not allowed to use any sort of communication devices during their *Match*. Devices with communication features must not be visible, or have the features turned off (e.g. a phone in airplane mode). Violations of this rule could be considered a violation of <G1>.

***<G8>* Only Human Players interact with Balls and the Field.** The only member of a *Drive Team* that can handle *Balls* or interact with the *Field* in any way other than operating a *Team's Robot* is the *Human Player*, and all *Human Players* must remain within their *Alliance Station Zone*.

<G8-1> **No contact with Robots during the match.** Team members may not touch any robots on the field once the match has begun. Minor violations of these rules that do not affect the *Match* will result in a warning. Violations that affect the outcome of the *Match* will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

Exception: A *Drive Team* member is allowed to ask a *Field Technical Advisor* to reach into the *Field* if the *Match* has started and their *Robot* has not moved at all. An FTA will assess the safety risk and may refuse the request. Touching the *Robot* in this case is permitted for only the following reasons:

- Turning the *Robot* power or Vex V5 Controller on or off.
- Plugging in a battery and/or other power-related devices.

<G9> **You can't force an opponent into a Foul.** Intentional strategies that cause an opponent to violate a rule are not permitted, and will not result in an infraction on the opposing *Alliance*.

Minor violations of this rule that do not affect the *Match* will result in a warning. Violations that affect the outcome of a *Match* will result in a *Disqualification*. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<G10> **Don't destroy other Robots; but be prepared for interaction.** Strategies aimed solely at the destruction, damage, tipping over, or entanglement of opposing *Robots* are not part of the ethos of the OCCRA competition and are not allowed. If the tipping, entanglement, or damage is ruled to be intentional or egregious, the offending *Team* may be *Disqualified* from that *Match*. Repeated offenses could result in *Disqualification* from the entirety of the competition.

A. *OCCRA High Rise* is intended to be an offensive game. *Teams* that partake in solely defensive or destructive strategies will not have the protections implied by <G10> (see <G11>). However, defensive play which does not involve destructive or illegal strategies is still within the spirit of this rule.

B. *OCCRA High Rise* is an interactive game. Some incidental tipping, entanglement, and damage may occur as a part of normal gameplay without violation. It will be up to the *Head Referee's* discretion whether the interaction was incidental or intentional.

<G11> **Offensive Robots get the benefit of the doubt.** In the case where *Referees* are forced to make a judgement call regarding a destructive interaction between a defensive and offensive *Robot*, or an interaction which results in a questionable rules violation, the *Referees* will err on the side of the offensive *Robot*.

<G12> **Let go of Balls after the Match.** *Robots* must be designed to permit easy removal of *Balls* from any mechanism without requiring the *Robot* to have power after a *Match*.

<G13> **"It ain't over 'till it's over."** All *Matches* will be scored after the *Match* ends, and once all *Balls* and *Robots* have come to rest. Robots must remain in an *Elevated* state for at least 5 seconds after the *Match* ends to receive an *Elevated* Score

<G14> **Be prepared for minor Field variance.** *Field Element* tolerances may vary from nominal by ±1.0". *Ball* tolerance and weights may vary from nominal by ±0.5" and ±0.25 lbs respectively. *Ball* placement at the beginning of the *Matches* may vary from nominal by ±6.0". *Teams* are encouraged to design their *Robots* accordingly. A *Team* may point out any *Field Element* or *Ball* that seems too much out of tolerance of its designated starting orientation to *Field staff*, and an attempt will be made to correct it; however a *Match* may be started without the issue resolved at the discretion of the *Head Referee*. Please make sure to check Appendix A for more specific nominal dimensions and tolerances.

<G15> **Replays are possible, but rare.** Replays are at the discretion of the *Head Referee*, and will only be issued in the most extreme circumstances.

<G16> **Using the Placebo.** If a *Team* is unable to *Field* a *Robot* for a *Match*, then their *Alliance* may request to use the *Placebo*. This *Robot* may be controlled by either *Team* on the *Alliance* for that *Match*. It is the responsibility of the *Alliance* requesting to use the *Placebo* to supply the *Robot* battery to use for the *Match*.

If there is at least one (1) *Team* from both *Alliances* in a given *Match* requesting to use the *Placebo*, then neither *Team* will be allowed to use it, and both *Alliances* must play with only one *Robot*.

The *Placebo* is supported and maintained by the OCCRA League, and event staff and volunteers from *Teams* at the event will attempt to keep the *Placebo* in good working condition. While event staff will do their best to keep the *Placebo* operational, no guarantees can be made on the condition or functionality of the *Placebo*. It is not intended to be above average at playing the game, just to have enough functionality to benefit the *Alliance* over not having a functional *Robot* at all.

<G17> **The Q&A system is an extension of the game manual.** All *Teams* must adhere to all OCCRA competition rules as written in this game manual. *Teams* have the opportunity to ask for official rule interpretations in the OCCRA Competition Q&A System. All responses in this system should be treated as official rulings from the OCCRA Game Design Committee (GDC), and they represent the correct and official interpretation of the OCCRA competition rules. The Q&A is the ONLY official source for rulings besides the game manual, and live rulings at events by the *Head Referee*.

The OCCRA Q&A system can be found at ChiefDelphi.

<G18> **The GDC reserves the right to make changes to the rules.** All rules in this manual are subject to change, as decided by the OCCRA Game Design Committee (GDC). We do not expect any major changes to take place, however if the GDC decides a change is needed, it will do so. Any strategies deemed not in the spirit of the game will be disallowed even if not expressly forbidden in the current rules, at the discretion of the *Head Referee*. Specific changes that could be considered would be the number of Balls that start either on the *Field* or in the *Human Player Zone*. Again, the GDC does not anticipate any changes will be needed.

Any changes made to the manual will be announced in Manual Updates emailed to *Teams* and posted on ChiefDelphi, and the game manual will be updated to reflect the change made. Any rule changes made will also be announced during *Drive Team* meetings at the beginning of every event.

