



SECTION 1

PEG PIG - INTRODUCTION

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SECTION 1 - INTRODUCTION

1.1 Overview

This section provides an introduction to Vex, and the origins of the *Peg Pin* Challenge. The majority of this document is taken directly from information provided by Vex. Certain sections have been edited to meet the requirements of the *Peg Pin* game developed by the Chipola Regional Workforce Development Board (CRWDB).

1.2 Moving Forward

In the history of the world, there has never been an age with a greater need for new scientists and engineers. Recent breakthroughs in chemistry, medicine, materials and physics have revealed a new set of challenges and created even greater opportunity for problem solving through technology. This underscores a dramatic challenge: there are not enough high school graduates choosing engineering majors in college. This does not reflect a lack of capacity for new students on the part of technical schools and universities, but a lack of interested and qualified applicants. Recognizing this dilemma, scores of organizations are creating programs designed to attract and engage young students in the study of science and technology. Many have found that robotics is a very powerful platform to attract and hold the attention of today's multi-tasking, connected youths. Robotics has strong appeal to this intensely competitive generation and represents the perfect storm of applied physics, mathematics, computer programming, design, and integrated problem solving, teamwork and thought leadership. Students with a previously undiscovered aptitude for STEM (Science, Technology, Engineering, and Math) curriculum are finding themselves in greater numbers due to the efforts of schools, volunteer organizations, corporations, and governments internationally.

The *Peg Pin* robotics challenge was developed by the Chipola Regional Workforce Development Board to be an entry level contest for competing schools in the region. The CRWDB plans to continue sponsoring Vex robotic contests in future years and provide assistance to schools each year that will enable the schools to expand their robotic inventory in terms of parts and knowledge.

Designed by the CRWDB, *Peg Pin* is available for free use by any organization with the time, energy and resources to organize a robotics event of any scale. It is our desire to help our local educational institutions attract, nurture and grow new engineering candidates worldwide. We believe this contest expands the knowledge base of our local community, exposes our future workforce to new and exciting career possibilities as well as provides an avenue for children with various talent proficiencies to take place in a team competition.

1.3 *Peg Pin* – A Primer

Peg Pin is an exciting and dynamic challenge which will provide teams with a high paced challenge for the duration of each three minute match. Each team will have to decide on a strategy that best fits their Robots ability to score points while also considering the strategy of their opponent. Teams will compete to score the most points by completing various tasks

including, moving pipes and stacking them in a specified area to score points, and moving tennis balls into a container.

