Jeu de Tire D'érable
(Maple Taffy Game)
Mobile Robotics Project Description

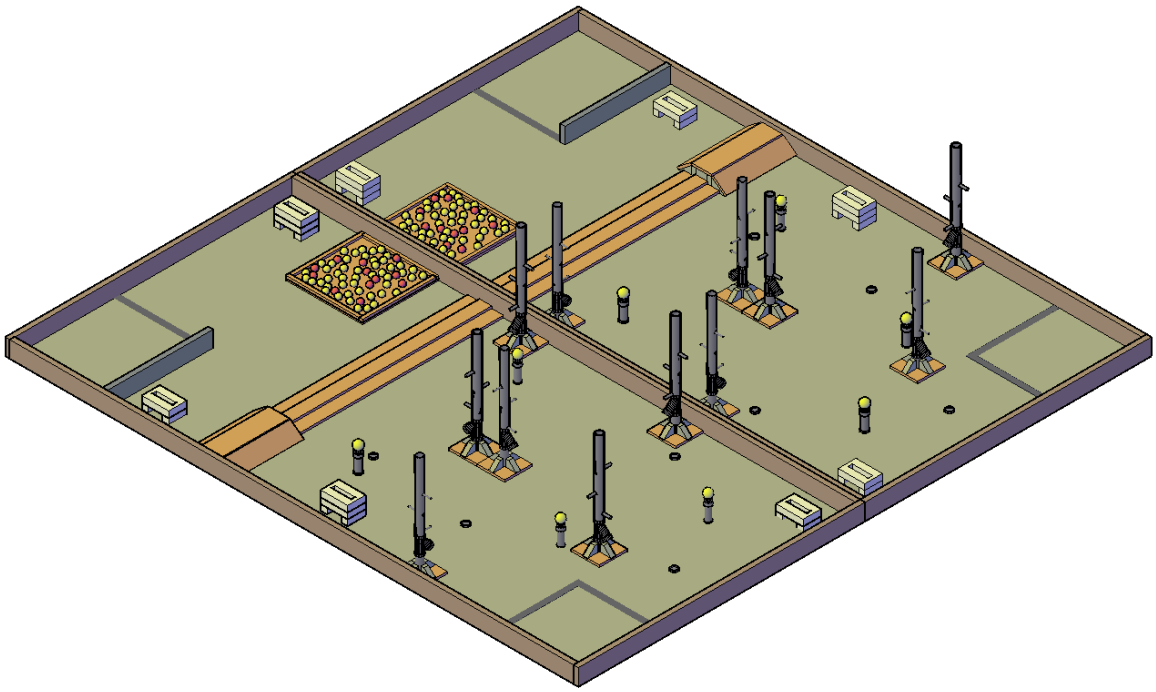

Figure 1: Overall Court

12 April 2024
NSCC Akerley Campus
Dartmouth, NS

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1. Definitions

A. Tele-Operated Robot Elements are elements under the direct/active control of competitors during game play using one or two radios/game controllers held by the courtside competitors.

B. Independent Autonomous Elements are elements that at the start of a game have a competitor pressing their start button or enter on a computer keyboard as the only competitor to Independent Autonomous Element communication during the entire game.

   a. Once the expiration of the time has been complete, these devices must be turned off safely. This may be done by the PTC/Judges.

   b. Mobile Independent Autonomous Elements are considered any autonomous element that moves about the court.

   c. Stationary Independent Autonomous Elements are considered any autonomous element that does not move about the court.

   d. Independent Autonomous Elements may interact with the team's tele-operated mobile robot. Tele-operated robots may initiate an active response by the Independent Autonomous Element which may be managed by a mechanical based system or a pre-programmed system internal to the Independent Autonomous Element

2. Game Overview

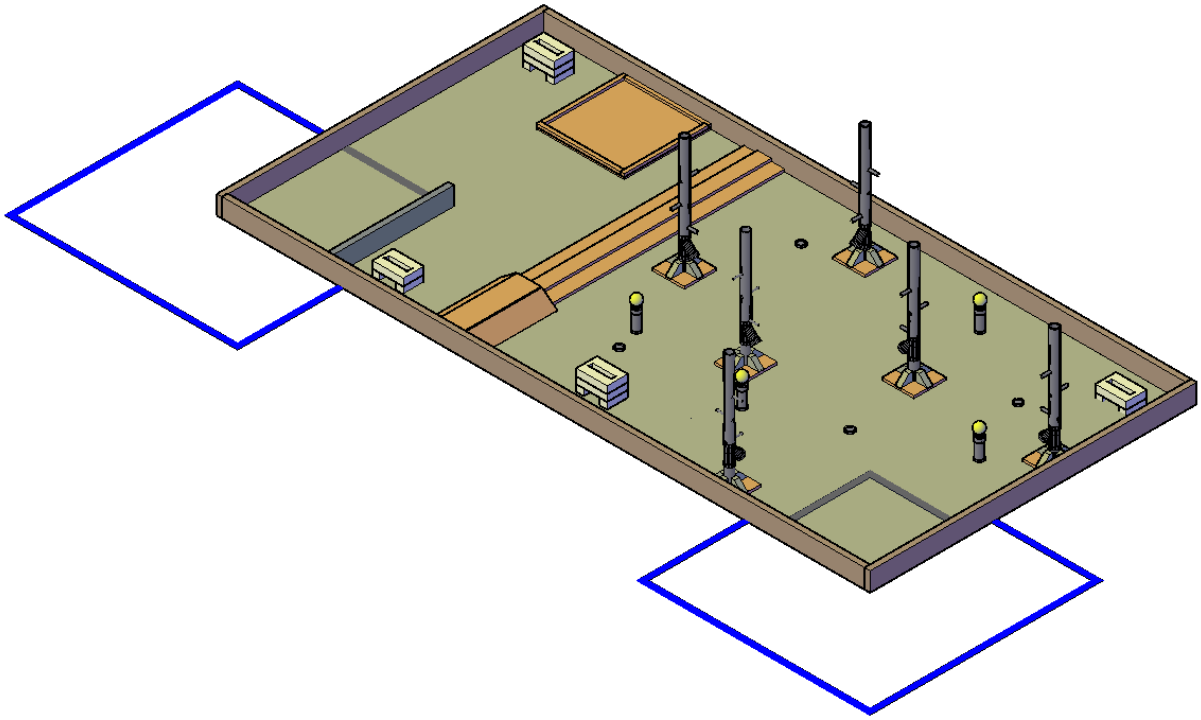

Figure 2: Team Court Overview

The core game situation requires a robot or robots to use the components provided in their Exclusive Use Court Space to:

A. Harvest the "Sap" from the "Maple Trees"
B. "Refine" the sap into "Maple Syrup"
C. Gather and move the "Snow Piles" into a designated location
D. Deposit the "Maple Syrup" onto the "Snow Piles" to make "Maple Taffy"

3. Detailed Court Areas

3.1. Court Overview

A. The overall court playing surface will be a 16′ by 16′ square.
B. Exclusive use team spaces are 8′ by 16′ rectangles.
C. Perimeter court walls will be made using 2" by 6" planks. This will result in the walls being approximately 5.5" tall.
D. The court surface may vary between melamine, concrete, hardboard, plywood, or the facility floor.
E. Detailed court information has been included in the Appendix section of this document.

3.2. Sugar Bush Area

A. Located at one end of the court area within each team's exclusive use area there will be a "Sugar Bush Area".
B. The "Sugar Bush Area" will contain:
    a. 6 "Maple Trees"
    b. 4 "Saplings"
    c. 4 "Rocks"
    d. 2 "Snow Piles" starting locations
C. The location of the "Maple Trees", "Saplings", and "Rocks" will have set locations.
    a. The location of these will be changed between the Round Robin and the Tournament.
    b. Detailed locations available in the Appendix A.
    c. These items will be secured to the court surface.
D. The "Snow Piles" will have set starting locations in the "Sugar Bush" as detailed in the Appendix A.
    a. One snow pile will be a "Short Snow Pile" and one snow pile will be a "Tall Snow Pile".
E. Teams will harvest the "Sap" from the trees in the "Sugar Bush Area".
F. Teams should try not to knock over any of the "Saplings".

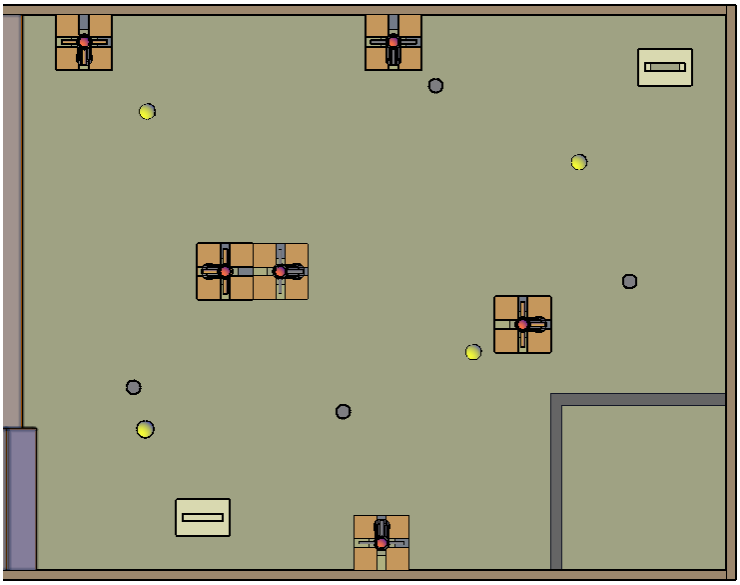

Figure 3: Sugar Bush Area

3.3. Sugar Shack Area

A. Each team's exclusive use area will contain a "Sugar Shack Area".

B. The "Sugar Shack Area" contains:

   a. 1 Sugar Shack Boiler

   b. "Maple Taffy Zone"

   c. 2 "Snow Piles" starting locations

C. The "Snow Piles" will have set starting locations in the "Sugar Shack Area" as detailed in the Appendix.

   a. One snow pile will be a "Short Snow Pile" and one snow pile will be a "Tall Snow Pile".

D. The "Sugar Shack Boiler" will be located on the middle barrier wall, 24 inches from the exterior court wall.

E. "Maple Taffy Zone" is an area within the "Sugar Shack Area" where teams will make the "Maple Taffy", located at the bottom left corner of Figure 4.

   a. This zone measures 30 inches wide by 36 inches in length.

   b. This Zone is defined by a 36 inch long wall (constructed of a 2" by 6" plank) along one side, the exterior court walls along 2 sides, and a tape line along the 4th side. See court dimensions for full details.

      i. The defining planes are the interior limit of the walls and the vertical plane extending from the exterior edge of the tape line.

      ii. Teams are not permitted to reach over the walls defining the "Maple Taffy Zone"

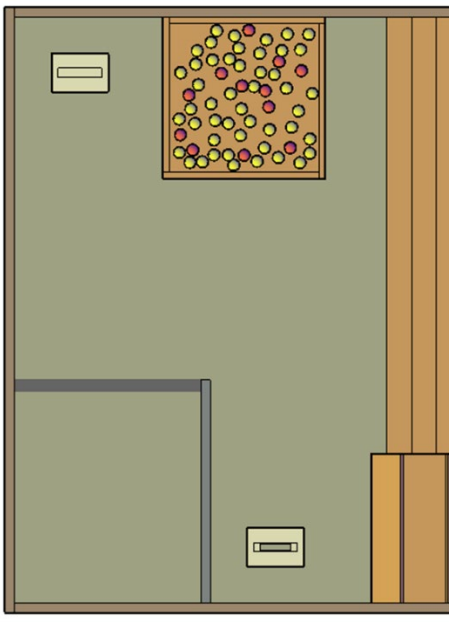

Figure 4: Sugar Shack Area

3.4. Hill Area

A. Separating the "Sugar Bush" from the "Sugar Shack Area" is the "Hill Area".

B. The "Hill Area" extends across each team's exclusive use area, from the middle barrier wall to the exterior wall.

C. Along the exterior wall, there is a 24-inch-wide ramp section.

D. The remaining hill area is composed of a 2-tiered step section

   a. The base of the step section is a 12-inch wide ¾ inch plywood piece.

   b. The top step is a 4-inch wide ¾ inch plywood piece, centered on top of the base step piece.

   c. This results in 4-inch wide ¾ inch high steps.