2.6 Specific Game Rules

<SG1> **Starting a Match.** Prior to the start of each *Match*, each *Robot* must be placed such that it satisfies the following conditions:

1. Two (2) *Robots* per *Alliance* are placed such that they are contacting the *Field Perimeter* in front of their own *Alliance Stations*, and not in the *Loading Zones*.
2. Each robot may be preloaded with one *Ball* prior to the *Match.*

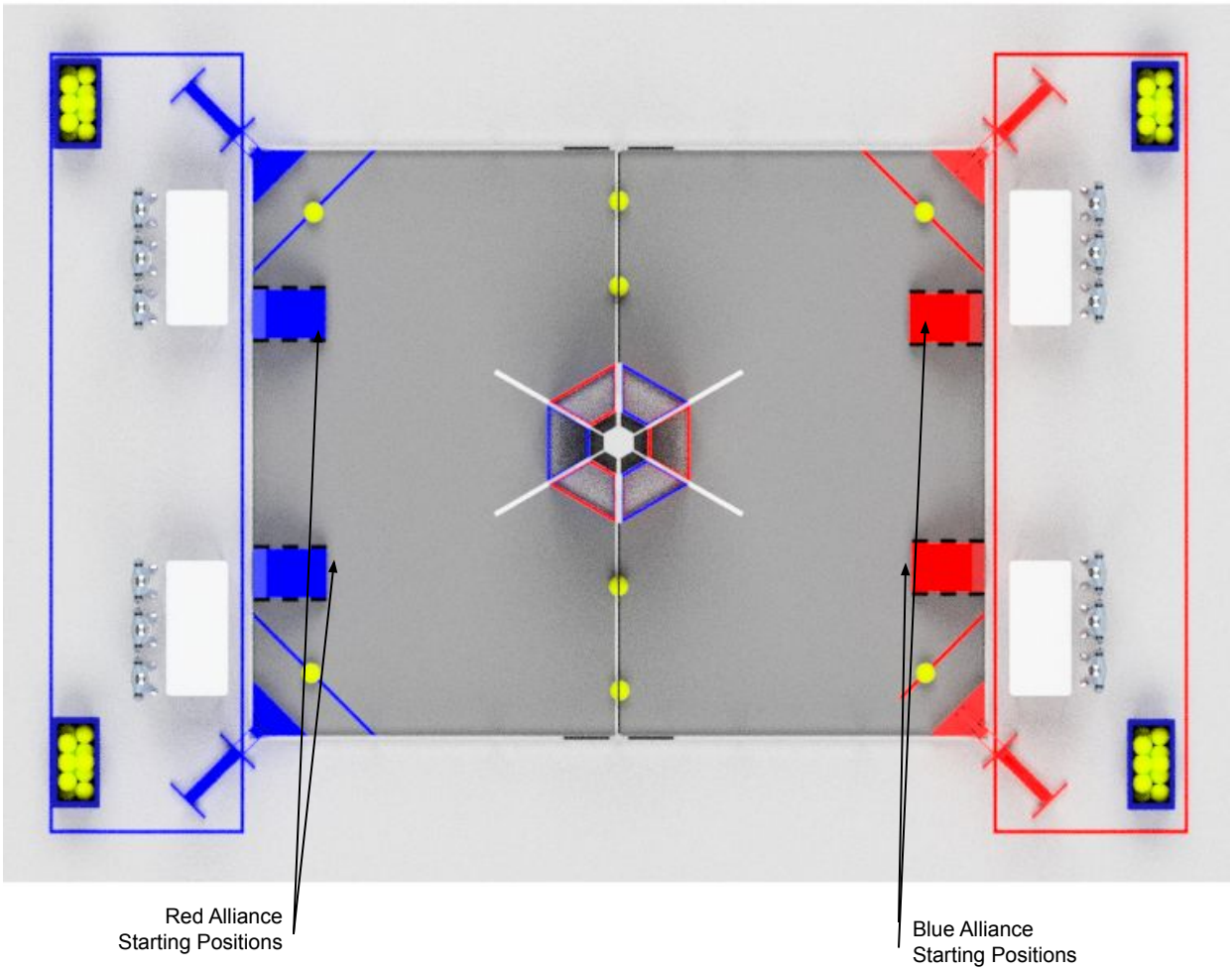


Figure 12: *Top view of the Field; annotated starting positions*

<SG2> **Robot extension is limited once the Match begins.** As per <G3>, at the beginning of a *Match, Robots* must be smaller than a volume of twenty-eight (28) inches wide by thirty-eight (38) inches tall by forty-eight (48) inches tall.

Once the *Match* begins, a *Robot* may extend horizontally up to twenty-two (22) inches past its initial *Starting Configuration* from any one side at time. Robots may not extend in multiple directions at once. Robots may not extend vertically above 92 inches (7.5 Feet) at any time.

Violation: FOUL per extension violation.

Minor accidental violations of this rule will only result in a verbal warning during a *Match*. Violations that affect the outcome of a *Match* of this rule will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

> Note: Due to these extension rules, *Robots* may be able to reach over or through the *Human Player Stations* or *Goals*, or outside the *Field Perimeter*. Any contact between *Robots* involving any extension per <SG2> will be scrutinized as detailed in <G10> and <G11>. *Robots* may not reach outside of the *Field Perimeter* in an egregious manner. Minor violations of this rule that do not affect or interfere with the *Match* will result in a warning. *Match* affecting offenses will result in a *Disqualification* at the *Head Referee's* discretion. *Teams* that receive multiple warnings may also receive a *Disqualification* at the *Head Referee's* discretion.

<SG3> **Do not touch the opponent's Goal or Goal Scored Balls.** *Robots* may not touch or interact with the opponent's *Goal* or any *Goal Scored Balls*.

Violation: FOUL per occurrence.