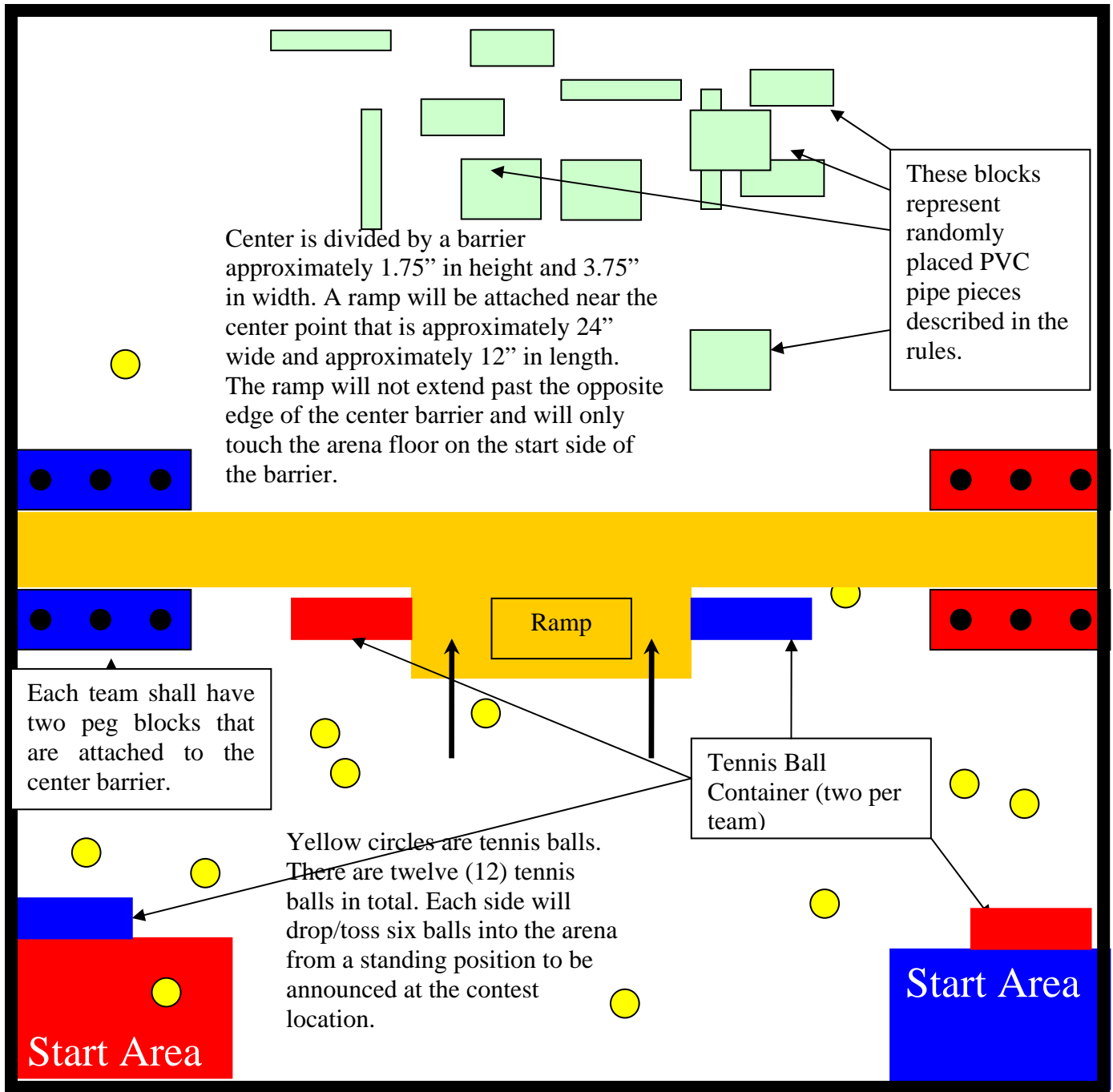
While participating in *Peg Pin* teams will develop new skills in response to the challenges and obstacles which stand before them. Some problems will be solved by individuals, while others will be handled through interaction with their student teammates and adult mentors. Teams will work together to build a Vex Robot to compete in the CRWDB tournament where they celebrate their accomplishments with other teams, family and friends. After the contest, students come away not only with the accomplishment of building their own competition Robot, but with an appreciation of science and technology and how they might use it to positively impact the world around them. In addition, they cultivate life skills such as planning, brainstorming, collaboration, teamwork, leadership as well as research and technical skills.

1.4 The Playing Field

Each team is tasked with determining how to best use their Robot, their knowledge and the resources available to outscore their opponent.

The next page shows a basic outline of the playing field and can be used by teams to help them better understand the task at hand.

Each team will be assigned to a start area, but after the start of the contest either team may enter the red or blue designated area. Each team will be assigned two peg blocks. Each team is limited to interacting with their own peg blocks.



Center is divided by a barrier approximately 1.75" in height and 3.75" in width. A ramp will be attached near the center point that is approximately 24" wide and approximately 12" in length. The ramp will not extend past the opposite edge of the center barrier and will only touch the arena floor on the start side of the barrier.

These blocks represent randomly placed PVC pipe pieces described in the rules.

Each team shall have two peg blocks that are attached to the center barrier.

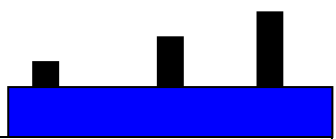
Tennis Ball Container (two per team)

Yellow circles are tennis balls. There are twelve (12) tennis balls in total. Each side will drop/toss six balls into the arena from a standing position to be announced at the contest location.

Start Area

Start Area

Side view of peg block



Notes: Drawing is not to scale. Before the start of each round the assistant driver will stand in an area to be announced at the contest location and toss or drop six tennis balls into the arena. Before a team may cross the center barrier they must place one tennis ball into one of their Tennis Ball Containers and stand the container upright. Once the container is upright and clearly standing without support from the Robot a judge will then announce they are clear to cross the barrier. Once the judge has cleared a team to cross the center barrier the clearance shall not be revoked even if the Tennis Ball Container falls. No team shall intentionally interfere with the attempt to make the first container stand upright.