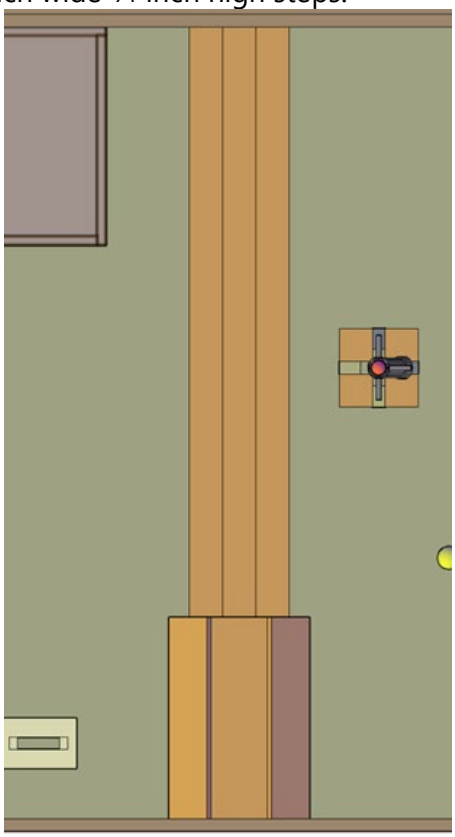

Figure 5: Hill Area

3.5. Starting Area

A. Tele-operated robot starting area is a 30-inch square located in the "Sugar Bush" in the corner of the exterior walls.

B. Optional Autonomous Element must start (and remain) within the "Sugar Shack Boiler"

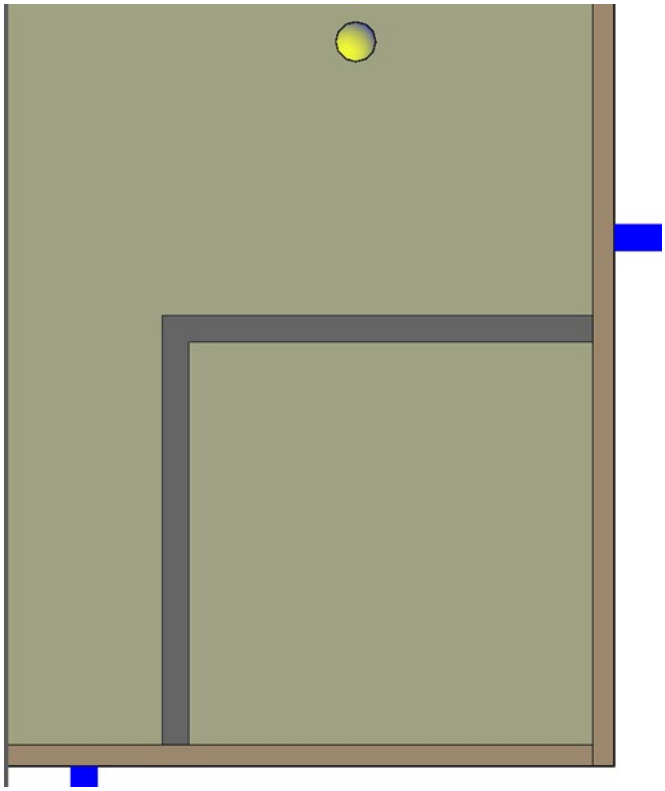

Figure 6: Tele-Op Robot Starting Area

3.6. Driver Zones

A. Each driver or spotter must remain in their designated driver zone.
B. A maximum of one driver may occupy each driver zone.
C. Driver zones are located on the exterior corners of the court.
D. Each team has 2 designated driver zones.
E. No other competitors are permitted within 6′ of the court.
F. See "Court Dimensions" in Appendix A for detailed dimensions.

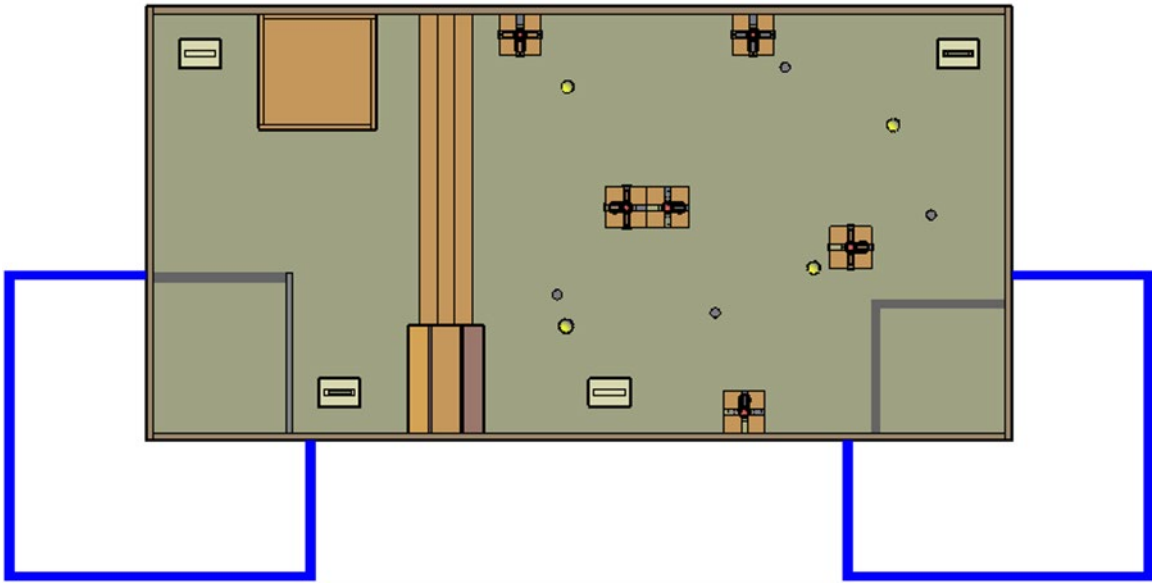

Figure 7: Net Placement

3.7. Game Pieces

A. Maple Trees:

a. Each "Sugar Bush" will contain 6 "Maple Trees".

i. The locations of the "Maple Trees" will change between the Round Robin and the Tournament.

ii. See "Court Dimensions" in Appendix A for specific locations.

b. "Maple Trees" are composed of:

i. ¾ inch thick plywood base, measuring 9 ⅜" x 9 ⅜"

ii. 4 supports, which are 2x4 pieces of wood cut at a 45o angle

iii. 2" inner diameter ABS pipe. There will be a base piece and a top piece.