Minor accidental violations of this rule will only result in a verbal warning during a *Match*. Violations that affect the outcome of a *Match* will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

<SG4> **Watch your Possession limit.** *Robots* may only possess up to two *Balls* at a time.

Violation: **FOUL** per every extra *Ball Possessed* beyond the *Possession* limit related to the *Robot* in question.

> Note: If a *Robot* has an extra *Ball* past its *Possession* limit, and quickly makes an effort to remove the *Ball* from the *Robot*, the *Team* may not be penalized. This judgement will be at the discretion of the *Head Referee*. Repeated intentional violations of this rule could result in *Disqualification* from the *Match*.

<SG5> **Hoarding is prohibited.** *Robots* may not *Hoard* more than two (2) *Balls* at any given time during a *Match*. *Possessed Balls* do not count towards the *Hoarding* limit.

Violation: **FOUL** every five (5) seconds the *Hoarding* occurs.

> Note: The key phrase in the definition of *Hoarding* is “actively blocking opposing *Robot* access”. This means strategically positioning a *Robot* such that it is “defending” *Balls*, and actively preventing an opponent from accessing them.
>
> *Hoarding* is a very intentional and strategic maneuver. Most scenarios where a *Robot* interacts with multiple *Balls* in the corner of the *Field* would not be considered *Hoarding*. However, *Teams* should exercise caution in these situations, and *Referees* are encouraged to provide verbal warnings if a *Robot* is in danger of a violation before a *Foul* is called. Repeated violations of this rule could result in *Disqualification* from the *Match*.

<SG6> **Keep Balls to yourself and your Alliance partner.** *Robots* may not intentionally drop or place *Balls* on or in an opposing *Robot*.

Violation: **FOUL** per *Balls* dropped or placed on opposing *Robot*.

Violations that affect the outcome of a *Match* will result in a *Disqualification*. Repeated violations of this rule could also result in *Disqualification* from the *Match*.

<SG7> **No descoring Balls from the Field or Goal.** Though it is expected that some *Balls* may unintentionally leave the *Field* during *Match* play, *Teams* may not intentionally or strategically remove *Balls* from the *Field*, or from any *Goal Level*.

Violation: **FOUL** per *Ball* descored intentionally

> Note: *Balls* that leave the *Field* during *Match* play, accidentally or intentionally, will be returned onto the *Field* closest to where it exited.
>
> Teams should keep <G11> and <SG3> in mind when considering this rule as well.

Minor accidental violations of this rule will only result in a verbal warning during a *Match*. Violations that affect the outcome of a *Match* will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

<SG8> **Don't "clamp" your Robot to the Field.** *Robots* may not intentionally grasp, grapple, or attach to any *Field Elements with the exception of the horizontal Elevation Bars*. Strategies with mechanisms that react against multiple sides of a *Field Element* in an effort to latch or clamp onto said *Field Element* are prohibited. The intent of this rule is to prevent *Teams* from both unintentionally damaging the *Field* and/or anchoring themselves to the *Field*.

Violation: **FOUL** every five (5) seconds the "clamping" occurs.

Minor accidental violations of this rule will only result in a verbal warning during a *Match*. Violations that affect the outcome of a *Match* of this rule will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

<SG9> **Only load Balls onto the Human Player Station.** *Human Players* may only load *Balls* onto the *Human Player Station*. *Human Players* should not be breaking the vertical plane of the *Field Perimeter* when loading *Balls* onto the *Human Player Station*.

Violation: **FOUL** per *Ball* loaded.

Violations that affect the outcome of a *Match* will result in a *Disqualification*. Repeated violations of this rule could also result in *Disqualification* from the *Match*. *Human Players* will be given verbal warnings if they are being unsafe at all.

<SG10> **Human Players can only carry one Ball at a time.** Each *Human Player* may individually only carry one *Ball* at a time, and no other *Drive Team* members are permitted to touch any *Ball* at any time.

Violation: **FOUL** per extra *Ball* carried.

Minor accidental violations of this rule will only result in a verbal warning during a *Match*. Violations that affect the outcome of a *Match* will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

> Note: *Human Players* on the same *Alliance* are allowed to pass, hand-off, or toss *Balls* to one another in order to more quickly get a *Ball* to the *Human Player Station*, as long as it is done in a safe manner. There is no limitation on which *Human Player Station* either of the *Human Players* on an *Alliance* can go to introduce a *Ball* to the *Field*, as long as they stay in the *Alliance Station Zone*.

<SG11> **Only one defender at a time.** Only one (1) *Robot* on an *Alliance* can be actively playing defense at a time. Chokeholding gameplay strategies are not permitted.

Violation: **FOUL** per occurrence.

Violations that affect the outcome of a *Match* will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

<SG12> **No interfering with Elevations.** *Robots* who are contacting the *Elevation Bar i*n the final 30 seconds of the *Match shall not be contacted by Robots* of the opposing *Alliance*.

Violation: A **5 point Elevation Bonus** will be awarded

Minor accidental violations of this rule will only result in a verbal warning during a *Match*. Violations which appear intentional or which prevent opposing robots from elevating once the bar is contacted shall result in a “Free Elevation” for the offended robot(s).

<SG13> **Don't touch your opponent in their Loading Zones.** *Robots* may not contact opposing *Robots* while the opposing *Robot* is at least partially touching their *Loading Zones*.

Violation: **FOUL** per occurrence, and again every five (5) seconds the contact continues.

Minor accidental violations of this rule that occur when the opposing *Robot* is not attempting to load a *Ball* from either the *Human Player Station* or floor at least partially within the *Loading Zone* will only result in a verbal warning during a *Match*. Violations that affect the outcome of a *Match* will result in a *Disqualification*. Multiple violations of this rule could also result in a *Disqualification* from the *Match*.