SECTION 2

PEG PIN - THE GAME

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SECTION 2 – THE GAME

2.1 Overview

This section describes the robotics competition game, called *Peg Pin*. It also lists the game definitions and game rules.

2.2 Game Description

Matches are played on a field initially set up as illustrated in the figures on the previous page. Two teams – one “red” and one “blue” – compete in each match. The object of the game is to attain a higher score than your opponent by stacking pipe onto pegs and by placing tennis balls into a container. All scoring is calculated based upon where balls, pegs and Robots come to rest when time expires.

There will be a total of twelve (12) tennis balls and twelve (12) pipe pieces in the field of play. Each team will have two peg blocks that only they are allowed to use for scoring.

2.3 Game Definitions

Ball – A tennis ball used on the field of play.

Center Barrier – A 1 ¾” tall and 3 ¾” wide barrier that divides the contest arena into fields of play known as a red field and a blue field. Robots may reach across this barrier but no part of the drive mechanism shall touch in the opposing teams designated area.

Coach – A student or adult mentor designated as the team advisor during the match and identified as the person wearing the “coach” badge.

Competition Team – A group consisting of at least two students and a coach, but no more than five students and a coach. During an actual match one student will be designated as a driver, one as the driver’s assistant, and the remainder will be identified as pit crew.

Design/Build Team – A group of individuals working together to design and build a Robot for competition. Must contain one coach, but may contain as many students as desired by the team sponsor.

Driver – A student team member responsible for operating and controlling the Robot and wearing a “Driver” badge.

Driver’s Assistant – A person on the team that shall be allowed to move around the three sides of the arena not staffed by the Driver and Coach for the purpose of giving verbal and visual instructions to the driver of the Robot.

Driver Control Period – The 4:00 (four minute) time period in which a Robot is operated by the driver.

Field of Play – The twelve foot by twelve foot (12’X12’) playing area surrounded by a barrier. Any objects leaving the field of play will be considered out of action and not returned to the Field of Play.

Match - A match consists of a driver controlled period lasting four (4) minutes.

Peg Block – A block approximately 3.75” wide and 1.75” high and 6” in length that contains three pegs of approximately 1/2” in diameter spaced across the top face. Each peg shall be a different height above the block. The first peg shall rise approximately 3” above the block, the second shall rise approximately 6” above the block and the third shall rise approximately 12” above the block.

Robot – Anything (which has passed inspection) a team places on the field prior to the start of a match.

Scoring Object – A tennis ball or pipe ending in position to score points once time has expired and all objects have come to a full stop. To score points for a team the scoring object may not be touching the scoring Robot.

Scoring Robot – The Robot for which points would be scored when considering the final resting position of an object on the field of play.

Tennis Ball Container – A container which is large enough to hold three standard tennis balls and shall start the contest lying on a side on in a position not considered upright.

Upright Tennis Ball Container - Upright is defined as the Tennis Ball Container not touching any portion of the arena except the arena floor with the closed based of the container.

2.4 Game Rules

2.4.1 – Scoring

- 1 No object is scored until all objects on the playing field have come to rest.
- 2 Teams may score points in their favor as long as the scoring item is not touching the scoring Robot.
- 3 A tennis ball that is not touching any part of the arena or the scoring team’s Robot and that is inside a team’s Tennis Ball Container shall count as two (2) points if the Tennis Ball Container is not in an upright position.
- 4 A tennis ball that is not touching any part of the arena or the scoring team’s Robot and that is inside a team’s Tennis Ball Container shall count as five (5) points if the Tennis Ball Container is in an upright position.
- 5 There shall be four (4) pipes of each point value as described in item 6 below placed in the arena prior to the start of each match.
- 6 Each pipe shall have a different point value as follows: 3” diameter pipe shall be three inches in length and worth ten (10) points. 2” diameter pipe shall be 6” in

