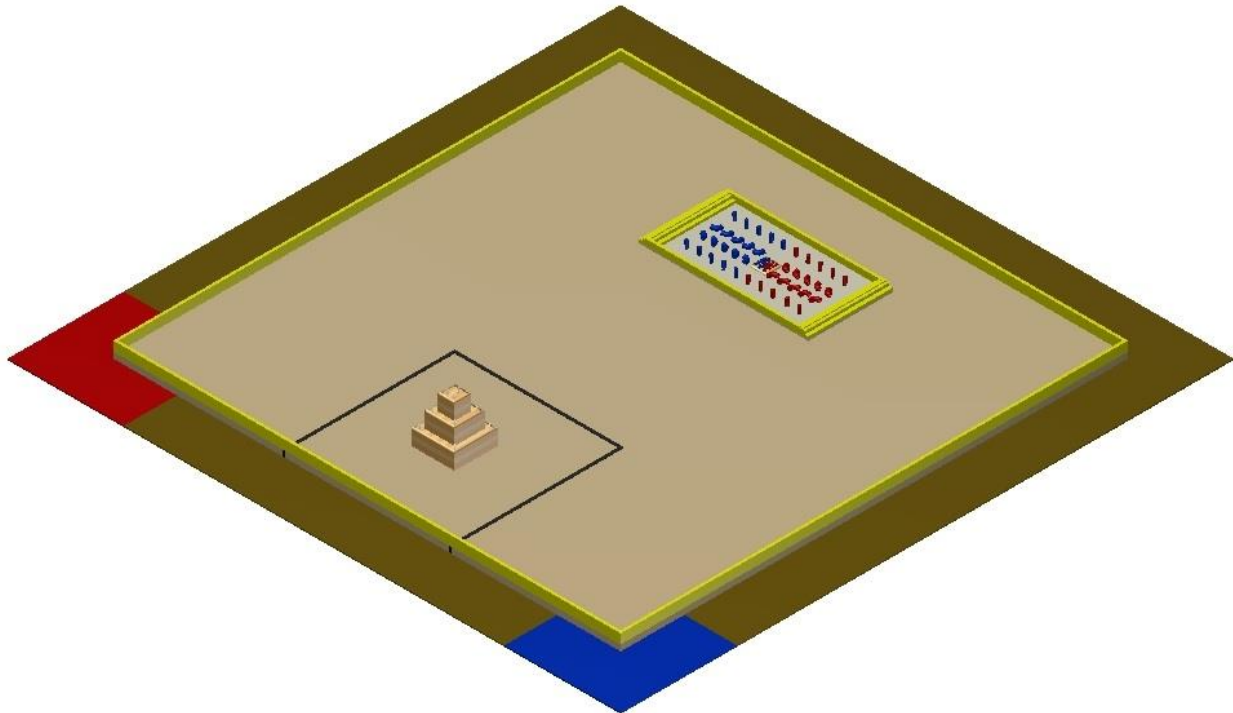


## 26<sup>th</sup> ONTARIO TECHNOLOGICAL SKILLS COMPETITION

# Robotics Contest – Harvest Time

Secondary Level - Team of 4



**Contest Date : Monday, May 4 and Tuesday, May 5, 2015**

Technical Chair - Bob Tone, **Tech On eh!**

**TECHNICAL COMMITTEE MEMBERS:**

Mario Blouin, Chef des Études Technologiques, École Secondaire de Hearst,  
Henry Schubach, Western Region Representative  
Mark Dimonte, Radio Control Expert,

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#### FURTHER COMMUNICATIONS

Questions for clarification of the rules can be made to the Technical Committee Chair [bobtone@rogers.com](mailto:bobtone@rogers.com).

To ensure that competitors have a positive experience at the Ontario Technological Skills Competition a competitor and their educator should review this scope document well in advance of the Ontario Technological Skills Competition, as well as checking back to the website for updated versions of the scope up until the event. All the information required to compete and have a positive experience at the OTSC is found in this document. If you have any questions about the scope or this contest, please ensure to contact the Technical Chair or the Skills Ontario Competition Department well in advance of the OTSC so we can address the question or concern well in advance of the OTSC.

#### MORE INFORMATION

For questions about the **registration process and eligibility** please refer to the Competition Information Package [www.skillsontario.com](http://www.skillsontario.com)

For **technical questions** that are contest specific, please contact the technical chairs at the email above or the Skills Ontario Competition Department at [otsc@skillscanada.com](mailto:otsc@skillscanada.com).

#### CONTEST STATUS:

- **This contest is offered as an official contest**
- **This contest is offered at the Skills Canada National Competition (SCNC)**
- **2015 is not a qualifying year for WorldSkills**

#### LOCATION :

**All contests at the 2015 OTSC are hosted onsite at RIM Park and Manulife Financial Sportsplex, Waterloo Ontario**

#### PURPOSE OF THE CONTEST:

To create an engineering project to encourage individuals with different skill sets to form co-operative teams to design, fabricate and operate a robot. The intent of the Skills Ontario Robotics Contest is to have teams of students independently designing / fabricating / operating robots capable of completing the competition tasks in competition with other student-fabricated robots. Teams are not allowed to develop or implement strategies based on interfering with their opponent's ability to complete the competition task set. It is expected and acceptable that teams will use some newly purchased and recycled parts or components (motors, gears, etc.) to fabricate mechanisms, which will complete the Skills Ontario Robotics Contest tasks. Robots will be inspected for adherence to this statement at the Ontario Technological Skills Competition.

**SKILLS AND KNOWLEDGE TO BE TESTED:**

- Drafting
- Mechanics
- Electronics
- Metalwork
- Woodworking
- Communications

**EQUIPMENT AND MATERIALS / ÉQUIPEMENT ET MATÉRIEL:**

Supplied by Skills Ontario Technical Committee:

- Playing Field, including Team Home Area
- One worktable with access to a 120V power outlet

Supplied by Competitors:

- Robots - Robot accessories (including batteries, battery charger, spare parts)
- Safety equipment, including mandatory eye protection
- Various tools required to modify and repair robots onsite
- Résumé

Please note: Competitors are not to bring their own power tools to the OTSC unless specified in the scope.

Please note: Competitors are not to bring their own computer to the OTSC

Media devices, such as cell phones, smart phones, mp3 players or PDAs are not permitted on the contest site.

Students should be familiar and competent in the use of the tools and equipment listed above as well as safety precautions that should be observed prior to attending the OTSC.

**SAFETY / SÉCURITÉ:**

Safety is a priority at the Ontario Technological Skills Competition. At the discretion of the judges and technical chairs, any competitor can be removed from the competition site for not having the proper safety equipment and/or not acting in a safe manner.

1. Spotters and drivers must wear CSA approved safety glasses during game play
2. When working in the pit area, it is mandatory to wear CSA approved eyewear (including side shields for prescription eyewear).\*

\*Competitors will not be permitted to compete until they have the needed safety equipment. Competition judges will have final authority on matters of safety.

**Competitors must show competence in the use of tools and/or equipment outlined in this scope and can be removed at the discretion of the judges and technical chairs if he/she does not display tool and/or equipment competency.**

#### JUDGING CRITERIA:

On the court performance of the robot in the set task.  
Performance in the job interview component will be the tie breaker, after round robin play.

#### RULES, REGULATIONS AND ELIGIBILITY:

Please be sure to review all eligibility criteria in the complete Competitor Information Package, available online at [www.skillsontario.com](http://www.skillsontario.com).

Eligibility Criteria:

**Secondary** students must:

- Be **21 years of age or younger** as of December 31<sup>st</sup> **in the competition year** (2015).
- Compete in only one contest at the OTSC. Students competing at a Qualifying Competition who do not advance in their designated contest area are not permitted to then register for a different contest at the OTSC.
- Possess a Canadian citizenship or landed immigrant status and be a resident of Ontario.

Other Rules and Regulations all competitors need to be aware of prior to attending the OTSC:

- Translators or other assistants (e.g. hearing impaired) are permitted in the contest site **only if this request was made during the registration process and approved in advance by the Skills Ontario office.**
- During the contest, no one will have access to the contest site except the Technical Committee Members, Judges, Skills Ontario staff and Competitors. Spectators, including teacher/advisors, will be provided a viewing area if possible.
- If there is any discrepancy between the English and French information in the scope, the English portion will be taken as the correct information.

Immediate disqualification may occur at the discretion of the technical chair if a competitor displays any one of the following:

- Acts inappropriately
- Shows disregard for the safety of themselves or those around them
- Breaks the established rules and regulations including:
  - Uses equipment or material that is not permitted
  - Dishonest conduct (cheating, plagiarism)

- Speaks with those outside the contest area
- Arrives to the contest site late

Sign-in for all contests will happen on the contest site the morning of the competition. Registration must take place prior to the deadline of March 27, 2015.

#### **JOB INTERVIEW :**

To assist competitors in preparing for their eventual job searches, there is a “job interview” incorporated into this contest. It is expected that the competitors will arrive **WITH A RÉSUMÉ** and be prepared for interview questions and discussion. Performance in the job interview component will be the tie breaker, after round robin play.