iv. 2" ABS 45o wye fitting, which will be called the "Spout"

v. 3 dowel pegs, which are 5" in length and ½ inches in diameter. These are called the "Taps"

vi. A 2x2 piece of wood cut at a 45o angle, to act as a block in the base ABS pipe

vii. Full details on the construction of the "Maple Trees" are available in the "Court Dimensions" in Appendix A

c. There are 2 types of "Maple Tree"

i. The "Short Maple Tree" will have a base ABS pipe length of 4 inches, and an ABS pipe top piece of 26 inches in length.

ii. The "Tall Maple Tree" will have a base ABS pipe length of 6 inches, and an ABS pipe top piece of 24 inches in length.

iii. The resulting difference between the trees will only be the height of the "Spout"

d. Each tree will have 3 "Taps".

i. The "Taps" are ½ diameter dowel, which is 5 inches in length.

ii. The "Tap Holes" in the "Maple Tree" are ⅝ inch diameter, and extend through both sides of the ABS pipe, directly through the middle of the pipe.

iii. The lower "Tap" will be in line with the spout.

iv. The middle "Tap" will be at a 90o angle with the spout.

v. The upper "Tap" will be at a 90o angle with the spout and a 180o angle with the middle "Tap"

vi. The "Tap Holes" will be drilled at:

vii. On the "Short Maple Tree":

1. Lower "Tap" will be located 3 inches from the bottom of the top ABS pipe piece (to the center of the hole).

2. Middle “Tap” will be located 6 inches above the lower “Tap” hole (measured center to center)
3. Upper “Tap” will be located 6 inches above the middle “Tap” hole (measured center to center)

viii. On the “Tall Maple Tree”:

1. Lower “Tap” will be located 1 inch from the bottom of the top ABS pipe piece (to the center of the hole).
2. Middle “Tap” will be located 6 inches above the lower “Tap” hole (measured center to center)
3. Upper “Tap” will be located 6 inches above the middle “Tap” hole (measured center to center)

ix. The “Tap Heights” on all trees will be the same distance from the court surface.

1. All “Lower Taps” will be at the same height from the court surface.
2. All “Middle Taps” will be at the same height from the court surface.
3. All “Upper Taps” will be at the same height from the court surface.

x. The “Taps” will start with one end of the dowel piece lying flush to the ABS pipe surface, and the other end sticking out of the “Maple Tree”.

1. The “Lower Tap” will have the end sticking out facing the same direction as the spout.
2. The “Middle Tap” will have the end sticking out facing the left side of the tree (when looking at the tree from the side which the spout is facing)
3. The “Upper Tap” will have the end sticking out facing the right side of the tree (when looking at the tree from the side which the spout is facing)

xi. Each “Tap” will hold a set amount of “Sap Pieces”.

1. The “Lower Tap” section of the “Maple Tree” will have 3 yellow “Sap Pieces”
2. The “Middle Tap” section of the “Maple Tree” will have 2 yellow “Sap Pieces” and 1 red “Sap Piece”, in the order of “Yellow - Yellow - Red” (bottom to top)
3. The “Upper Tap” section of the “Maple Tree” will have 3 yellow “Sap Pieces” and 1 red “Sap Piece” in the order of “Yellow - Yellow - Yellow - Red” (bottom to top)

xii. Pulling the “Tap” out of the tree will allow the “Sap Pieces” to fall down the inside of the “Maple Tree”

1. Pulling the “Lower Tap” will allow the “Sap Pieces” to fall out of the spout.
2. Pulling the “Middle Tap” or the “Upper Tap” will allow the “Sap Pieces” to fall within the tree, and onto any remaining pieces within the tree.
    a. To be specific: If a lower “tap” has not been removed, and a higher “tap” has been removed, then all the “Sap Pieces” would be resting on the lower “tap” that has not been removed.

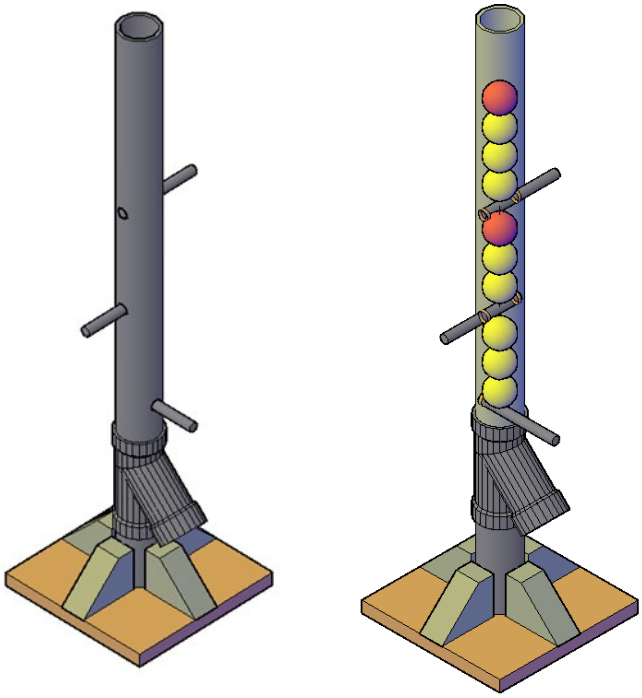

Figure 8: Maple Tree

B. Snow Piles
    a. There are 4 “Snow Piles” in this game.
    b. “Snow Piles” are constructed using 2” thick rigid foam insulation, then covered in white duct tape.
    c. There are 2 different types of “Snow Piles”
        i. The “Short Snow Pile” is constructed using 2 layers of rigid foam insulation.
            1. The bottom layer is composed of 2 pieces, 2 inches in width and 6 inches in length. They are positioned 5 inches apart.
            2. The top layer is composed of 1 piece, 9 inches in width and 6 inches in length.
            3. The top layer has a 1 inch wide, 7-inch-long rectangular hole cut through the middle of it.
            4. See “Court Dimensions” in Appendix A for full details.