- length and worth twenty (20) points. 1" diameter pipe shall be 12" in length and worth thirty (30) points.
- 7 The ½" diameter pegs that rise above the Peg Block shall have different point multiplier values based upon the location of the peg block and the height of the peg. For the peg board on the opposite side of the center barrier from the start area the point multipliers are as follows: The shortest peg is worth 1X, the middle peg is worth 2X, and the longest peg is worth 3X. For the peg board on the same side of the center barrier as the start area the point multipliers are as follows: The shortest peg is worth 4X, the middle peg is worth 5X and the longest peg is worth 6X. (Example: A ten (10) point pipe placed on the 3X peg shall be worth thirty (30) points.)
 - 8 Teams may place multiple pipes on any peg; however only the bottom pipe will count for scoring. In the event one pipe fits over another and both are deemed "on the bottom" only the lowest scoring pipe will count.
 - 9 A pipe that is on a peg and not touching the Robot or anything other than the peg or peg block shall be scored if it is the bottom pipe on the peg.
 - 10 In order to place a pipe on a peg a Robot must not have any wheel, track or drive mechanism in contact with the top of the center barrier and must be on the same side of the center barrier as the peg block they are attempting to place pipe.
 - 11 A Robot at the end of the match that rests with no part of the Robot touching any part of the arena except inside their colored starting area shall score five points.
 - 12 A completed log book submitted for judging counts as ten (10) points.
 - 13 In case of a tied final score the tie will be broken in the following manner: If only one of the two teams has submitted a log book the team that submitted the log book shall be declared the winner. If the score is still tied after the log books are considered, the point value of the pegs shall be considered in order from highest value (6X) to lowest value (1X). If after reviewing the 6X value the teams are still tied, the judges shall determine the 5X value and continue until one team has a higher value and is declared the winner. If the teams are still tied after all pegs have been valued, the tennis ball points shall be used. If both teams are still tied the teams will each toss one tennis ball into an arena cleared of all other items and the team to move their tennis ball across the center barrier first shall be declared the winner. To be considered across the center barrier the tennis ball shall touch the floor on the opposite side of the barrier and not be in contact with the scoring Robot. If after one minute neither team has moved a tennis ball across the center barrier a coin toss will determine the winner.

2.4.2 – Safety Rules

<S1> If at any time the Robot operation is deemed unsafe or has damaged the playing field, surface, or barriers, by the determination of the referees, the offending team may be disqualified. The Robot will require re-inspection before it may again take the field.

<S2> If a Robot goes completely out-of-bounds (outside the playing field), it will be disabled for the remainder of the match by a contest judge. **Note:** The intent is NOT to penalize Robots for having mechanisms that have mechanisms or only a part of the robot that cross the outside field border during normal game play.

<S3> If a Robot is deemed to be intentionally working against the spirit of the rules the judge may disable the offending Robot.

<S4> If a Robot is deemed to intentionally move or otherwise work to disable or cause damage to another Robot a judge may disable the offending Robot for the remainder of the match. Repeated violations of this rule may result in the removal of the offending Robot and team from the competition.

2.4.3 – General Game Rules

<G1> At the beginning of a match, each Robot must not exceed a volume of 18 inches wide by 18 inches long by 18 inches tall. Any expansion beyond these measurements must occur after the match has begun and must be powered without direct human contact. An offending Robot will be removed from the match at the Head Referee's discretion.

<G2> Alignment devices (templates, tape measures, lasers, etc.) that are not part of the Robot may not be used to assist with the position of the Robot.

<G3> Each Team shall include at least one driver, one driver's assistant, and one coach.

<G4> During a match only the driver, a driver's assistant and a coach may be within the designated participant area next to the field of play. Each individual will be required to stay in their assigned area or their Robot may be disabled by a judge.

<G5> Items that leave the playing field are considered out of play. These items will not be returned to the field until a match winner is decided.

<G6> No team member may make intentional contact with any game or field object once the match has begun. An instance of intentional contact will result in the team making contact having their robot disabled for the remainder of the match.

<G7> During a match, Robots may be remotely operated only by the drivers and/or by software running in the on-board control system. If a coach touches his/her team's controls anytime during a match, the Robot will be disabled and the team disqualified.

<G8> Scores will be calculated for all matches either immediately after the match or when all objects on the field come to rest.

<G9> Robots may not intentionally detach parts during any match, or leave mechanisms on the field. If a detached component or mechanism prevents scoring, the team will be disqualified. Multiple infractions may result in disqualification for the entire competition.

<G10> Strategies aimed solely at the destruction, damage, tipping over, or entanglement of Robots are not in the spirit of this competition and are not allowed. However, *Peg Pin* can be an interactive contact game. Some tipping, entanglement, and damage may occur as a part of the normal game play. If the tipping, entanglement, or damage is ruled to be

intentional, the offending team may be disqualified from that match. Repeated offenses could result in a team being disqualified from the remainder of the competition.

<G11> Robots must be designed to permit easy removal of balls and/or pipes from any grasping mechanism without requiring that the Robot have power after the match.