Sample interview questions and a scoring breakdown are available at [www.skillsontario.com/hr](http://www.skillsontario.com/hr).

Please note there are no facilities on site for printing.

#### **CLOTHING REQUIREMENTS:**

Competitors are to be dressed in a clean and appropriate manner. Competitors are not permitted to wear clothing with logos or printing. The exception to this rule is the logo of the school, school board, college or MTCU District that the competitor is representing. **ONLY** the logo of the institution under which the space is registered can be visible. Corporate logos or names are not permitted on a competitor’s clothing.

#### **MEALS:**

Skills Ontario will provide a basic lunch and a beverage for competitors. Lunch will be confirmed closer to the competition; no alternative meals will be provided. If the competitor has specific dietary needs, specific tastes or feels that they may require additional sustenance, it is recommended they bring the necessary food with them. If the competitor is part of a contest of a physical nature, it is highly recommended they bring additional snacks.

**ANY FOOD BROUGHT TO THE VENUE MUST BE NUT FREE. ANY NUT PRODUCTS FOUND ON SITE WILL BE REMOVED.**

**OTSC AGENDA:**
**May 4, 2015**
**Ontario Technological Skills Competition**
**Day 1 – Tournament Play**

|   |   |
|---|---|
| 7:00am – 7:30am   | Sign-in at each contest site              |
| 7:30am – 8:00am   | Orientation <sup>^</sup>                  |
| 8:00am – 9:00am   | On-court practice time and Job Interviews |
| 9:00am – 11:30am  | Tournament Games                          |
| 11:30am – 12:30pm   | Lunch                                     |
| 12:30pm – 3:30pm  | Tournament Games                          |
| *3:30pm – 4:30pm  | *Open Court for teams to practice         |
| <p>*To ensure all teams receive an equal number of games, this practice time may be reduced.<br/>All teams must be off the court and out of the pit area by 4:30pm.<br/>Robots must remain in the Pit Area overnight.</p> |   |

**May 5, 2015**
**Ontario Technological Skills Competition**
**Day 2 – Tournament Play in the morning, Playoffs in the afternoon**

|                   |                        |
|-------------------|------------------------|
| 8:30am – 9:00am   | Practice Time on Court |
| 9:00am – 11 :30am | Tournament Games       |
| 11:30am – 12:30pm | Lunch                  |
| 12:30pm – 4:30pm  | Playoff Games          |
| 3:45pm            | Bronze Medal Game      |
| 4:15pm            | Gold Medal Game        |

**May 6, 2015**
**Closing Ceremony**

|                  |                      |
|------------------|----------------------|
| 9:00am – 11:30am | Closing Ceremony     |
| 12:00pm – 1:00pm | Team Ontario Meeting |

**Contest Location:** RIM Park and Manulife Financial Sportsplex, 2001 University Avenue East Waterloo.

**Closing Ceremony Location:** Waterloo Memorial Recreation Complex, 101 Father David Bauer Drive, Waterloo.

- Each competitor will receive one wristband at the contest orientation. This wristband identifies competitors as such and will also be used as the competitor's closing ceremony ticket on May 6. Competitors must ensure that the wristband remains on his/her wrist from the beginning of the competition until after the closing ceremony.

**TEAM ONTARIO:**

The Gold-medal winning competitor(s) in this contest may be eligible to advance to the Skills Canada National Competition (SCNC), hosted May 27-30, 2015 in Saskatoon, Saskatchewan.

**For a student to represent Ontario at the SCNC they (or someone representing them) MUST be present at the Team Ontario meeting (taking place immediately following the OTSC Closing Ceremony) and must be ready to commit to attending the SCNC at that time.**

**SKILLS CANADA NATIONAL COMPETITION (SCNC):**

The SCNC will be hosted, May 27-30, 2015 in Saskatoon, Saskatchewan. Competitors should consider preparing for this event prior to attending the OTSC by reviewing the national scope as well. The national scope is available online at

<http://skillscompetencescanada.com/en/scope/>

**ADDITIONAL INFORMATION:**

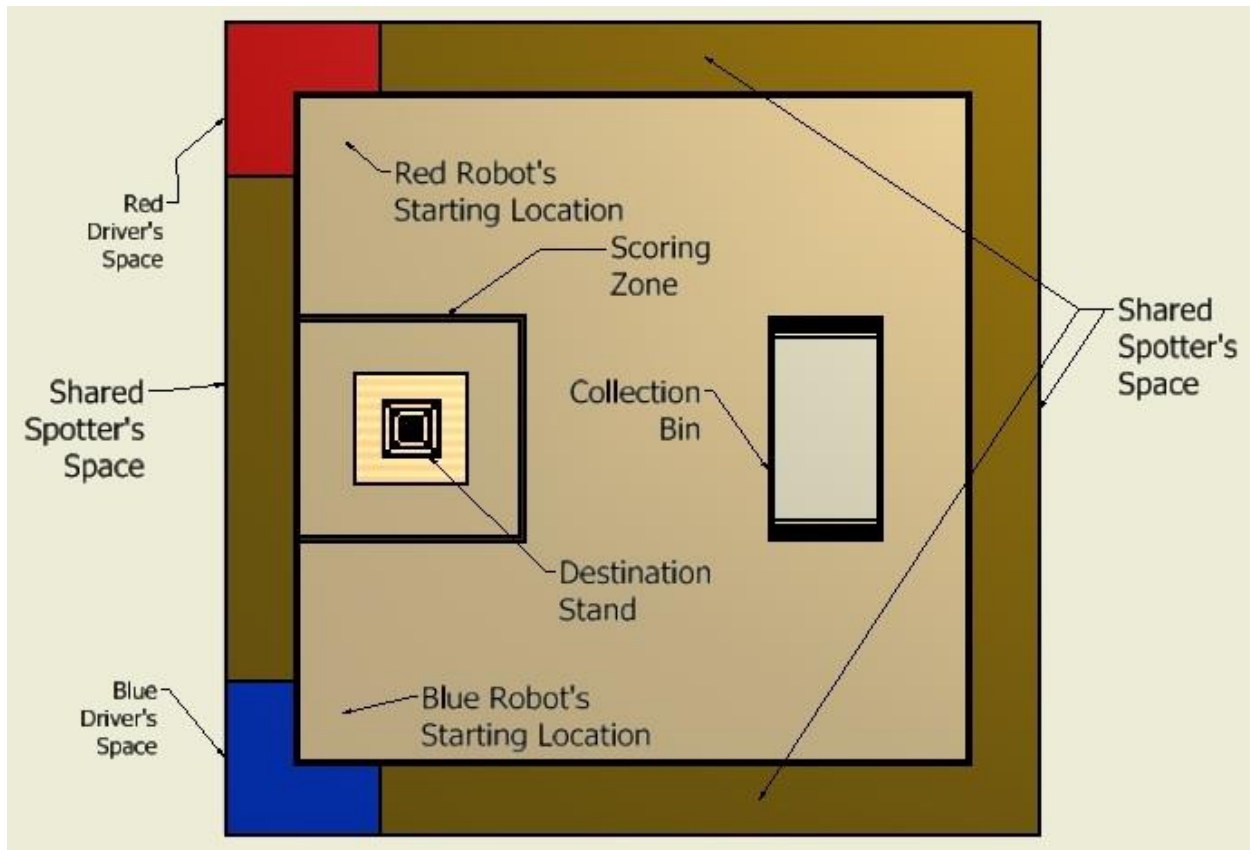
- The Competition Information Package can be found at [www.skillsontario.com](http://www.skillsontario.com) .
- Results for the OTSC will be posted online starting Friday, May 8, 2015, at [www.skillsontario.com](http://www.skillsontario.com).
- Information on the Conflict Resolution Procedure can be found on our website in the Competition Information Package at [www.skillsontario.com](http://www.skillsontario.com) .
- If you have any questions regarding the OTSC or this contest, please contact Skills Ontario or the technical chair prior to April 24, 2015, as all staff will be onsite setting up the following week.

**SPECTATORS :**

**Competitors are encouraged to invite spectators to attend. It is free of charge to attend the OTSC, but there is a \$10 fee for attending the Closing Ceremony.**



### THE GAME



The core game situation is that two farmers have inadvertently planted crops in a single field (Identified in the game court as the 'Collection Bin').

Now it is harvest time and the two robots need to harvest their designated crop objects and deliver their own crop objects onto the "Shared Destination Stand".

Once the game starts there are no exclusive use court floor areas assigned to teams.

The drivers are located at corners of the raised court. The court floor will be 4.125 inches above the facility floor.

The spotters have shared use of all perimeter court areas not designated as driver's spaces.

The court surface will be concrete, masonite or plywood. (The better side will be used)

### Crop Objects

The 'Crop Objects' will be:

- 20 Straight 1.5 Inch ABS Pipes 4 Inch long,
- 20 Bow ABS 2 Inch 90 Degree Connectors and
- 20 Golf Balls

Note: The Crop Objects will be colour coded to identify which objects are assigned to each team.