<SG14> **Don't linger in your opponent's Loading Zones.** *Robots* may only be partially or fully within opposing Loading Zones for a maximum of five (5) seconds if they are being contacted by opposing *Robots*. If *Robots* are pushed into their opponent's zone by their opponent, they are still required to exit the zone within five (5) seconds, unless the opponent is *Trapping* the *Robot*, preventing them from exiting the zone.

Violation: **FOUL** after five (5) continuous seconds and additional **FOUL** every five (5) seconds thereafter.

A *Robot* that has shown to be non-functional will not be assessed **FOUL**s under this rule unless it is directly preventing the opponent from gaining reasonable access to their *Human Player Station*. If they become functional later in the *Match*, **FOUL**s could be assessed at the *Referee's* discretion. Violations that affect the outcome of a *Match* will result in a *Disqualification*. Repeated violations of this rule could also result in *Disqualification* from the *Match*.

<SG15> **No Trapping for more than five (5) seconds.** A *Robot* may not *Trap* an opposing *Robot* for more than five (5) seconds during a *Match*. A *Trap* is officially over once the *Trapping Robot* has moved away and the *Robots* are separated by at least six (6) feet. If a *Team* does *Trap* the same *Robot* again without backing up at least six (6) feet, the count will resume from where it left off when the *Trapping Robot* initially backed off.

Violation: **FOUL** per *Trap* count.

Violations that affect the outcome of a *Match* will result in a *Disqualification*. Repeated violations of this rule could also result in *Disqualification* from the *Match*.

<SG16> **The Field should be laid out according to the manual.** At the start of the *Match*, all *Balls* and *Field Elements* will be placed in their designated locations. See Appendix A for exact measurements and specifications. Any concerns regarding *Balls* or *Field Element* starting positions should be raised with the *Head Referee* prior to the *Match*; *Team* members should never adjust *Balls* or *Field Elements* themselves.

Section 3 - The Competition

3.1 Overview

This section describes the *Qualification Matches*, how qualification ranking works, the *Alliance Selection* process for eliminations, the elimination bracket, and variations of *Matches* at events. It also includes competition definitions and competition rules.

3.2 Competition Description

The *2022 OCCRA High Rise* season will consist of two (2) qualification events and a county championship. All *Teams* may participate in any or all of the two (2) qualification events. *Teams* will be scheduled for a set number of *Qualification Matches* at each of the qualification events. In 2022 teams will be able to play up to sixteen (16) qualification matches across the three (3) total events. Unlike most seasons, there will not be a Diversity Competition due to the shorter season. In *Qualification Matches*, *Teams* will be randomly paired with and against each other.

The *Team* with the highest *Match Point Total* at each individual qualification event will be awarded the event champion, with awards given for second and third place. Judged awards are also given at each qualification event; more information on these can be found in Appendix E. Regardless of how many total *Qualification Matches* a *Team* plays over all of the qualification events, the twelve (12) highest Match scores a *Team* has will be totaled and used to rank all participating *Teams* for the county championship.

"Based on these rankings, Teams will take turns selecting an Alliance partner for the elimination tournament. All Teams will participate in the tournament at the county championship. The structure of the elimination tournament is contingent on the number of teams participating in the league, and will be announced at a later date. The winning Alliance will be crowned the 2022 OCCRA High Rise Champions.

3.3 Competition Definitions

Alliance Captain - The highest ranked *Team* on an Alliance that invites an available *Team* to join their *Alliance*.

Alliance Flag - A device displayed on a *Robot* to display which *Alliance* (“red” or “blue”) it is assigned to in a given *Match*.

Alliance Selection - The process of choosing *Alliances* for the elimination *Matches*.

Alliance Selection Die - A foam cube decorated to resemble a standard six-sided die used to determine the number of seeded *Teams* excluded from selecting each other during *Alliance Selection*.

Elimination Match - A Match used in the process of determining the champion Alliance at the county championship. These Matches are played after the Alliance selections.

Inspection - The process that a *Team* goes through to determine their eligibility to compete at an event.

Qualification Match - A *Match* used to determine the qualification rankings.

Team Pit - A designated area supplied for each *Team* to maintain and store their *Robot* and supplies at an event.

Team Representative - A *Student* chosen to represent their *Team* during *Alliance Selection* for the *Elimination Matches*.

Tie - An *Alliance* ties a *Match* when it has earned the same amount of *Match Points* during *Match* play than its opponent. A *Tie* can result in a *Tie Bonus* being added to their *Match Points* for that *Match* in *Qualification Matches*.

Timeout - A three-hundred (300) second period of play stoppage that an elimination *Alliance* can call once during the *Elimination Matches*. A *Timeout* may also be called by event staff in the case where a *Team* or *Alliance* has to play back-to-back *Matches*.

Volunteer - An individual assisting or filling an event staff role. *Teams* must supply at least one (1) individual associated with their *Team* at each event they attend.

Win - An *Alliance* wins a *Match* when it has earned more *Match Points* during the *Match* than its opponent. A *Win* can result in a *Win Bonus* being added to their *Match Points* for that *Match* in *Qualification Matches*.

3.4 Qualification Matches

Schedule

- The *Qualification Match* schedule will be available prior to the opening ceremonies at the event, once all participating *Teams* have arrived. Due to late *Team* arrivals, this may be delayed closer to the start of *Matches* for the day. *Teams* should ensure they are not tardy, or they may risk being left off the *Match* schedule for that event.

  The schedule will indicate *Alliance* partner and *Match* pairings. It will also indicate the *Alliance* color - “red” or “blue”.

- The *Qualification Matches* will start immediately after opening ceremonies in accordance with the *Qualification Match* schedule.
- *Teams* will be randomly assigned an *Alliance* partner to compete with against two randomly assigned opponents in each *Qualification Match*.
- All *Teams* will be scored on the same number of *Qualification Matches*.
  - In some cases, a *Team* will be asked to play in an additional *Qualification Match*, but will not receive credit for playing this extra *Match*.