ii. The “Tall Snow Pile” is constructed using 3 layers of rigid foam insulation.
    1. The bottom layer is composed of 2 pieces, 2 inches in width and 6 inches in length. They are positioned 5 inches apart.
    2. The middle layer is composed of 1 piece, 9 inches in width and 6 inches in length.
    3. The top layer is composed of 1 piece, 9 inches in width and 6 inches in length.
    4. The top layer has a 1 inch wide, 7-inch-long rectangular hole cut through the middle of it.
    5. See “Court Dimensions” Appendix for full details.

d. “Snow Piles” will start in their designated starting location.
    i. 2 “Snow Piles” will start in the “Sugar Bush”
    ii. 2 “Snow Piles” will start in the “Sugar Shack Area”
    iii. For detailed locations, see “Court Dimensions” Appendix.
    iv. “Snow Piles” will start in these locations for all matches.

e. “Snow Piles” must be moved from their starting location to the “Maple Taffy Zone”.
    i. To be considered “inside of the Maple Taffy Zone” the “Snow Pile” must be completely within the zone, as defined by the vertical planes on the limits of the “Maple Taffy Zone” as described above.
    ii. “Snow Piles” must be completely within the “Maple Taffy Zone” for the “Maple Syrup” pieces placed on them to form the “Maple Taffy” and be scored as such.

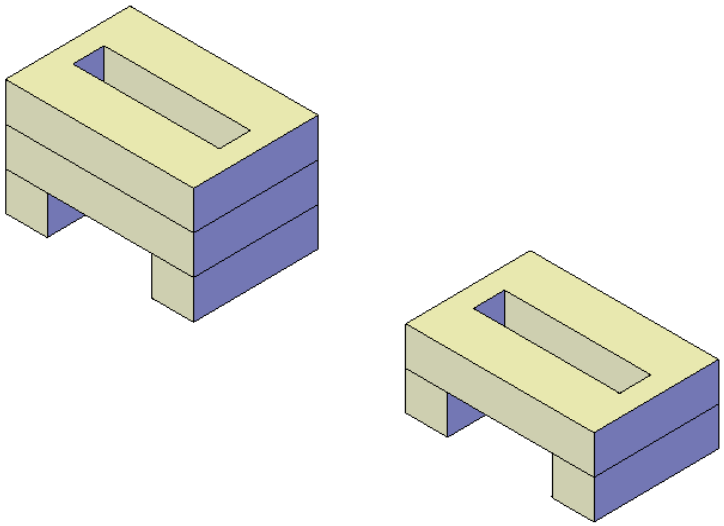

Figure 9: Snow Piles

C. Sugar Shack Boiler

a. Each team will have access to a "Sugar Shack Boiler" within their "Sugar Shack Area".

b. "Sugar Shack Boiler" will be composed of one 26-inch square piece of ¾ inch plywood as its base.

c. On top of the base, there will be a 1-inch-wide strip of ¾ inch plywood along the exterior edge of the "Sugar Shack Boiler".

d. The "inside" space in the "Sugar Shack Boiler" will be a 24-inch square.

e. A team's optional "autonomous element" must remain inside the "Sugar Shack Boiler" at all times.

i. The optional "autonomous element" is permitted to start within the "Sugar Shack Boiler"

ii. The optional "autonomous element" is not permitted to be outside of the "Sugar Shack Boiler"

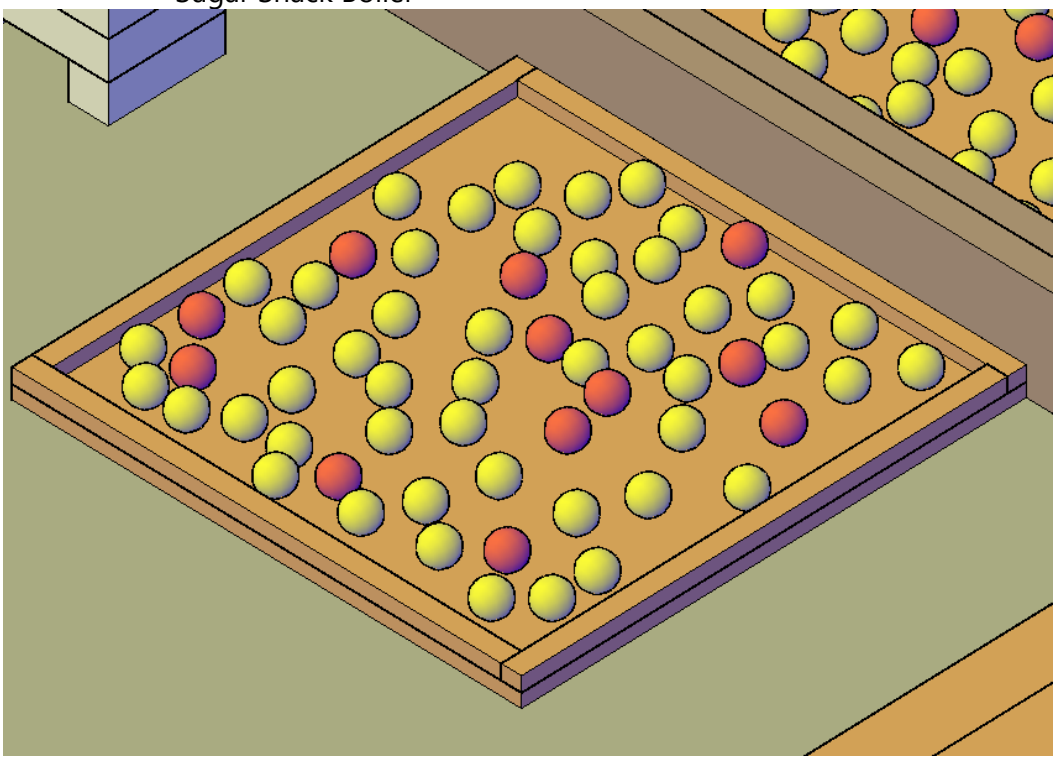

Figure 10: Sugar Shack Boiler

D. Saplings and Rocks

a. Located within the "Sugar Bush", there are 4 "Sapling" obstacles and 4 "Rock" obstacles.

b. Each "Sapling" consists of:

i. A 6 inch long 1.5-inch diameter ABS pipe, capped on both ends. The caps used are identified in the parts list at the end of this document (with the court dimensions and parts).