Canadian Tire Reference:  
Reload Bridgestone Recycled  
Golf Balls, White, 12-pk, Product  
#86-1570-2  
Cost: \$12.99 for a dozen balls



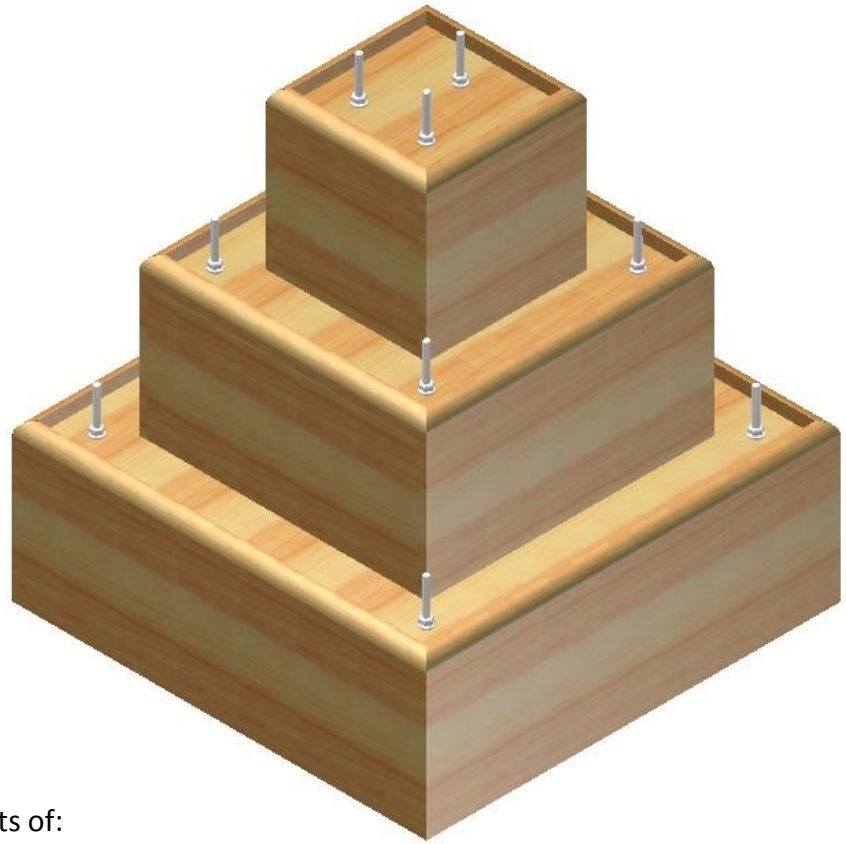
Canadian Tire Reference:  
Bow ABS Drainage Pipe  
Product #63-2302-0  
Cost: \$7.99 (For a 1.5 in. by 5 ft.  
Pipe)

Note: The Crop Object Pipes will  
be 4 inch long pieces



Canadian Tire Reference:  
2 In. Bow ABS/DWV 90 Degree  
Elbow Product #63-2669-8  
Cost: \$5.09

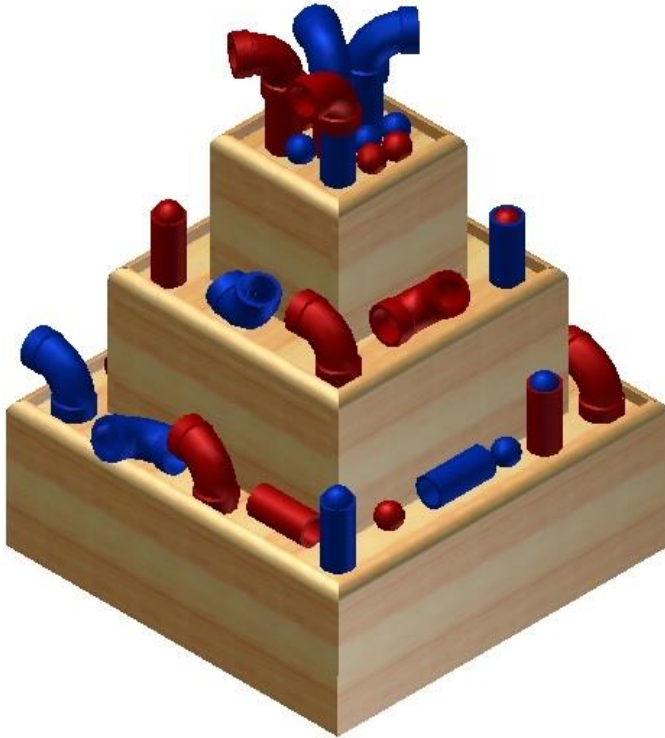
### Destination Stand



The Crop Destination Stand consists of:

- A three tiered set of shelves
- Each shelf provides 'A 3 Inch Wide Open Space' and a number of 'Pegs' (1/2 Inch Carriage Bolts extending 2.5 Inches out of the Shelf) to receive Crop Objects
- The perimeter of each shelf is defined by a  $\frac{3}{4}$  inch quarter round with the straight edge facing inwards
- The points awarded will be determined based on the shelf / peg location to which a Crop Object is delivered:
- Top Shelf 3 points / Top Shelf Peg 4 points
- Middle Shelf 2 points / Middle Shelf Peg 3 points
- Bottom Shelf 1 point / Bottom Shelf Peg 2 points

Scoring Sample



- At NO TIME will teams have exclusive ownership of any area of the Destination Stand
- Teams may interact with their opponent's objects on the Destination Stand by:
  - a) Placing their own object **ON** the opponent's object (an Elbow on an opponent's straight pipe) or **IN** the opponent's object (a golf ball in an opponent's straight pipe)
  - b) Pushing / moving / hitting an opponent's objects to make room for their own object IS ALLOWED as long as this involves ONLY object to object contact.

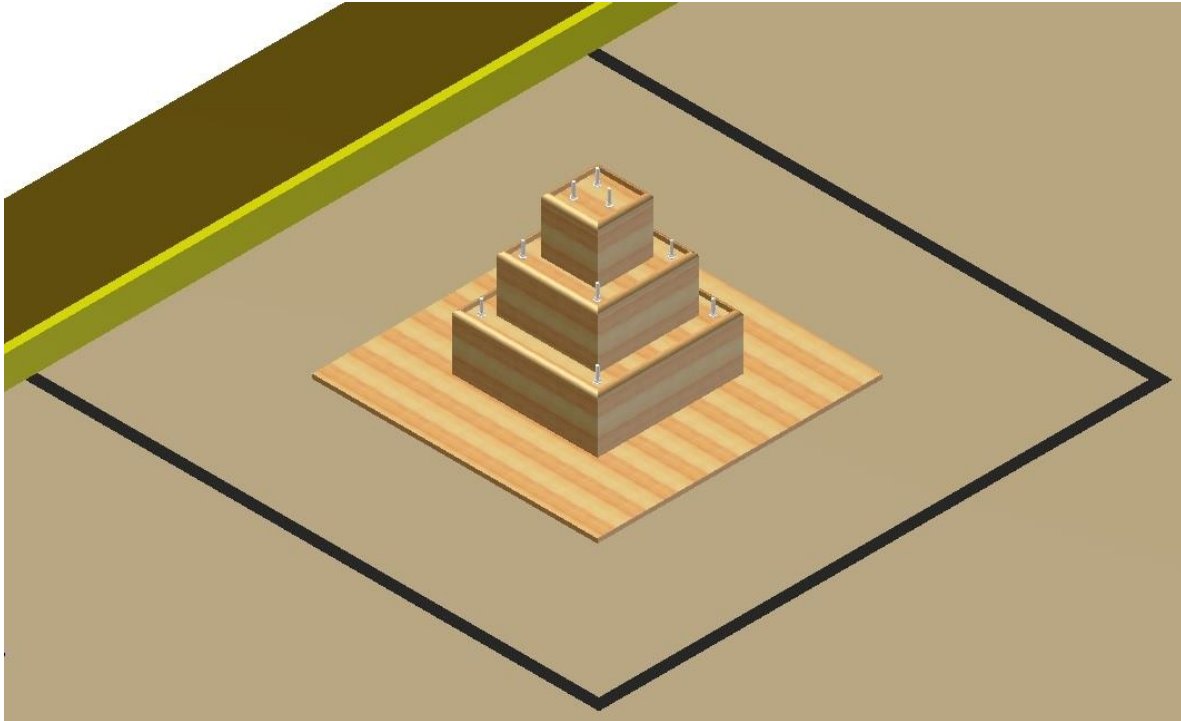


**Note:** At NO TIME can a robot grasp an opponent's object to reposition / remove it from the Destination Stand.

**Note:** It is possible that an opponent's Crop Objects will fall off a shelf when a new Crop Object is being introduced into the shelf space.

**Note:** It **IS ALLOWED** to use your Crop Object to knock an opponent's Crop Object OFF a peg but if a robot does this then they **MUST** place their Crop Object on that peg.

**Note:** Robots are **NOT Allowed** to use their Crop Object in a sweeping motion to clear multiple Crop Objects off a shelf.