Scoring

- At the conclusion of each *Qualification Match*, *Match Points* will be issued. The amount of *Match Points* a *Team* will earn in a given *Qualification Match* will be equal to the total number of *Match Points* their *Alliance* earned in the *Match*, with an additional ten (10) *Match Points* added to the total if their *Alliance* won the *Match*, or an additional five (5) *Match Points* added to the total if their *Alliance* tied their opponent in the *Match*. In the event of a Zero (0) - Zero (0) point *Tie*, no *Win Bonus* will be awarded to either *Alliance*.
- For a *Qualification Match*, if the *Robot* or *Placebo* is not on the *Field* at the start of a *Match*, that *Team* will receive zero (0) *Match Points* for that *Match*.

3.5 Rankings

The rankings for *OCCRA High Rise* are cumulative over all of the *Qualification Matches* played at any events. A *Teams* rank will be determined based on the total of its twelve (12) highest *Match Point* totals from all of the *Qualification Matches* they played. If a *Team* has not played at least twelve (12) *Qualification Matches*, the scores of their participating *Matches* will be used and a score of zero (0) *Match Points* will be entered to create a complete set of scores for twelve (12) *Qualification Matches*. All *Qualification Matches* played are eligible towards a *Teams Match Point Average*, including those played at the county championship, but excluding any surrogate *Matches* they played at an individual event (a *Match* more than what most other *Teams* played at that single event)..

If two *Teams* are *Tied* with the same *Match Point Total*, then the following tiebreakers will applied one at a time until the *Tie* is broken:

1. The *Team* with the most *Matches Won* out of all *Qualification Matches*.
2. The *Team* with the most *Matches Won* in head-to-head *Qualification Matches* between the tied *Teams*.
3. The *Team* with the highest *Match Point Score* in a single *Qualification Match*.
4. The *Team* with the next highest *Match Point Score* in a single *Qualification Match* if the previous highest score was tied, etc.
5. If all the above *Match Point Totals* were tied, a coin flip executed by the *Head Referee*, with the highest numbered *Team* picking between heads and tails.

For the qualification events, first (1st), second (2nd), and third (3rd) place awards will be given to participating *Teams* based on the total number of *Match Points* accumulated in their equal number of *Qualification Matches* played at an event.

The above tiebreakers will be used for the rankings at an individual qualification event, with the total number of *Qualification Matches* equally played at the event being used as applied to tiebreaker one (1). If there is still a tie after tiebreaker four (4) is applied, then the *Teams* will tie for the respective award. Tiebreaker 5 will not be applied for the individual qualification event rankings.

3.6 Alliance Selection

Alliance Selection is the process of *Teams* selecting another *Team* they will play with for the *Elimination Matches*. This process directly follows the final *Qualification Matches* played at the county championship. *Teams* will take turns picking their *Alliances* in the order they ranked in based on their *Qualification Matches*.

The *Alliance Selection Die* will be thrown onto the *Field* by the *Head Referee*. The number of dots that land facing up on the Alliance Selection Die plus two (2) will designate the highest seeded Team that will be eligible to be picked during Alliance Selection.

For example, if the first *Alliance Selection Dice* has a two (2) land up, then the total would be four (4), meaning that the fourth (#4) seeded *Team* would be the first *Team* eligible to be selected. The third (#3) seeded team will be the highest the limit of eligible teams to be picked will be, and the ninth (#9) seeded *Team* will be the lowest the limit of eligible teams to be picked will be (6+2).

OCCRA has instituted this procedure as opposed to just setting a pick limit in the rankings to discourage *Teams* from losing *Matches* on purpose (in the hopes of getting a “better” partner in the *Alliance Selection* process). When *Teams* lose *Matches* intentionally, it hurts the ranking of their *Alliance* partner, makes the *Matches* less exciting for the audience, and runs contrary to the ethical standard that we strive to maintain in OCCRA. The randomness of the *Alliance Selection Die* roll is used by OCCRA to encourage fair play by all *Teams*.

When a *Team* is selected to join an *Alliance*, they can either accept the invitation and join the *Alliance*, or they can respectfully decline and choose to form their own *Alliance*. *Teams* may also decline if they would like to sit out *Eliminations* (for example if their *Robot* is broken, etc.) If there is only one *Team* left at the end of *Alliance Selection*, and they do not have another *Team* still available to join their *Alliance*, they may use the *Placebo* as their second *Robot*.

The elimination bracket can handle up to sixteen (16) *Alliances*, and therefore *Alliance Selection* will continue until no more eligible *Teams* are remaining to be picked, with the *Placebo* being used on the last alliance if it is an odd number of *Teams*.

During *Alliance Selection*, each *Team* must send one (1) *Team Representative* to speak on behalf of their *Team*. If a *Team* moves into a selecting position, then that *Team Representative* will become an *Alliance Captain*.

3.7 Elimination Matches and Scoring

At the county championship event, an elimination bracket will be used after *Alliance Selection* to determine the 2022 *OCCRA High Rise* Champions.

The structure of the elimination tournament is contingent on the number of teams participating in the OCCRA league in 2022.

The format for the 2022 OCCRA Elimination Tournament shall be announced in an update to all teams at a later date.

Regardless of the tournament format the following rules will apply:

Match scoring in *Elimination Matches* is the same as *Qualification Matches* except that no *Win Bonus* or *Tie Bonus* will be awarded or added to *Match* scores.

If an *Elimination Match* ends in a tie, the match will be replayed to determine a winner.

Section 4 - The Robot

4.1 Overview

This section describes the rules specific to *Robots* in *OCCRA High Rise* Any rules that may apply to the *Robots* specifically listed in any of the other sections still apply, whether they are listed here again or not.