<G12> Field tolerances may vary by as much as +/- 1", so teams must design their Robots accordingly.

<G13> A Robot cannot pin (inhibit the movement of an opposing Robot while in contact with one or more field elements) an opposing Robot for more than five seconds. If a referee determines this rule to be violated the offending Robot will be disabled for the match, and any points scored by the offending Robot will be divided by two (2).

<G14> Robots may display a team name. All team names must be approved by the CRWDB. Robots may not display logos for products or from companies deemed inappropriate by the CRWDB for a high school based competition. The CRWDB and the contest judges reserve the right to reject team names at their sole discretion.

<G15> The arena will be placed on mats this year. The mats will be the same type of mats used for the speed course from last year.

2.4.4 – Peg Pin Specific Game Rules

<SG1> Prior to the beginning of the match the judge shall give each Driver's Assistant six tennis balls and instruct the individual to stand at a specified spot outside the arena. The Driver's Assistants will then toss the tennis balls into the arena in a manner that causes the first part of the arena they touch to be on the same side of the center barrier as the start area.

<SG2> After the balls have been tossed into the arena a contest official will dump a container of pipe into the arena near the wall on the opposite side from the start area. After the pipes have been placed each team will place their Robots according to <SG3>.

<SG3> A coin flip will be used to determine start locations in the round robin portion of the tournament. The highest seeded team shall select during the elimination tournament. In either case the selection shall be made after the pipes have been placed in the arena. At the beginning of each match, the two Robots in the round must be placed such that they are entirely within the color designated starting area. Any Tennis Balls in the start area that need to be moved in order to properly place a Robot will be placed along the center barrier on either side of the ramp. A tennis ball will not be moved unless there is no location within the start area to place the robot.

<SG4> A ball or pipe is not considered scored if it is being touched by the scoring Robot at the conclusion of a match. A ball is not considered scored if it touches any part of the arena floor. A pipe is not considered scored if it is touching any part of the arena other

than the peg or peg board. For the purpose of scoring, the Center Barrier shall be considered part of the peg board.

<SG5> Teams may not move, or caused to be moved, any object on the field prior to the start of the match with the exception being the team's Robot or as described in <SG1> above.

<SG6> A Robot may not intentionally remove a pipe from their opponent's peg. An attempt to do so will first result in a warning and then result in disqualification. If a Robot does intentionally remove a pipe from an opponent's peg the Robot that removed the pipe shall have no points scored for any pipe placed on their own peg(s). A judge will take into consideration if the action was an attempt to grab a pipe placed near the peg by the other team or if it was an attempt to move pipe from a peg. A second intentional attempt to remove a pipe from an opponent's peg shall result in the offending team being disqualified from the match.

<SG7> A match shall last four (4) minutes or until a team ends the match by scoring a pipe on all six of their pegs and placing their Robot at a stop inside their colored start area as described in **2.4.1 – Scoring** - 11.



SECTION 3

PEG PIN - THE TOURNAMENT

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SECTION 3 – THE TOURNAMENT

3.1 Overview

The *Peg Pin* competition will be played in a tournament format. The tournament will include a short practice session prior to the start of matches. Each team participating in *Peg Pin* will be guaranteed at least two matches. Please note that cell phones are not allowed within the area designated for the playing arena.

3.2 Tournament Definitions

Team Captain – A student chosen to represent their team in the event a team decision is needed by tournament officials.

Crystal Assignment – The designated radio frequency crystal that a team will use for a given match. These will be provided to teams before each match.

Practice Time – An unscored period of time used to provide time for teams to get acquainted with the official playing field.

Seeding – All seeding for initial tournament brackets and/or pool assignments will be randomly selected.

3.3 Practice Time

At the event practice time will be available for all teams on both a scheduled and a first come-first served basis. Prior to the event date all teams will be provided with an initial time period for team practice on the event field. Teams will be allotted ten minutes of field time to use in any manner they see fit. Teams will need to ensure they arrive far enough in advance to install the crystal assigned to their team for practice time. Additional practice time will be made available on a first come/first served basis if the event schedule allows for additional practice time.

3.4 Pool Play/Match Ladder

Event organizers may elect to hold pool play in order to determine teams that move forward to a single elimination bracket. Pool play may only be used if each pool will contain a minimum of three teams so that each team has at least two matches. If pool play is used event organizers will post at the event a defined set of rules as to how pool play will be used to seed the following elimination tournament. The rules must establish for all participants how the ladder will be seeded and must give higher seeding to teams based first upon rank within their respective pool and second upon their average score per match played.