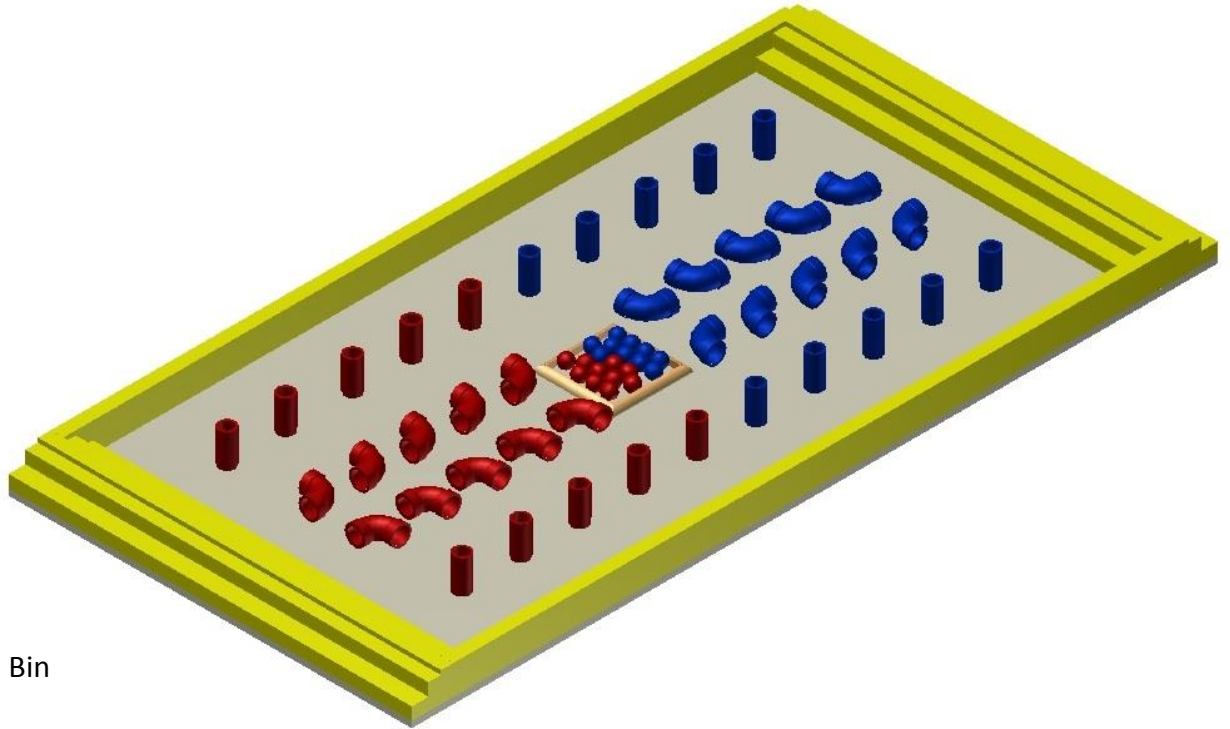
### The Scoring Zone

- Is a 98 by 96.5 Inch area with the Destination Stand positioned at its' center
- The Destination Stand is sitting on a 4 by 4 foot  $\frac{3}{4}$  inch sheet of plywood

### Rules Related to Crop Object Possession

- It is acceptable that robots accidentally or deliberately collect an opponent's Crop Objects when they are harvesting crop objects in the Collection Bin, on the Open Court Floor or in the Scoring Zone.
- If a robot is in possession of an opponent's Crop Objects at the end of the game their opponent will be awarded 2 Points for each of the opponent's Crop Objects in the robot's possession.

If Teams want to dump / off load crop objects to the floor then this must be done in the Scoring Zone.



### Collection Bin

- At the start of games the Collection Bin will contain ALL Crop Objects in the pattern shown above
  - Note:** Teams will have the option to use alternate start-of-the-game Crop Object patterns / set-up arrangements
- The Collection Bin Is built on a 4 ft. by 8 ft. by ½ in. sheet of plywood
- The Collection Bin Has 3.5 by 1.5 in. tall sides
- The Collection Bin Has a set of enter / exit steps at each end
  - a) **Entry Step One** is 2 in. tall and 2 in. wide
  - b) **Exit Step One** is 1.5 in. tall and 2 in. wide
  - c) **Entry and Exit Steps Two** are 1.5 in. tall and 1.5 in. wide
  - d) **Entry and Exit Steps Three** are 0.5 in. tall and 1.5 in. wide
- Robots have the following options when harvesting Crop Objects:
  - (a) Use the steps and fully enter into the Collection Bin
  - (b) Climb over the Collection Bin side walls and fully enter into the Collection Bin
  - (c) Reach over the Collection Bin side walls into Collection Bin to harvest Crop Objects

**2015 Scoring Sheet :** Referee’s will use a Harvest Scoring Table to calculate the End-of-Game Points awarded to Teams.

| 2015 Skills Ontario Robotics Score Sheet |  |   |   |   |   |  |  |                  |
|--|--|---|---|---|---|--|--|------------------|
| Game #<br>Team Name                      | Total Number of Crop Objects Delivered onto Shelf<br>One Value: One Point Each | Total Number of Crop Objects Delivered onto a Shelf<br>One Peg Value: Two Points Each | Total Number of Crop Objects Delivered onto Shelf<br>Two Value: Two Points Each | Total Number of Crop Objects Delivered onto a Shelf<br>Two Peg Value: Three Points Each | Total Number of Crop Objects Delivered onto Shelf<br>Three Value: Three Points Each | Total Number of Crop Objects Delivered onto a Shelf<br>Three Peg Value: Four Points Each | Total Number of Crop Objects IN Opponent’s Possession at the End of the Game<br>Value: Two Points Each | Total Game Score |
|  |  |   |   |   |   |  |  | 0                |
| <b>Team Signature:</b>                   |  |   |   |   |   |  |  |                  |
| Game #<br>Team Name                      | Total Number of Crop Objects Delivered onto Shelf<br>One Value: One Point Each | Total Number of Crop Objects Delivered onto a Shelf<br>One Peg Value: Two Points Each | Total Number of Crop Objects Delivered onto Shelf<br>Two Value: Two Points Each | Total Number of Crop Objects Delivered onto a Shelf<br>Two Peg Value: Three Points Each | Total Number of Crop Objects Delivered onto Shelf<br>Three Value: Three Points Each | Total Number of Crop Objects Delivered onto a Shelf<br>Three Peg Value: Four Points Each | Total Number of Crop Objects IN Opponent’s Possession at the End of the Game<br>Value: Two Points Each | Total Game Score |
|  |  |   |   |   |   |  |  | 0                |
| <b>Team Signature:</b>                   |  |   |   |   |   |  |  |                  |

**Game Overview**

- Games will involve two robots at a time
- Robots share a court area with:
  - An open smooth surface
  - A Crop Collection Bin
  - A Scoring Zone and
  - A Destination Stand
- Robots will attempt to harvest Crop Objects from the Collection Bin and deliver Crop Objects onto the Destination Stand.
- Robots must stop all operation when the time ends.

Robots must be designed and built by students to the criteria outlined in this document.

A pit area is provided so that students may make repairs and improvements to their robots between games. (Note: Teachers are not permitted in the pit area AT ALL after orientation or their team will be disqualified)



**Teams MUST bring their robots into the competition space when the Orientation Meeting is held.**

**Teams are NOT allowed to remove their robot from the competition area during the overnight period between Competition Day 1 and Competition Day 2.**

The pit area and competition court may be available to teams to work or practice during lunch breaks.

Strategies aimed at deliberately damaging other robots are not in the spirit of the competition and will not be allowed.

Teams must understand that deliberate bumping / ramming of your opponent robot is not allowed. However, when two very mobile robots are sharing an open court space and trying to take possession of shared objects **THERE WILL BE ACCIDENTAL ROBOT COLLISIONS**. Teams need to take this into consideration when designing and driving their robot.

**Medals will be awarded based on:**

- Robot on-the-court performance in the competition task set as identified through the results of tournament play and playoffs.

#### **RULES AND REGULATIONS**

1. Each Team will be assigned a start-of-the-game position for their robot.
2. Each team will be assigned a driver's area at a corner of the square court, outside the court wall behind their start-of-the-game robot position.
3. A robot may be in possession of an unlimited number of Crop Objects at a time.
4. Teams may NOT install a camera or other image generating device on their robot for the purpose of sending a signal / image to an outside the court surface lap top or other type of signal receiver visible to either the Spotter or Driver.

### TOURNAMENT PLAY

1. Tournament standing will be based on the total number of points scored in all games played by each team.
2. Teams will play in an equal number of tournament games.
3. If time permits, teams will participate in an equal number of games against each opponent team.
4. Tournament games will last 4 minutes.
5. The amount of time between games will be determined by the number of participants. This information will be provided to teams at the start of the tournament.
6. Between tournament games, battery changes and repairs to robots may be completed at the team's assigned pit area worktable.
7. During the competition, students must maintain safety at industry standards such as the wearing of safety glasses at all times in the pit area.
8. During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.
9. Damaging the court, the Crop Distribution Bin, Crop Objects or Destination Stand is illegal. If a robot's design causes damage to the court / the Crop Distribution Bin, Crop Objects or Destination Stand then it will not be allowed to compete until it can operate without causing damage. Games missed due to this situation will be forfeited.