4.2 Robot Rules

<R1> **What is a Robot?** Only one (1) *Robot* will be allowed to compete per *Team* in *OCCRA High Rise*. Though it is expected that *Teams* will make changes to their *Robot* at the competition, a *Team* is limited to only one (1) *Robot* at the competition. As such, a *Robot*, for the purposes of the *OCCRA High Rise* competition, has the following subsystems:

> Subsystem 1: Mobile *Robot* base including wheels, tracks, legs, or any other mechanism that allows the *Robot* to navigate the majority of the flat playing *Field* surface.
>
> Subsystem 2: Power and control system that includes the hardware outlined as part of the OCCRA Control Box, and the associated motors and actuators for the mobile *Robot* base.
>
> Subsystem 3: Additional mechanisms (and associated motors and actuators) that allow manipulation of *Balls* or navigation of *Field Elements*.

Given the above definitions, a minimum *Robot* for use in any *OCCRA High Rise* event must consist of Subsystems 1 and 2 above. Thus, if you are replacing an entire Subsystem of either Subsystem 1 or 2 from above, you have now created a second *Robot* and are no longer legal.

- *Teams* may not compete with one *Robot* while a second is being modified or assembled.
- *Teams* may not switch back and forth between multiple *Robots* during a competition. This includes using different *Robots* for *Qualification* and *Elimination Matches*.

- Multiple *Teams* may not use the same *Robot*. Once a *Robot* has competed under a given *Team* number at an event, it is "their" *Robot* - no other *Teams* may compete with it for the duration of the competition season.

  Note: *Teams* using the *Placebo* for a *Match* are excused from this rule. The *Placebo* may be used by a *Team* that already has its own *Robot* in the case that their *Robot* is not able to play a *Match*. The *Placebo* may be used by any and all *Robots* at any event; with the exception of in *Elimination Matches* unless they are the lowest seeded *Alliance* and there were an odd number of teams at the county championship.

<R2> **Robots must be pre-inspected.** All *Robots* must be pre-inspected using the *Robot* Pre-Inspection Worksheet (Appendix D) before coming to the official inspection at the first event of the season. An adult mentor and at least one *Student* must carry out this pre-inspection. This form is required to be submitted at the official check-in station (registration) at the first event the *Team* attends.

<R3> **Robots must be inspected.** Every *Robot* will be required to pass a full inspection before it is cleared to compete. This inspection will ensure that all *Robot* rules are met. Inspection will take place at the beginning of every event a *Team* attends. Inspection will be performed by event staff and follow the same worksheet as the *Robot* Pre-Inspection Worksheet.

- If significant changes are made to a *Robot*, such as partial or full replacement of Subsystem 3, it must be re-inspected before it will be allowed to compete.
- If a *Robot* has multiple functional configurations, all possible configurations must be inspected before being used in competition.
- *Teams* may be requested to submit to random spot-inspections by event personnel. Refusal to submit will result in *Disqualification*.
- *Referees* or event staff may decide that a *Robot* is in violation of the rules. If this occurs, the *Team* in violation will be *Disqualified* and the *Robot* will be barred from the *Field* until it passes re-inspection. Minor infractions may only result in a warning, at the discretion of the *Head Referee*.

<R4> **Certain mechanisms may not be allowed.** The following types of mechanisms and components are NOT allowed:

- Those that could potentially damage *Field Elements*.

- Those that could potentially damage other competing *Robots*.
- Those that pose an unnecessary risk of entanglement.

<R5> **Robots have starting and expansion size limits.** At the beginning of any *Match*, *Robots* must be smaller than twenty-eight inches (28”) wide by thirty-eight inches (38”) long by forty-eight inches (48”) tall.

- During inspections, *Robots* will be measured in one of two ways:
    1. *Robots* will be placed on top of a rectangle of tape, with the dimensions to the outer edges of the tape matching the length and width constraints.
    2. A tape measure or similar measuring device will be used to check the height, and possibly the length and width of the *Robot*.
- Any restraints used to maintain starting size (i.e. zip ties, rubber bands, etc.) MUST remain attached to the *Robot* for the duration of the *Match*.

Robots may expand beyond their starting size constraints after the start of a *Match*, in accordance with <SG2>; twenty-two inches (22”) outside the *Starting Configuration*. *Robots* may not expand vertically past the forty-eight inch (48”) tall starting limit.

<R6> **Robot components can be made before kickoff.** Components, whether it be parts or assemblies, can be used to compete with that were used in a previous OCCRA season, or from any offseason development or other robot competition, so long as the components used meet the requirements of all the other rules in this manual.

<R7> **Robots should be completely developed by Students.** *Robots* must be designed, built, and programmed by *Students*. Teachers, mentors, parents, etc. may answer questions, give instruction on practices, help build practice *Field Elements*, assist in tool and safety education, etc. but should not be involved in the design, build, programming, or development of the *Robots*.

> Note: This rule is enforced via the “honor system”, as there is no way for OCCRA to enforce this rule on *Teams* outside of events. We ask that all *Teams*, and specifically all teachers, mentors, parents, etc. use their best judgement as to whether they should do something or not. If there are any questions, the *OCCRA High Rise* Q&A can be utilized.

<R8> **Robots have a weight limitation.** *Robots* may not weigh more than one-hundred fifteen pounds (115lbs), including the battery and all decorations. *Robots* utilizing a pneumatic system with a compressor mounted on the *Robot* may weigh a maximum of one-hundred twenty pounds (120lbs). *Robots* that have a pneumatic system without a compressor mounted to the *Robot* are restricted to the 115 pound weight limit.

<R9> **Robot frames should be off the ground and not easily stuck.** *Robots* may not have any “wedge” shaped frame members on the edge of of the *Robot*, and may not have any frame members that could snag the carpet of the *Field*. This is a subjective rule that will be inspected on a case-by-case basis, so *Teams* should use their best judgement to ensure their frame will not easily wedge under other *Robots* or *Field Elements*, or snag or catch on the carpet.