1. The top cap will remain unmodified.
2. The bottom cap will be cut down to an internal height of ½ inches.

ii. On the top of the ABS pipe, on top of the cap, there will be a 1-inch hex nut secured to the top. On top of the hex nut is where a standard tennis ball will sit.

iii. The cap on the bottom of the ABS pipe will be secured to the court surface. The ABS pipe will be fitted into this cap, but will be able to be knocked loose from the base cap.

1. Knocking the ABS pipe from the cap onto the court surface will not be considered damage to the court.
2. Any action by the robots which cause the secured cap to break away from the court surface may be considered damaging the court, and would be treated as such.

c. Each "Rock" consists of the same bottom caps as the "Sapling".

i. The cap will be secured to the court surface.

1. Any action by the robots which cause the secured cap to break away from the court surface may be considered damaging the court, and would be treated as such.

d. The "Saplings" and "Rocks" will switch places between the Round Robin and the Tournament.

i. See "Court Dimensions" Appendix for full details.

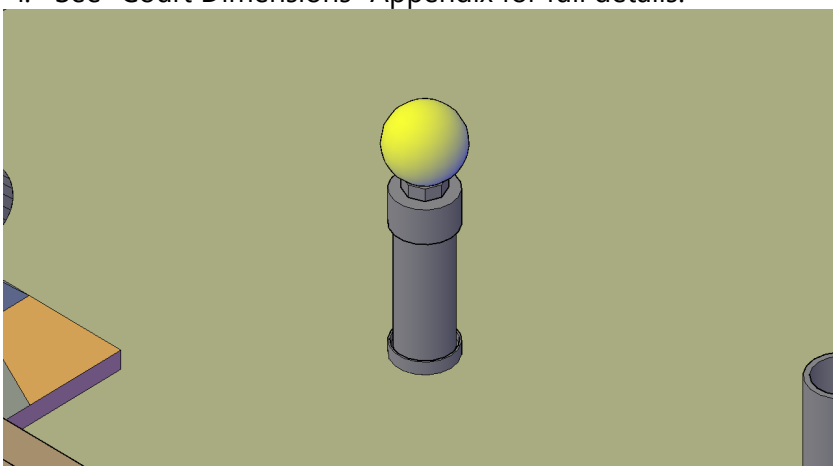

Figure 11: Sapling

3.8. Additional Notes

a. At no time are teams permitted to intentionally reach over any wall.

i. Teams are not permitted to cross the middle barrier.

ii. Teams are not permitted to cross the exterior walls.

iii. Teams are not permitted to cross any interior walls.

b. At no time are teams permitted to intentionally pass game pieces over any walls.
c. Any game pieces which fall outside of the court area are no longer in play.
d. Should any game pieces fall into the opponent's court area, those pieces shall remain in play and usable by the opposing team.
    i. This applies to all game pieces which may count for points.
    ii. Should a larger game piece fall into the opposing team's court, it may be removed at the Judge's/PTC discretion.

4. Game Description

A. Games will be played between 2 teams.
    a. Games will last 4 minutes.
        i. The amount of time between matches will depend on the number of teams participating. This information will be provided to teams at the start of the competition.
        ii. Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game.
        iii. Between games, battery changes and repairs to robots may be completed at the team's assigned "Pit Area Worktable", with appropriate PPE and Safety.
B. It is a team decision what roles team members will fill.
    a. Drivers are the competitors holding the robot controller(s) and asserting direct control over a Tele-Operated robot.

5. Scoring Summary

Scoring will be done at the end of each 4-minute match. All scores will be based on the location of things at the end of each match.

5.1. Snow Pile Scoring

A. For each "Snow Pile" delivered to the "Maple Taffy Zone", 2 points will be awarded.
B. Each "Snow Pile" must be completely within the "Maple Taffy Zone" to be awarded points.

5.2. Sap Scoring

A. Every "Sap Piece" within the "Sugar Shack Boiler" at the end of the match will be awarded 1 point.
    a. This includes all "Maple Syrup" pieces and all "Non-Maple Component" pieces.
    b. Within the "Sugar Shack Boiler" is defined as within the 24-inch square defining the "Inside of the Sugar Shack Boiler".
    c. "Sap Pieces" are considered to be within this area as long as they are fully within the area, as defined by the vertical plane extending upward from the outside barrier of the "Sugar Shack Boiler".

B. Every “Maple Syrup” piece on top of a “Snow Pile” within the “Maple Taffy Zone” will be awarded 2 points.
    a. If a “Snow Pile” is not fully within the “Maple Taffy Zone”, all “Maple Syrup” pieces on top of that “Snow Pile” will be awarded 0 points.
    b. ”On top of” is defined as being fully supported by the top plane of the “Snow Pile”. This includes sitting in the cut-out groove or sitting on top of the flat top surface.
        i. Balls which are rolling when the game time expires will be counted wherever they come to rest.

5.3. Sapling Scoring

A. Competitors will be awarded points for each “Sapling” that remains intact.
    a. 1 point will be awarded for each “Sapling” still standing.
        i. A “Sapling” is considered standing if the ABS pipe is still standing within the secured cap.
        ii. The “Sapling” does not need to be standing fully upright, as long as it is still in the secured cap and being supported by the secured cap.
        iii. If the “Sapling” is touching the court surface, it will not be considered standing.
    b. 1 point will be awarded for each tennis ball which remains on top of the “Sapling”.
        i. The tennis ball is considered on top of the sapling if it is fully supported by the sapling.
        ii. If the tennis ball is touching anything else, it will not be considered supported by the sapling.
        iii. The “Sapling” Points will be awarded at the end of each match.
    c. If a “Sapling” or Tennis ball becomes knocked over during a match, it is considered knocked over.
        i. Competitors will not be allowed to rebuild these “Saplings”. Once they are knocked over, they are no longer eligible for points.

5.4. End of Match Location

A. Teams will be awarded 2 points if their tele-operated robots return to the starting zone.
    a. Robots must have fully left the starting zone at some point throughout the game to receive these points.
    b. Robots must be fully within the starting zone at the end of the match to receive these points.
        i. This means the robots must not break the vertical plane at the edge of the starting zone to gain these points.
B. 1 Additional point will be awarded to the team to fully complete the task and return to

the starting zone in the fastest time during each match.

a. A fully completed task is defined as:
    i. Delivering all “Non-Maple Components” into the “Sugar Shack Boiler”.
    ii. All “Snow Piles” have been delivered into the “Maple Taffy Zone”.
    iii. All “Maple Syrup” pieces have been delivered onto the top of the “Snow Piles” within the “Maple Taffy Zone”.
    iv. All “Saplings” remain fully intact.