NOTE: Damage is considered to be BREAKING court components. Robots bumping into court components and causing them to shift position without breaking any court element will NOT be considered to be damaging the court. It is expected that all court components will be fixed firmly in place so that the court is a neutral factor in the competition.

Deliberate strategies aimed at the destruction, collision, damage, overturning, entanglement or active blocking of competitor robots are not in the spirit of the game and are strictly forbidden. Ramming and pushing are not allowed.

Note: A warning will be given for the first offense. A second occurrence in a single game will result in forfeiture of and removal from the game.

Expulsion from the competition will occur after a third game disqualification.

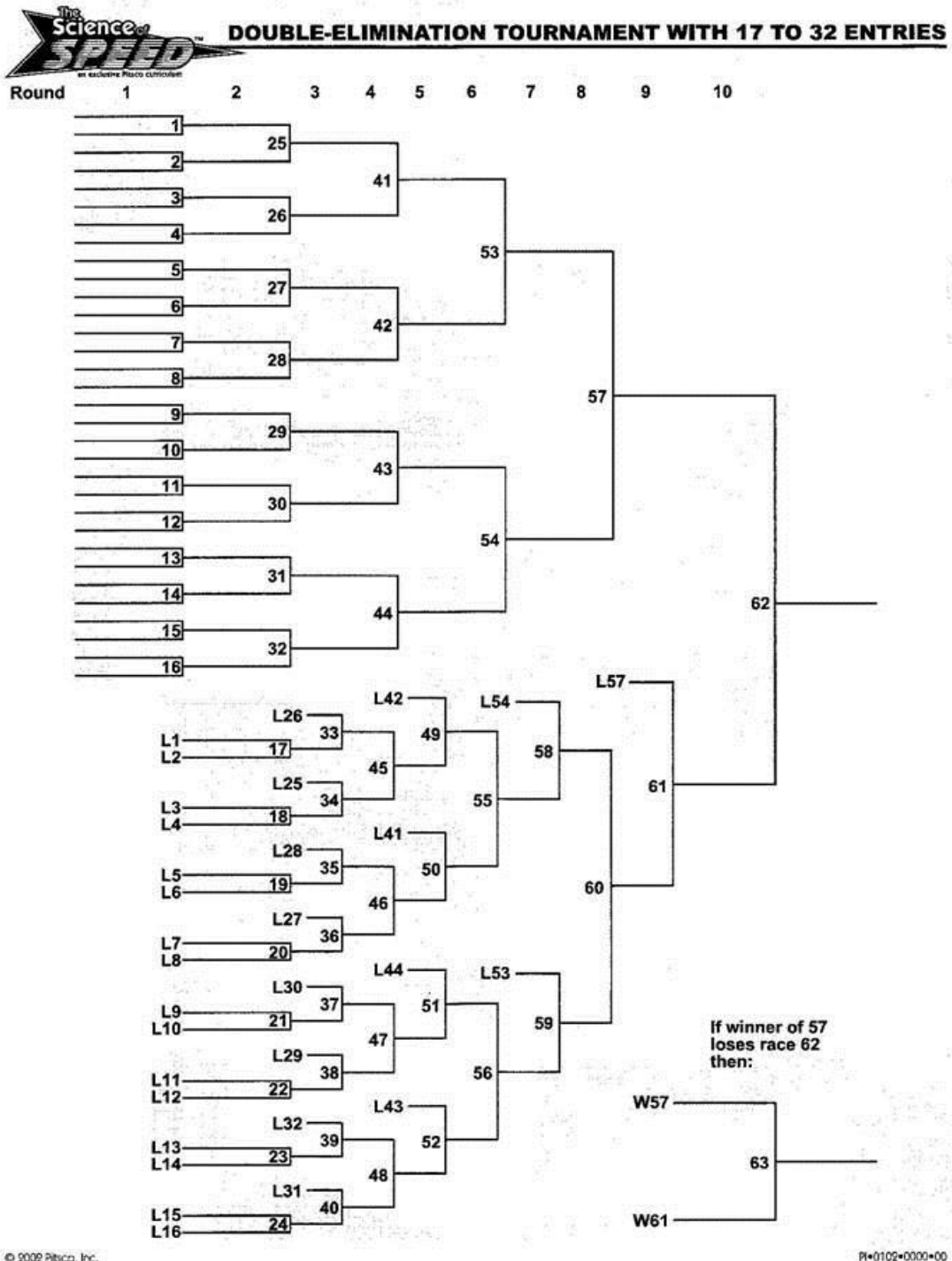
**NOTE: Teams MUST expect there WILL BE ACCIDENTAL COLLISIONS during game play when two Robots are pursuing Crop Objects in the Collection Bin and neither driver decides to back off as they both are approaching the Crop Objects.**

10. Games will start on time. Teams are responsible for knowing when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game.
11. If teams must withdraw from a scheduled game due to mechanical problems then they are asked to inform the Referee as promptly as possible of their decision to default 'Forfeit the Game'.
12. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
13. If a robot is malfunctioning and represents a hazard to participants, other robots or itself in the opinion of the Referee, then, the referee may stop the clock, and may authorize the shutting off of the robot during a game. Disabled robots or parts of robots not generating any safety concerns will be left on the court until the game time expires.
14. Teams will be allowed two competitors in the courtside area. Drivers and spotters may switch roles during a game. The driver is the competitor holding the robot controller and controlling the robot. The spotter is the competitor providing navigational guidance to the driver through verbal instructions and hand gestures.
15. Drivers must remain in their assigned area throughout the game.
16. Spotters may move freely within the shared spotter's areas.
17. Spotters may **not** enter an opponent team's drivers area.
18. At the start of a game, robots are expected to be in their assigned starting positions. Robots arriving AFTER the game has started will be allowed to enter the game and use the time remaining in the 4 min. game.
19. Robots must not leave the competition court at any time during a game.
20. It will be a referee's ruling that decides if an 'End of the Game Crop Delivery' took place before or after the game-ending buzzer sounded.
21. Crop Objects landing outside the court boundaries, as a result of robot behavior, **will not be returned** to the competition court.

#### PLAYOFF PLAY

1. 16 teams will advance to the playoffs following the tournament.
2. Two robots will play on the court in playoff games.
3. Playoff games will be standard game length (4-minutes).
4. Playoff games cannot end in a tie. If a tie score exists in a playoff game then additional 4 minute periods will be played (as many as needed) until one of these extra periods ends with one team ahead. Note: Teams will NOT be allowed to return to their pit area table to make repairs, change batteries between the extra periods of a playoff game. If 'Overtime Periods' are required the time between these periods will be set at 4 min.
5. The Playoffs will be structured on a double knock-out format. Teams will need to lose TWO playoff games to be eliminated.
6. Initial playoff game pairings will be based on the final tournament standings.

The playoff pattern displayed in this scope is based on sixteen teams.



### COURT LAYOUT

Please note: Although great pains will be made to keep the court in compliance with the drawings, some inaccuracies in construction may occur. Please make your robot designs allowing for a possible ½ inch tolerance.

The primary court items that have a direct bearing on robot design are:

- 1) The open court surface consists of the good side of a 'Good One Side Plywood Sheet'.
- 2) The perimeter court wall is made from 2 by 4 inch planks laying on their narrow edge.
- 3) The Destination Stand is plywood and the Top of the 4 by 4 foot by ¾ in. Plate it is on will be the good side of a 'Good One Side Plywood Sheet'

Detailed court information has been included in the Appendix Section of this scope document.

## THE ROBOT

### RESTRICTIONS

All robots must **pass** a pre-competition inspection for compliance with the safety and design rules before they will be allowed to participate in tournament games.

Note: Robots must remain in compliance with these rules throughout the competition. If teams fall out of compliance with these rules then they will not be permitted to compete and will forfeit all of their scheduled games until they have corrected the problem.

### START OF THE GAME ROBOT STATUS

When a robot's main power is turned on prior to the start of a game the robot must be in an overall 'Idle State' and the following conditions must exist:

1. The robot must be stationary in its assigned starting location.
2. The robot must be in compliance with the maximum overall size restriction of 8 cubic feet.
3. All systems may be ON.
4. All required system start-up adjustments must be completed.
5. All electrical / mechanical systems and student made electronic circuits must be under the control of a kill switch(es) capable of being shut off with a single hand motion.
6. Air system circuits may be fully charged to 100 PSI and their compressors can be ON.

### OVERALL ROBOT SIZE

Robots must not exceed an overall size of 8 cubic feet (13,824 cubic inches) at the start of each game. Robots may expand to a larger size once a game has started.

Overall robot size will be calculated by using the maximum single dimension in each category (length / width / height) of the robot, not average dimensions.