Event organizers may elect to forgo pool play and randomly seed all teams in a match ladder. In the event a match ladder will be used without pool play the match ladder must allow for double elimination so that all teams are guaranteed at least two matches. Event organizers must post at

the event a representation of the match ladder that clearly shows how the matches will proceed. If a double elimination ladder is used event organizers are allowed to change the ladder as necessary due to changes that may be made necessary due to a double elimination event.

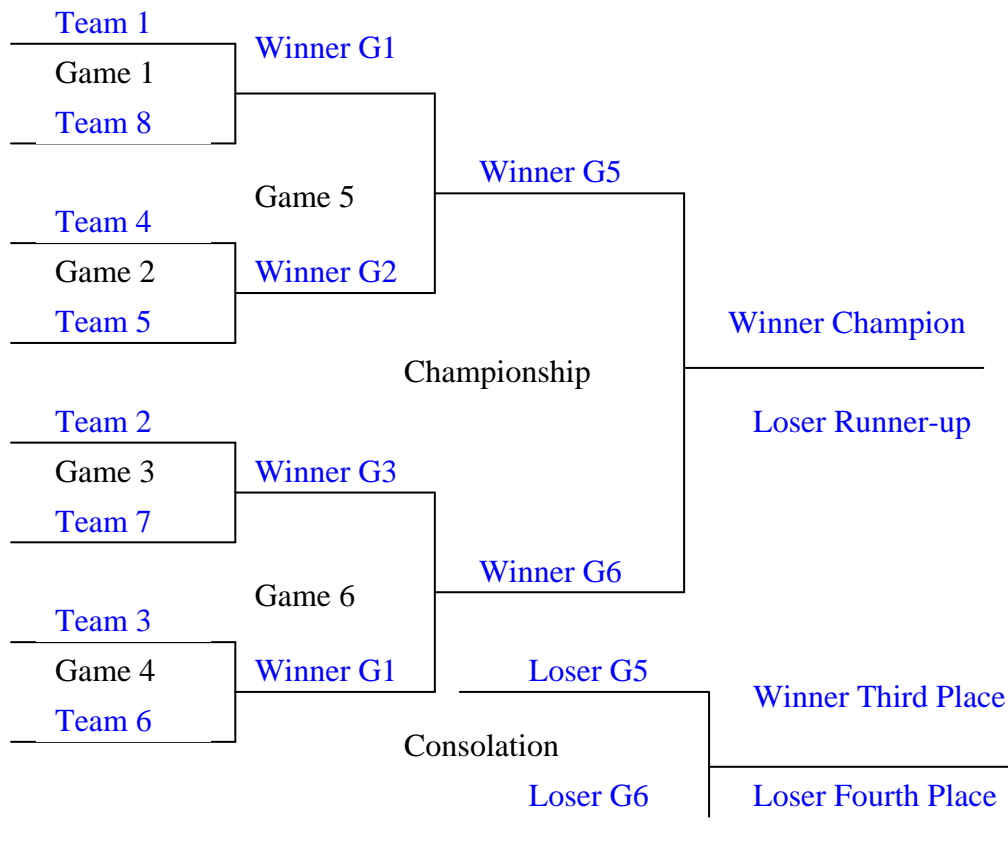
Example of Pool Play

Pool A	Pool B	Pool C	Pool D
Team Alpha	Team Beta	Team Gamma	Team Delta
Team Epsilon	Team Zeta	Team Eta	Team Theta
Team Iota	Team Kappa	Team Mu	Team Nu
Team Xi	Team Omicron	Team Pi	Team Rho

Using Pool A the Pool Schedule would be:

- Team Alpha vs. Team Epsilon
- Team Iota vs. Team Xi
- Team Alpha vs. Team Iota
- Team Epsilon vs. Team Xi
- Team Alpha vs. Team Xi
- Team Epsilon vs. Team Iota

Single Elimination Ladder Example:



3.5 Tournament Rules

<TR1> Referees have ultimate authority during the competition. **Their rulings are final.**

<TR2> The referees will not review any recorded replays.

<TR3> Any questions for the referees must be brought forward by the Team Captain prior to the start of the next match on the same field. In the event no further matches are to be played on the field in question the Team Captain will have ten minutes in which to bring forward any questions.