5.5. Match Record and Point Standings

A. Teams will be ranked based on their overall game record.
    a. Wins will be awarded 2 points.
    b. Tie-breaker losses will be awarded 1 point.
    c. Regulation losses will be awarded 0 points.

6. Marking Sheet

2024 Skills Canada – Mobile Robotics – Nova Scotia				
Maple Taffy Score Sheet				
Game Number:	Team A:		Team B:	
	Count	Score	Count	Score
Snow Piles Delivered into Maple Taffy Zone (2pts each)				
Sap Pieces in the Sugar Shack Boiler (1pt each)				
Maple Syrup pieces delivered onto the Snow Piles in Maple Taffy Zone (2pts each)				
Saplings Standing (1pt each)				
Tennis balls remaining on Sapling (1pt each)				
Tele-op Robots returned to Staring Zone? (2 pts)	Y / N		Y / N	
Fastest to fully complete task? (1 pt)	Y / N		Y / N	
Total Score				
Winner				
Tiebreaker Loss				
Competitor Signatures				

7. Pit Area and Court Access

A. Competitors MUST wear safety glasses when doing fabrication work involving material removal or adding processes (grinding, cutting, soldering, etc.).

B. Only registered competitors are permitted in the contest space.

C. 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.

   a. Designated teacher/industry team advisors are not permitted in the competition area during the competition.

   b. Teachers and industry advisors are not permitted to handle tools or robot parts.

   c. Students must affect all repairs and modifications on their robot.

D. A pit area is provided so that students may make repairs and improvements to their robots between games.

   a. Teams will be provided with a 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.

   b. Teams must have a purpose-built tabletop robot stand, designed to keep the robot wheels off the ground/tabletop surface regardless of orientation.

      i. This stand or these stands should hold the robot(s) securely and be capable of preventing the robot(s) from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

   c. A team's pit area must be kept safe at all times.

      i. This specifically means:

         1. Robots must be on the stand at all times when a battery is installed and connected to the robot

         2. Pit areas must be kept clean, tidy and free of all tripping hazards. Extension cords and power bars must all be taped, zip tied or Velcro tied as per industry standards (minimum of 1 tie every 8 inches, must place 1 tie before and after every corner)

E. Teams MUST bring their robots, tools, and supplies into the skill area at Orientation. Teams are NOT allowed to remove their robots (or any part of their robots) from the skill area during the overnight period between Orientation Day and Competition Day of the contest.

F. Laptops may be removed overnight by competitors.

G. Competitors are not permitted to be in the competition area during times which are not scheduled as competition times.

H. This includes before the competition day begins, after the competition day ends, and during lunch.

I. At no time is a competitor permitted to be in the competition area if PTC members are not present.

8. Game Play

A. Teams may participate in a single or a double 'Round Robin Tournament', depending on number of participating teams.

B. Each game of the round robin will award either two (2) points for a win, one (1) point for a draw, and zero (0) points for a loss, to the respective participating teams.

C. Tournament Standing will be based on the total number of points gained at the end of each game.

D. Teams will play a balanced number of Tournament Games.

E. Teams will participate in an equal number of Games in the Round Robin Tournament.

F. There will not be Playoff Games.

G. Tournament games will last 4 minutes.

H. 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.

I. Between tournament games, battery changes and repairs to robots may be completed at the team's assigned Pit Area Worktable.

J. During the competition, protective safety glasses are expected to be worn while performing material removal tasks (cutting, drilling, etc.).

K. During game play, judges/PTC will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.

   a. It will be a PTC/Judge's ruling that decides if the robot is in violation of the rules of the game.

      i. If any rule violations are noted during the competition, the following escalation pathway will be followed:

         1. During a match:

            a. 1st Warning. In match warning when noticed.

            b. 2nd Warning. In match warning when noticed, with the team clearly told the next occurrence is disqualification.

            c. Disqualification of the match. The team will then be subjected to a discussion with the judges. The team will have to prove the violation is addressed before they are allowed to proceed in another match.

         2. Not during a match (Practice time, inspection, or other)

            a. Discussion with the team about the violation noticed with the judges.

            b. Teams will not be permitted to proceed until the judges are

convinced the violation is addressed.

3. Note: Depending on the severity of the violation, warnings may be skipped.

L. No aerial (flying) robots are allowed.

M. Damaging the court area is prohibited. If a robot's design causes damage to the court elements, 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 involves BREAKING court components. Robots bumping into court components and causing them to shift position without breaking any court element will NOT be viewed as 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.

   a. "Sapling's" are an element of play in the court, they may be knocked over and do not count as damage to the court.

   b. "Rocks" are an element of play in the court, made to make access difficult or tricky, they may be driven over, on etc., however intentional damage is prohibited.

N. Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game. Competitors cannot enter onto the court surface or adjust their robot during a game.

O. 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 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.

P. It is a Team Decision what roles team members will fill. Drivers are the competitors holding the robot controller(s) and asserting direct control over a Tele-operated robot.

Q. The Spotter would be the competitor providing navigational guidance to the driver.

R. Competitors may change roles while a game is in progress.

S. Competitors (Drivers and/or Spotters) must remain in their Assigned Courtside Team Area throughout the game.

T. Competitors may not enter an opponent team's Assigned Courtside Team Area at any time during game play.

U. At the start of a game, robots are expected to be in their Designated Starting Position.

V. Robots arriving AFTER a game has started will be allowed to enter the game and use the time remaining in the 4 min. game.

W. Robots must not leave the contest court at any time during a game.

X. It will be a referee's ruling that decides if an 'End of the Game Component Placement' took place before or after the game-ending buzzer sounded.

Y. Scoring will take place after the End of the Game Buzzer

Z. If a piece falls out of the court, it may not be retrieved and will be considered out of the

game for the remainder of the game time.

a. Should any game pieces fall into the opponent's court area, those pieces shall remain in play and usable by the opposing team.
    i. This applies to all game pieces which may count for points.
    ii. Should a larger game piece fall into the opposing team's court, it may be removed at the PTC/Judge's discretion.