This overall size maximum will allow a robot to be any of the following example sizes, or indeed some other variation that does not exceed 13,824 cubic inches:

- (a) an overall dimension of **24 by 24 by 24-inches**, (13,824 cubic inches), or
- (b) an overall dimension of **42 by 18 by 18-inches**, (13,608 cubic inches), or
- (c) an overall dimension of **36 by 21 by 18-inches**, (13,608 cubic inches), or
- (d) an overall dimension of **48 by 24 by 12-inches**, (13,824 cubic inches).

Metric Robot Size Conversion:

24 inch = 60.96 cm

61 cm x 61 cm x 61 cm = 226,981 cubic cm

8 cubic foot = 226 534.773 693 507 cubic cm

### OVERALL ROBOT WEIGHT

- No weight restriction is imposed on the robots.
- Robots should be built with robustness in mind. Accidental bumps and scrapes will happen.
- Teams must consider protection of sensitive components and durability of exposed ones when designing all elements of their robots.

### SUGGESTED PARTS LIST

A quick note about manufactured parts: Although it is impossible to create a comprehensive list of all acceptable parts, a list has been made to provide guidance for teams.

Acceptable components:

- |                                |                             |   |
|--------------------------------|-----------------------------|---|
| • electronic speed controllers | • rims                      | • servo motors                                |
| • motors                       | • bearings                  | • batteries                                   |
| • gears                        | • compressed air tanks      | • harvested gearboxes from mechanical devices |
| • sprockets                    | • gauges                    | • PLC unit and interface                      |
| • chains                       | • tubing connectors         | • Microprocess                                |
| • belts                        | • RC transmitter / receiver |   |
| • tires                        |                             |   |

## Examples

Wheel assembly: tire, tube, hub & bearing.

Power plants, this could involve complete core systems. The intention is to enable power to be delivered to student-created mechanisms.

- A power drill where the complete motor/gear box/clutch/chuck is used.
- An automobile power headrest motor/flexible drive shaft/linear gear assembly are used.
- A photocopier chain drive involving the motor/drive shaft/drive chain sprocket is used.
- A photocopier gearbox to be used to manage a non-photo-copier motor.
- An electric scooter or wheelchair motor mounted on a student-designed and created frame.

It is a team's responsibility to ensure robot compliance to standards.

## POWER SOURCES / MANAGEMENT

1. The total voltage in any individual circuit **cannot** exceed **24 Volts**.
2. The **maximum continuous** power rating allowed in any circuit is **240 W**, which will be limited by voltage and fuse selection. Example:  $12\text{Volts} \times 20\text{ Amps} = 240\text{ Watts}$
3. Teams are reminded that it is the purpose of a fuse to protect the students themselves and the equipment in their circuits. Teams must develop circuit diagrams, and calculate the appropriate values for all circuits on their robot. Teams must submit a wiring diagram of their robot's circuits.
4. Each current branch path from the battery must include either an **in-line fuse, circuit breaker** or be connected to a dedicated fuse in a rack.
5. Fuse blocks, in-line fuses must be readily accessible for inspection purposes.
6. Teams must use a wire gauge which is appropriate to the current values in each circuit.
7. Batteries must be completely sealed commercial battery packs.
8. All **wires** and **batteries** are to be mounted **securely** to the robot, taking into consideration that they must be protected from damage due to abrasion when the various robot elements move.
9. Teams are responsible for charging their own batteries and must have a complete set of batteries. It is recommended that a spare set be available.
10. Robots must be able to be turned off with a single motion. Robot Controller receivers may be in an independent circuit.
11. Teams may use new or recycled motors. See list of suggested parts.
12. There is no restriction on the number of motors used on a single robot.
13. No explosive materials of any kind may be used (ether, gunpowder, acetylene etc.).

## NON-ELECTRICAL (BATTERY) ENERGY SOURCES

Pressure-based energy sources (air or other) may be pre-charged to a maximum of 100-PSI pressure in their reservoirs (cylinders) at the start of each game.

1. Air pressure systems using competitor-made or modified air pressure hardware are **NOT** permitted.
2. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.
3. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.

4. The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.
5. Tension-based energy sources (elastics, springs or other) may be in either a relaxed at rest state or in a tense / compressed state at the start of each game.
6. Laser devices are prohibited.

### **ROBOT CONTROLLERS**

1. All teams must use 2.4 GHz “non-crystal” control systems.
2. **Teams are allowed the use of only 6 Channels managed through the use of a Maximum of 6 controller components (Joy Sticks / Toggle Sticks / Push Buttons / Dials / Sliding Switches) on their operator-held control unit to support operator to robot communication.**
3. Robots may not transmit information or a signal of any type to ‘Off the Robot’ devices.
4. If a Robot Controller has more than 6 channels available Teams CANNOT move to one of these additional channels in the event of a channel-based equipment failure.

### **PIT AREA**

1. Competitors MUST wear safety glasses in the pit area and it is a competitor’s responsibility to provide their own safety glasses.
2. Only registered robot competitors are permitted in the pit area.
3. Designated teacher/industry team advisors are permitted in the pit area **only** to inspect the worktable setup of their team prior to the start of the tournament.
4. Designated teacher/industry team advisors are **not** allowed in the pit area during tournament and playoff play.
5. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
6. Teams will be provided with pit area workspace on a standard project table. Depending on the number of teams and availability of space, teams may have to **share** a 60 by 30 inch table.
7. Each pit area table will have access to one electrical outlet. Teams are requested to bring a 25-foot multi-outlet extension cord / power bar as part of their equipment.
8. It is required that teams fabricate a **tabletop stand** for holding their robot in the pit area. This stand should hold the robot securely and be capable of preventing the robot from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