<TR4> The only people permitted by the playing field are the driver, driver's assistant and team coach. They will be identified by badges. These badges are interchangeable.

<TR5> **All team members, including coaches, must wear safety glasses or glasses with side shields while in the pit or while in the team area during matches.**



SECTION 4

PEG PIN - THE ROBOT

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SECTION 4 – THE ROBOT

4.1 Overview

This chapter provides rules and requirements for the design and construction of your Robot. A Robot is a remotely operated vehicle designed and built by a team to perform specific tasks when competing in *Peg Pin*. Prior to competing at the event, all Robots will have to pass an inspection. Refer to Appendix 1 for the Robot Inspection Guidelines and the Inspection Checklist.

4.2 Robot Rules

There are specific rules and limitations that apply to the design and construction of your Robot. Please ensure that you are familiar with each of these Robot rules before proceeding with Robot design.

<R1> Only ONE Robot will be allowed to compete per team in the *Peg Pin* event. Though it is expected that teams will make changes to their Robot at the competition, a team is limited to only ONE Robot.

- a. It is against the intent of this rule to compete with one Robot, while a second is being modified or assembled.
- b. It is against the intent of this rule to switch back and forth between multiple Robots during a competition.
- c. It is against the intent of this rule for a team to allow their Robot to be used by another team.

<R2> Every Robot will be required to pass a full inspection before being cleared to compete. This inspection will ensure that all Robot rules and regulations are met. Initial inspections will take place during team registration/practice time.

- a. If significant changes are made to a Robot, it must be re-inspected before it will be allowed to compete.
- b. All Robot configurations must be inspected before being used in competition.
- c. Teams may be requested to submit to random spot-inspections by event personnel. Refusal to submit will result in disqualification.
- d. Referees or inspectors may decide that a Robot is in violation of the rules. In this event, the team in violation will be disqualified and the Robot will be barred from the playing field until it passes re-inspection.

<R3> The follow types of mechanisms and components are NOT allowed:

- a. Those that could potentially damage playing field components.
- b. Those that could potentially damage other competing Robots.
- c. Those that pose an unnecessary risk of entanglement.

- d. Those that carry signs, messages, symbols, or words that are deemed unacceptable by the event staff.

<R4> At the beginning of any match, the maximum allowed size of a Robot is 18”X18”X18”.

- a. During inspections, Robots will be placed into a “sizing box” which has interior dimensions matching the above size constraints. The CRWDB reserves the right to use other measuring devices. To pass inspection, a Robot must fit within the box without exerting ANY force on the box walls or ceiling (i.e., if the Robot cannot be held inside by the box itself).
- b. Robots may extend beyond their starting size constraints after the start of the match.
- c. Any restraints used to maintain starting size (i.e. zip ties, rubber bands, sting, etc.) MUST remain attached to the Robot for the duration of the match.

<R5> Robot construction is constrained to the following:

- a. Parts may be used as designated below:
 - Only those components provided by the CRWDB to each team may be used in the construction of the Robot.
 - Teams may not “share” parts from one team to another. (i.e., if the parts provided contain only one of part “A” then a Robot may not use more than one of part “A” in the design.)
 - The packaging, manual binders, Styrofoam, cardboard, plastic bags, etc. from the Vex kits are NOT included and CANNOT be used for Robot construction. Only the Vex parts themselves are allowed.
 - Schools that have parts that malfunction or that become lost may, using their own funds, purchase a replacement part as long as the part is an exact match for the original.
- b. The following additional components may also be used:
 - Ten (10) elastic bands, #32 size only
 - 40” of 1/8 Nylon Rope
 - 6” of 3/4” wide Velcro
 - 12” X 15” of Non-Slip Pad
- d. Teams may add non-functional decorations from parts not on the above list, provided that these parts do not affect the outcome of the match, and must be in the spirit of the competition.
- e. No additional components may be used.

<R6> All parts used must be tracked and reported on the Design Log to be graded.

<R7> During inspections if there is a question about whether something is an approved component, the lead event official will be required to make a decision.

<R8> No more than one transmitter may control a single Robot during the tournament. No modification of the Vex transmitter is allowed of ANY kind.

<R9> Robot receiver must be accessible by the competition personnel.

- a. The radio crystal must be easily removed from the Robot without any Robot disassembly.
- b. The radio crystals will be provided to each team for each match.