<R10> **Robots have limitations on what parts can be used.** All parts on the *Robot* must come from one of three sources:

1. Parts that come supplied in the Kit of Parts (KoP).
2. Parts that have been fabricated from simple material stock using allowed tools.
3. Parts that are COTS and cost less than or equal to $100 as an individual part.
    - Any items that are ordered from a vendor as a “special-order” item, or in other terms is customizable to certain specifications is not allowed.
    - If a device or mechanism cannot be bought for less than $100, but the individual components that make up the device or mechanism can be bought for a total cost of less than $100 and then assembled by the *Team*, it is legal to use.
    - The AndyMark AM14U frame only kit is exempt from this rule and is legal to use as the robot drive chassis.
    - Any part that is not readily available to all *Teams* is not allowed.

<R11> **Robots and parts may only be made using certain tools.** Any custom fabricated parts by the *Team* must be made using approved tools and machinery. The list of approved tools and machinery is as follows:

- Any standard hand tools (screwdrivers, pliers, center punch, tape measure, hammer, wrench, file, knife, deburring tool, etc.)
- Chain breaker/chain puller
- Manual pry bar or press
- Any standard type of hand saw (hacksaw, coping saw, miter saw, etc.)
- Any standard type of electric saw (saber saw, jigsaw, bandsaw, circular saw, etc.)
- Any standard electric drill and bit set (drill bit, taps, dies), including a drill press
    - This does NOT include precision machines (mill, lathe, CNC, Router, etc.)
- Any standard rotary tool (Dremel-type) and the corresponding bits
- Any standard vice or clamp
- Any standard type of sander, chisel, or grinder (includes electric belt sanders)
- Any standard soldering iron and solder
- Any standard pop-rivet tool, stapler, and staple gun - manual, electric, or pneumatic
- Any standard heat gun, hair dryer, etc.
- Any standard non-industrial sewing machine
- Low cost 3D-Printers such as Ender, Prusa, or Makerbot; Printing in PLA or ABS materials. Expensive commercial printers and exotic materials are not allowed.

All tools must be used in a safe manner, and within the specific shop safety rules each *Team* has in place. OCCRA suggests any cutting tools, manual or electric, be supervised by a qualified adult.

> Note: There are no “precision machining tools” on this list; the use of industrial-level machines not typically found in high schools (such as mills, lathes, CNC routers, laser-cutters, CNC brakes, etc.) would create an unfair advantage to those *Teams* with accessibility to such machines and are prohibited.

<R12> **Robots must have an Alliance flag holder, and visible team number.** All *Robots* must have a flag holder to retain an *Alliance* flag supplied by OCCRA at the events. This flag holder must be a piece of half (½) inch PVC pipe that extends upward from the *Robot* and allows the *Alliance* flag to be visible from all sides. *Robots* must also have a *Team* number displayed that is written in digits at least four (4) inches high and visible from all sides.

<R13> **Robots with pneumatics must follow strict guidelines.** All pneumatics components used must be COTS items and unaltered in any way that might compromise the integrity of the component. Any COTS pneumatics parts are allowed as long as they meet the criteria of <R10>.

The only compressors allowed on a *Robot* are one of the following:

- The Thomas compressor
- The AndyMark 1.1 Pump
- VIAIR 00090 compressor (supplied in the KoP)

The only tubing sizes allowed is the eighth inch (⅛”) supplied in the KoP or standard quarter inch (¼”).

The pneumatic circuit must be controlled with a pressure switch and relay, and protected with a relief valve at one-hundred twenty (120) psi or lower.

The pressure to all actuators must be controlled by regulators and may not exceed sixty (60) psi. The gauge on this regulator must be readily visible for ease of reading.

For safety reasons, a pressure relief valve must be connected to the accumulator tank(s) and easily accessible.

<R14> **Robots may only use certain motors and servos.** The only motors legal to use on the *Robot* are twelve (12) Volt DC brushed motors rated below three-hundred fifty (350) Watts, and must be from the KoP, or available for purchase from AndyMark, BaneBot, The Robot Space, or VEX. There is no limit as to how many motors a *Team* is allowed to use, however *Teams* should keep in mind that maximum total current on the *Robot* is limited to one-hundred twenty (120) Amps, and there are eight (8) motor control signal outputs on the Vex Controller. Brushless motors are not legal in OCCRA.

Standard electric servos including the VEX 393 may also be used, and there is no limit as to how many servos can be used. However, no servos are included in the KoP.

<R15> **Robots must use certain power sources.** There are two main power sources for an OCCRA *Robot*. The Vex Controller must be powered by the VEX 7.2V Battery, and *Teams* must either used the one provided in the KoP, or purchase one directly from VEX or The Robot Space. Any servos on the *Robot* should be powered through the Vex Controller.

The rest of the *Robot* must be powered by an eighteen (18) Amp-hour twelve (12) volt battery, either supplied through the KoP, or a functionally equivalent model. Any battery that is legal for competition in the FIRST Robotics Competition will also be considered legal to use in OCCRA. No lithium-ion batteries are allowed.

<R16> **Robots can only use certain control devices.** There is no limit to how many relays and motor controllers a *Team* can use. The Spike relay or the Adafruit DRV8871 are legal relays to use. The Victor SP, Victor SPX, Talon SRX, SPARK, and SPARK Max are legal motor controllers that can be used. The compressor must be run by a single automotive relay that OCCRA will supply to all *Teams* in the KoP.

All wires routed from motors and actuators must be secured to the strain relief bolt on the side of the control box before entering the box and attaching to the various relays and motor controllers.

<R17> **Robots can only use certain gauge size wire and breakers.** Only the following specified wire gauge sizes may be used:

- #6 gauge or larger wire must be used between the twelve (12) volt *Robot* battery and the positive and negative distribution strips.
- #16 gauge or larger wire must be used to carry current from the relay controllers to the pneumatic solenoids.
- #14 gauge or larger should be used for all other wiring on the *Robot*.

Main circuit-breakers may be either eighty (80) amp or one-hundred twenty (120) amp (OCCRA will continue phasing out the eighty (80) amp breakers). Branch circuits must be protected by breakers rated at thirty (30) amp or lower.