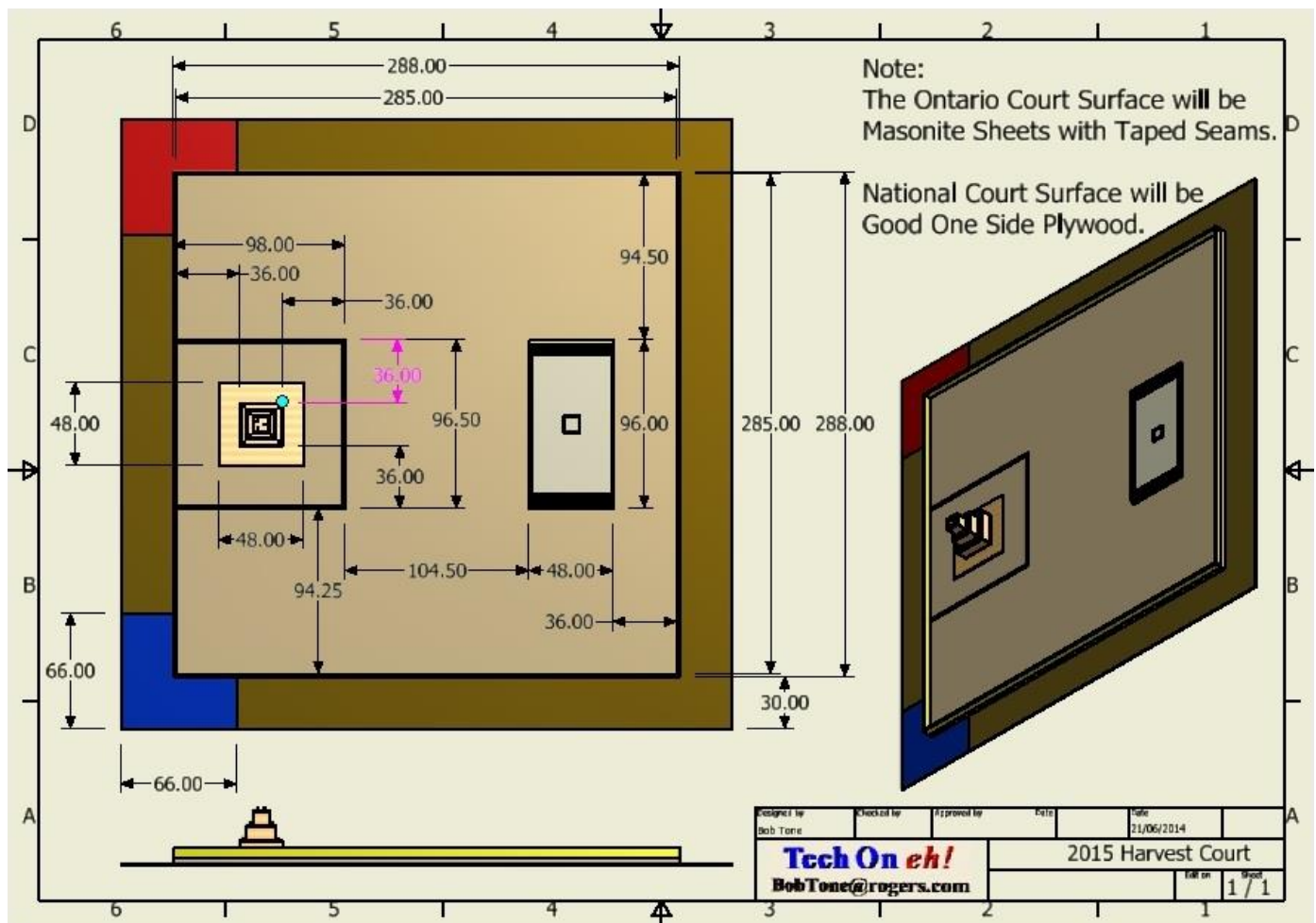


APPENDIX

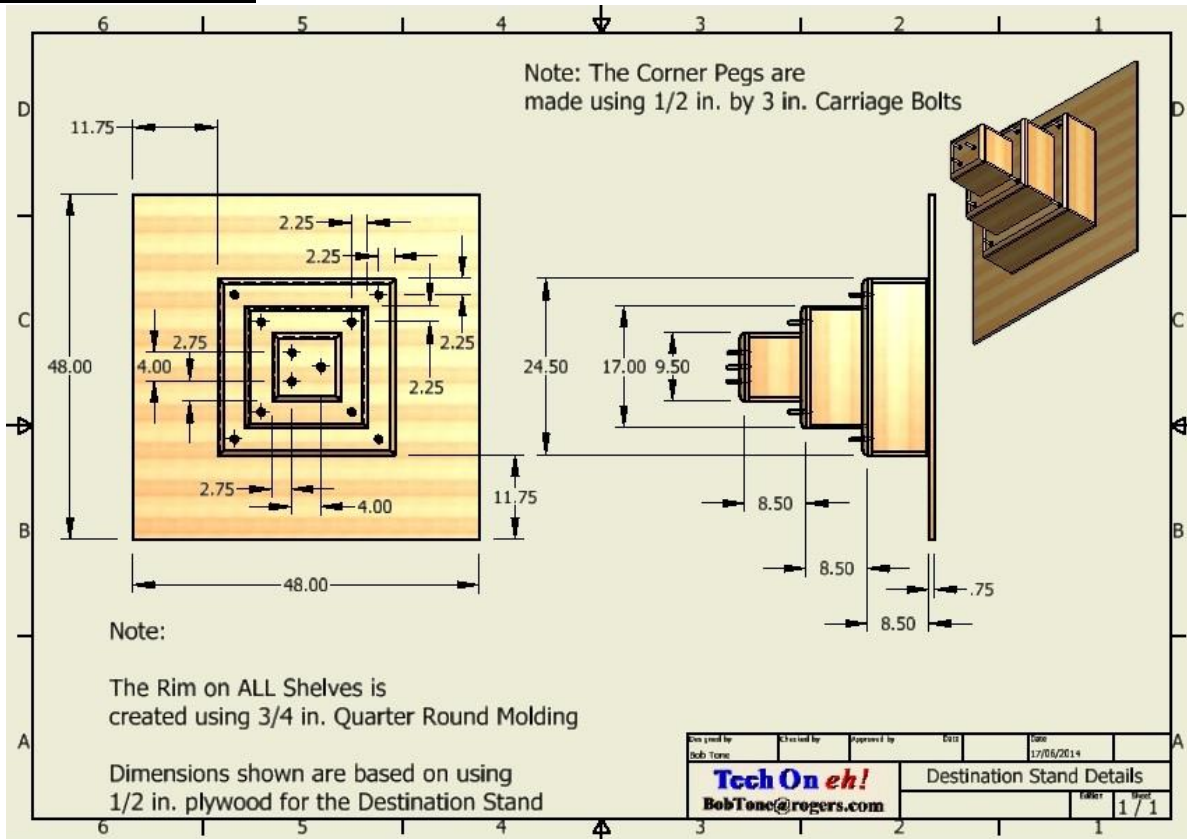
Overall Court Dimensions:

- The court playing surface will be a square measuring 285 inches from inside to inside of opposite court walls with a 30 inch wide perimeter pathway all around the court.
- The perimeter court walls will be made using 2 by 4 inch planks.
- This wall will as a result be approximately 3.5 inches tall.
- The court surface will be concrete, masonite or good one side plywood
- The court floor will be elevated 4.125 Inches above the facility floor.

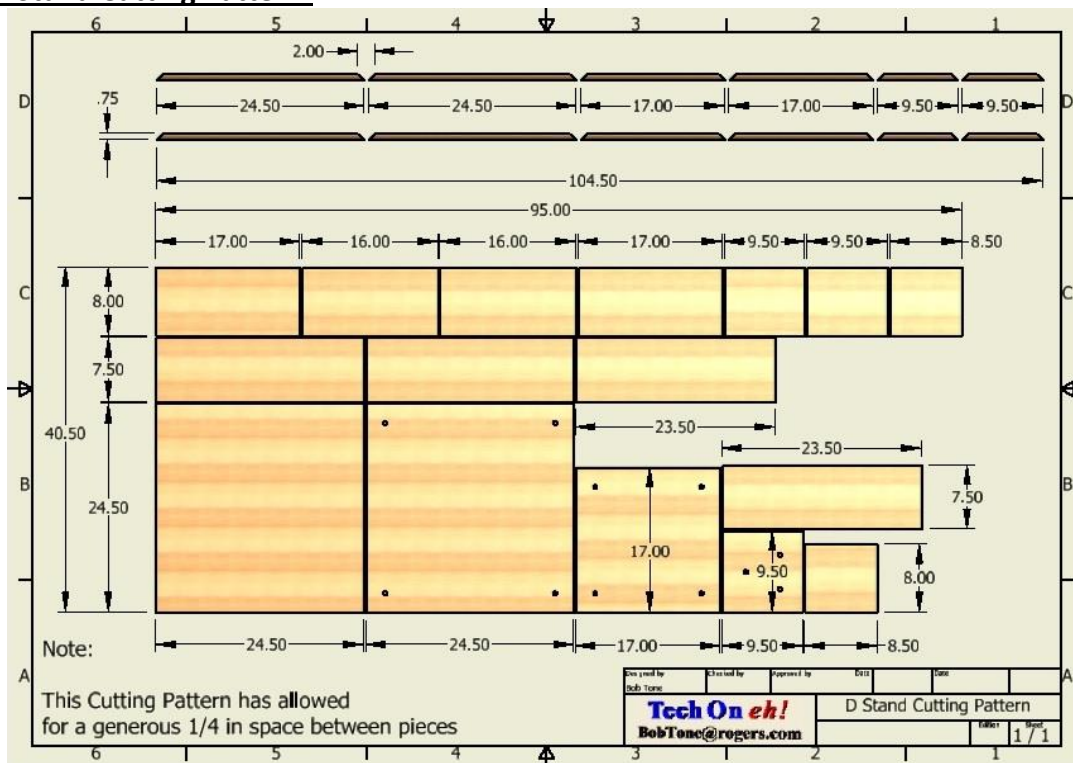
Overall Harvest Court Size Details:



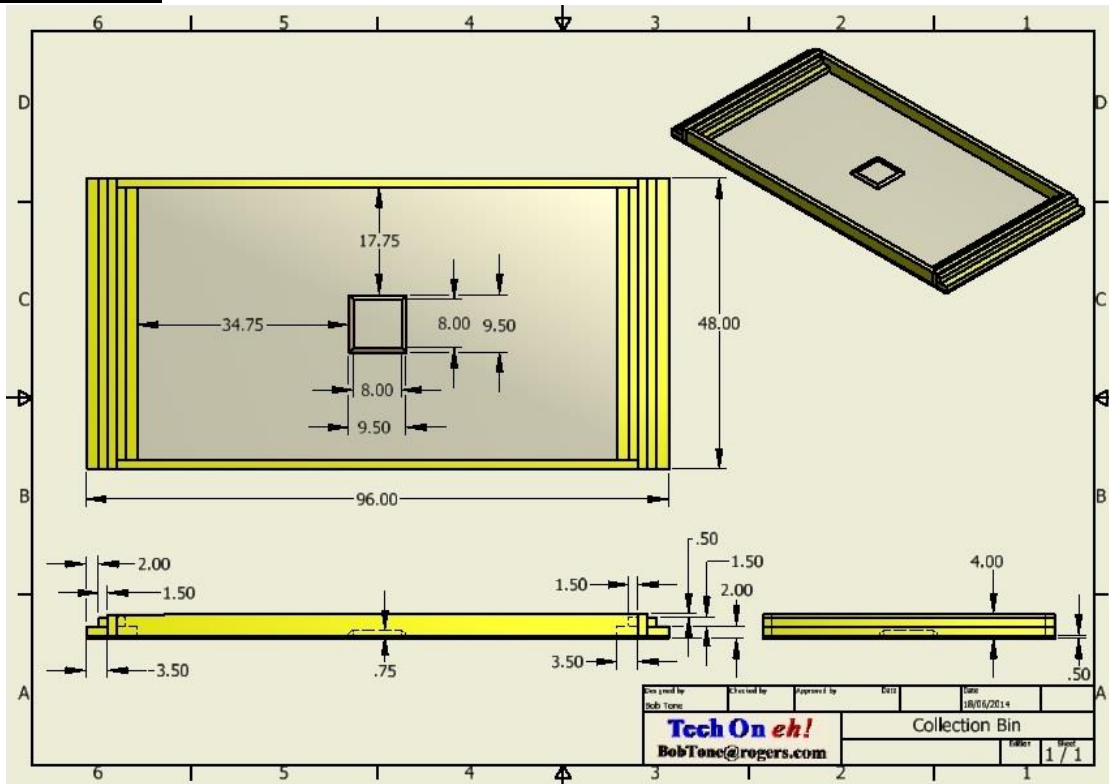
**Destination Stand Details:**



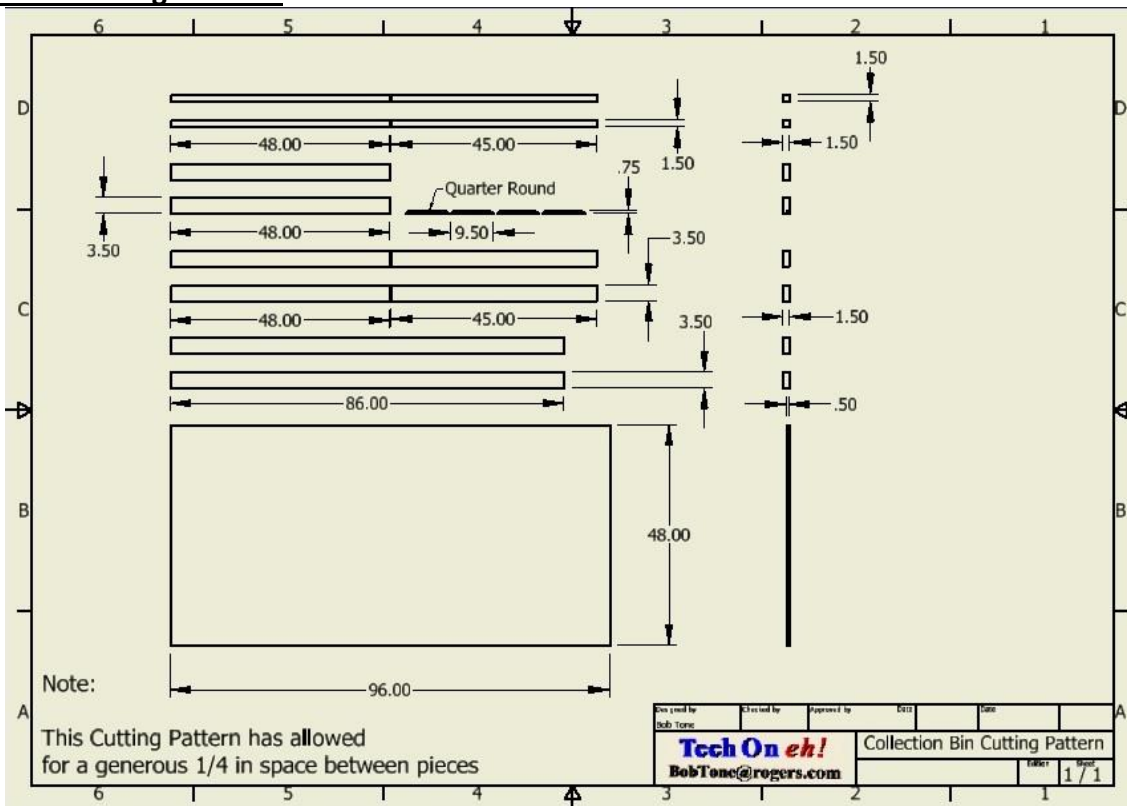
**Destination Stand Cutting Pattern:**



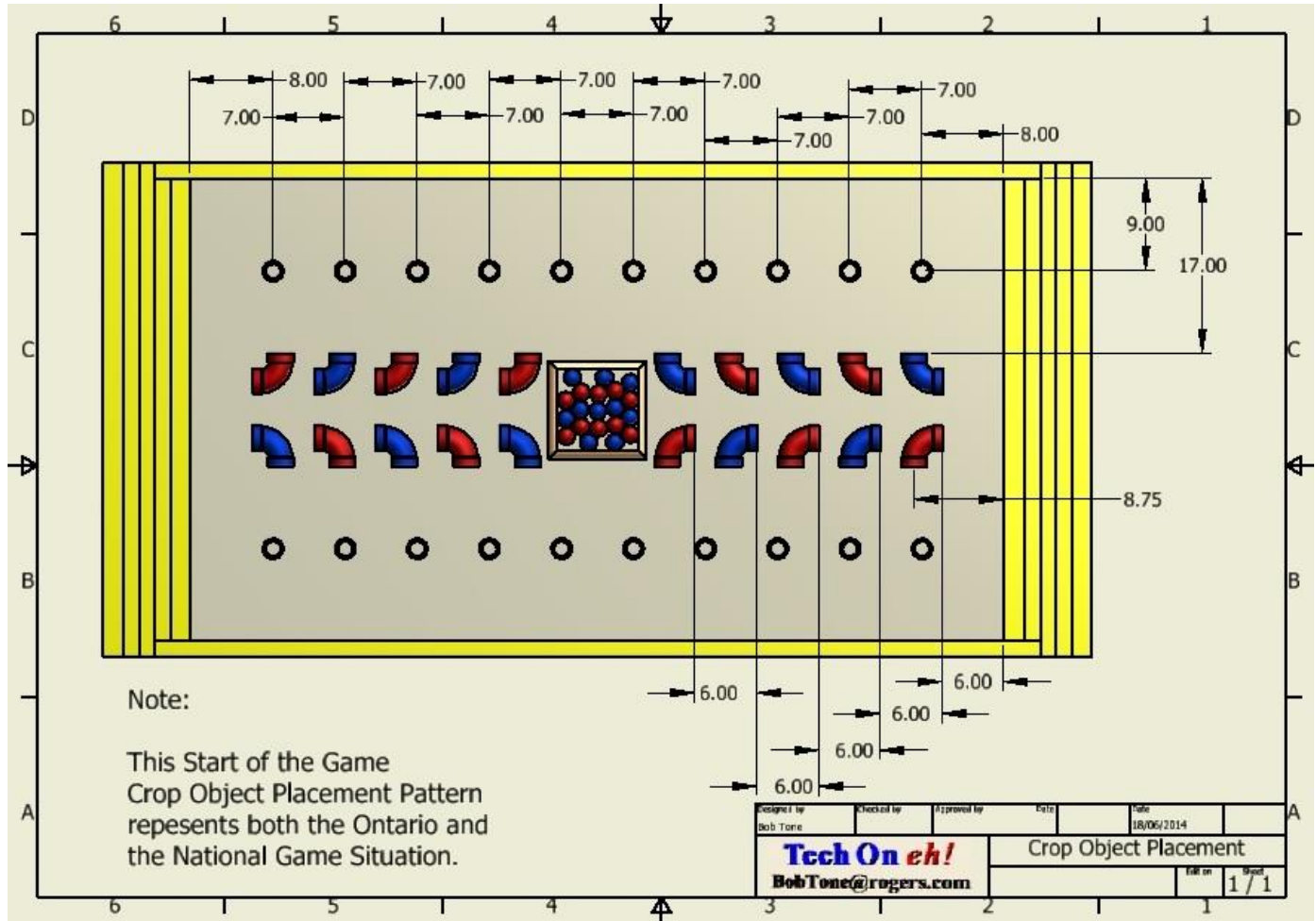
**Collection Bin Details:**



**Collection Bin Cutting Pattern:**



**Start-of-Game Crop Placement in the Collection Bin Pattern:**



**PRE-INSPECTION FOR COMPLIANCE WITH SAFETY AND DESIGN RULES**

- Mandatory Wiring Diagram provided
- Mandatory Pressure System Circuit Diagram provided
- Table Top Robot Stand
- Overall volume  $\leq 8 \text{ ft}^3$  or  $13,824 \text{ in}^3$
- No explosives/combustibles
- No lasers
- All batteries are sealed commercial batteries in good physical condition
- Batteries wired in series should be the same amp hour rating (ex. both 1500 mAh) and batteries in parallel are of same voltage (ex. both 12 volts)
- Batteries securely mounted
- Total voltage in any individual circuit does not exceed 24V
- No circuit exceeds 240W (Voltage x Fuse Current Rating)
- All circuits have a fuse or breaker (breakers must have **DC rating**)
- Appropriately gauged wiring for each circuit
- Wires and connections are in good physical condition
- Wires and connections are not exposed to physical abrasion
- Motors not over-voltaged by more than 50% (a 12V motor can be run at 18V)
- No competitor-made or modified air pressure hardware being used
- Only commercially manufactured pressure tanks (cylinders) can be used
- Pressure indicator
- Pressure in tanks does not exceed 100 psi
- Over-pressure safety valve
- Pressure tanks and related gauges and controls are shielded from damage due to collisions
- Robot is able to be turned off with a single motion. Radio receivers may be in an independent circuit.
- Only 6 Channels managed through the use of a maximum of 6 controller components (Joy Sticks / Toggle Sticks / Push Buttons / Dials / Sliding Switches) on their operator-held control unit to support operator to robot communication are being used
- Demonstration of robot functionality with rated fuses

Additional concerns:

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|--|--|
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|--|--|

Robot Evaluator Signature

Team Representative Signature