<R18> **Robots must have a control box.** All of the electrical control systems used on the *Robot* should be housed within the control box, a single clear plastic case. The controls case has been pre-wired for *Teams* convenience. Components should be neatly laid out and arrange key components so that their indicator lights are clearly visible to event staff, *Referees*, and *Field Technical Advisors*.

Robots must use the VEX V5 controller as the *Robots* main CPU on board. All the other main electrical control system components (fuse block, relays, motor controllers, and fuses/circuit breakers) should be housed within the control box.

The control box should be securely mounted to the *Robot*, such that it will not move or fall off when the *Robot* runs into *Field Elements* or other *Robots*. The lid of the control box should be secured to the box using the clasps, but *Teams* are encouraged to add something to help keep the lid secure on the box. The lid must be easily removed and the inside of the control box easily accessed.

Teams may use a PWM splitter cable if they wish to have a single control signal run multiple relays or motor controllers.

<R19> **Robots must be controlled using VEX joysticks.** The *Robot* must be controlled using the VEX joysticks. *Teams* may tether a second joystick to the first if they wish to control the *Robot* using multiple joysticks.

<R20> **No modifications to pneumatic or electrical components.** *Teams* may not modify any pneumatic or electrical components in any way, unless otherwise stated in official OCCRA documentation.

Section 5 - Conduct and Safety, Team Updates, Q&A

Section 5.1 - Conduct and Safety Rules

<CS1> ***Keep the Robot and Drive Team members safe.*** *Teams* should ensure that all actions the *Robot* makes on the *Field* and in general are safe. If the *Robot* becomes out of control or is putting anyone in danger, the joysticks should be turned off and every effort made possible to stop the *Robot* from operating.

All *Students* on the *Drive Team* are required to wear safety glasses and closed toed shoes while at the *Field*. *Students* should make sure they are never reaching inside the *Field* during a *Match*.

An adult is allowed to help transport the *Robot* on and off the *Field* if desired to ensure student safety. This adult is not allowed in the *Driver Station* during the *Match*.

<CS2> **Keep the pit area safe, clean, and respectful.** *Teams* should ensure that they do everything they can to be respectful to the venue hosting the event and the other *Teams* around their pit area.

All *Students* in the pit are required to wear safety glasses and closed toed shoes. *Students* must also make sure that they are using safe practices when operating any tools in the pit, and should get adult supervision for anything that requires it.

Students should keep their pit clean, with no loose parts on the floor as a tripping hazard, all trash thrown away or recycled, and no horseplay anywhere in the pit area. Food and drink is not allowed in the pits, with the exception of bottled drinks.

<CS3> **Use any available electricity in the pit safely.** There may or may not be available electricity in each *Team* pit at an event.

If *Teams* do not have electrical power available in their pit, they may set up equipment (such as battery chargers, power tools, etc.) on the side of the overall pit area such that it is out of the way and set up safely. Due to the possibility of not having electrical power access in the *Team's* pit, it is suggested that *Teams* bring cordless equipment to use in their pits.

If *Teams* do have electrical power in their pit, it is expected that they keep power lines organized and not in the way so as to cause tripping hazards. *Teams* should use OCCRA supplied cables and power strips to set up the electrical power, as this helps keep the event more organized and easier to clean up at the end of the event.

No electrical tools that cause any sparks or excessive noise are to be used in the pit areas at events.

<CS4> **Be on your best behavior when attending events.** OCCRA highly values teaching and promoting professional attitudes and manners, and expects all *Students* to conduct themselves in such a manner. Anyone who is found to be excessively disrespectful or unprofessional by event staff may be asked to leave.

Team spirit is highly encouraged at events, and OCCRA wants all *Students* to cheer for their *Team* and other *Teams* as much as possible. Signs, spirit materials, etc. are all encouraged as long as they do not negatively affect other spectators experience. Excessively loud noise makers that are distracting to field staff and *Drive Teams* may be removed. Laser pointers are strictly forbidden.

<CS5> **No sponsors on Robots, apparel, or at events.** OCCRA is very appreciative of any and all corporate sponsors that help support the organization. Any corporation that contributes personnel resources or financial resources in excess of $200 to OCCRA will be recognized by the organization with a large banner at each event, public address announcements at each event, with acknowledgement in brochures and in printed programs.

Individual *Teams* shall not display corporate names or logos on their *Robots*, *Team* apparel, or anywhere at the events where an association with an individual school is apparent.

Section 5.2 - Manual Updates

Throughout the season, there may be updates that need to be made to the game manual, as well as other information *Teams* need to know. OCCRA will email a Manual Update to *Teams* any time the manual or other updates occur, with any important information either the Game Design Committee or OCCRA steering committee feels needs to be shared. These Manual Updates will also be posted on the OCCRA Forum on ChiefDelphi.

Section 5.3 - Q&A System

The Q&A system is an opportunity for *Students* and/or their teachers, mentors, parents, etc. to ask specific questions about the *OCCRA High Rise* rules and interpretations that they do not think are completely clear or about something they do not think is addressed in the rules. The Q&A System will be managed by the Game Design Committee, and any answers given are official rulings by the GDC and are an extension of this game manual. Only answers given in writing in the Q&A System are official rulings outside of the game manual, other then live rulings by the *Head Referee* at events.

Questions asked in the Q&A system should be specifically about *Match* play, the competition structure, or specific technical questions related to the *Robot* rules. The GDC will not answer questions that use examples of mechanisms or anecdotal descriptions. If the answer to a question is already in the game manual, the GDC will direct you to read the game manual, and quote the specific rule pertaining to your question.

Any answers that are critical enough to the rules will cause an update to the game manual to better clarify in the manual the issue that the answer covered. These will be published in the game manual and notified to teams in Manual Updates.

The OCCRA Q&A system can be found at ChiefDelphi.