9. Court Layout

A. 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.**
    a. The open court surface will consist of the good side of Plywood Sheets **OR** the facility floor **OR** the smooth side of Masonite Sheeting.
    b. Detailed court information has been included in the Appendix Section of this document.

10. The Robot(s) Restrictions

A. 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 their scheduled games until they have corrected the problem.

B. During Game Status
    a. Robots may expand beyond the starting volume once the game begins.
    b. A team's Robots must remain in their designated areas for the duration of the game.
        i. All Robots must remain in their own team's court.
        ii. All Tele-operated Robots are permitted to access any area within the team's exclusive use area (in compliance with all other rules).
        iii. The team's Optional Autonomous Element must remain in the "Sugar Shack Boiler" for the duration of the game.
    c. Strategies aimed at preventing the opponent from playing the game are not permitted, as they are not in the spirit of fair play, and will not be permitted.

C. Each team's optional Autonomous Element must not have any direct interaction with the competitors.

11. Start of the Game Robot Status

A. Complete Team Entries must not exceed an overall size of 4 cubic feet (6912 cubic inches) at the start of each game.

B. Total volume will be measured of the combined Tele-operated robots (in their starting position) volume plus the volume of the optional Independent Autonomous Element.

C. Team entries may expand to a larger size once a game has started.

D. Robots must start within their designated starting area.
    a. Tele-operated Robots must start together in the same configuration used during the volume calculation. Tele-op robots must also be completely within the "Tele-operated Robot Starting Area", as described in Section 3.5
    b. The optional Independent Autonomous Element must start in the "Sugar Shack Boiler"
E. When a Tele-operated 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:
    a. They must be stationary
    b. They must not be in possession of any game pieces
F. All systems may be turned ON
G. Air System Circuits may be fully charged to 100 PSI, and their compressors can be ON

12. Team Robot Overall Entry Size

A. Complete Team Entries must fit within the designated starting area at the start of each game, as defined by the vertical plane of the starting area.
B. Complete Team Entries must not exceed an overall size of 4 cubic feet (6,912 cubic inches) at the start of each game.
C. Team Entries may expand to a larger size once a game has started.
D. Team Entries may start in 2 parts:
    a. Tele-operated robots must start together, and their total volume will be taken based on their overall starting position (see Figure 13).
    b. Optional autonomous element must start in the "Sugar Shack Boiler". Their volume will be taken based on their starting position (defined as the starting position at the beginning of the tele-op match)
    c. Total volume will be calculated by adding the total tele-op volume to the total autonomous volume, like this:

        Total Tele-op Volume + Total Autonomous Volume = Total Volume.

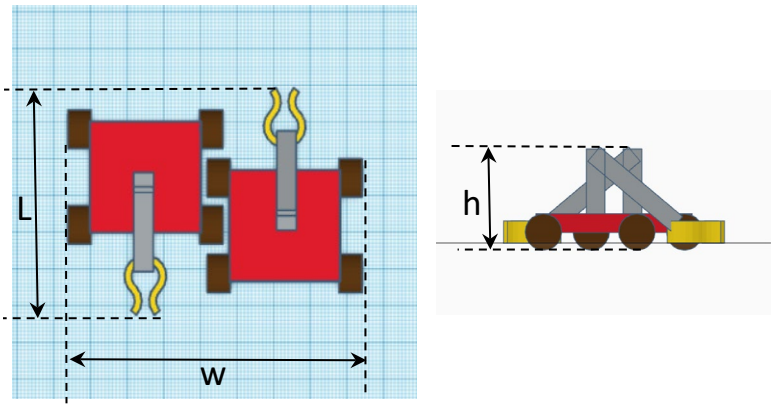

Figure 12: Volume Measurement

13. Power Sources/Management

A. The total voltage in any individual circuit cannot exceed 24 Volts.

B. The maximum continuous power rating allowed in any circuit branch is 240 W, which will be limited by voltage and fuse selection. A larger main fuse can be used to provide protection for motor controllers. To calculate power in any given circuit, use the following formula: Power (Watts) = Voltage (Volts) x Current (Amps).

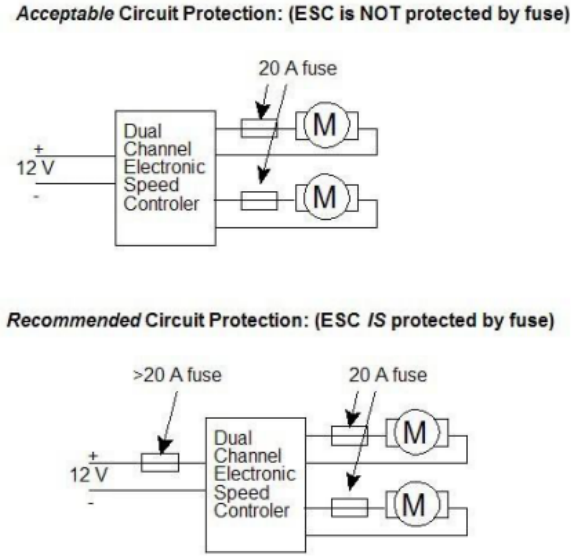

Figure 13: Circuit Protection

C. 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.

D. Each current branch path from the battery must include either an in-line fuse, resettable fuse, circuit breaker, or be connected to a dedicated fuse in a rack.

   a. Devices with a known, dedicated internal fuse (based on manufacturer's documentation) are considered to have this requirement met, assuming the fuse

rating is appropriate.

i. If the system is unknown to the PTC, teams may be required to produce this documentation.

ii. There are no modifications made to the system.

iii. There are no external circuits which do not contain a fused circuit. Proper fuses are required for modified circuits

E. Batteries must be complete sealed commercial battery packs.

a. All batteries must be a complete sealed commercial battery pack.

b. All batteries must be securely mounted to the robot.

c. 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).

d. Competitors must have the Safety Data Sheets for their batteries.

F. ALL Robots must be able to be turned off with a single motion.

a. The "Kill Switch" must be easily accessible

b. The "Kill Switch" must be securely mounted

G. Robot Controller receivers may be in an independent circuit.

H. No explosive materials of any kind may be used (ether, gunpowder, acetylene, etc.).

14. Non-Electrical (Battery) Energy Sources

A. 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.

B. Air pressure systems using Competitor-made or modified air pressure hardware are NOT permitted.

C. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.

D. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.

E. The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.

F. 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.

G. Laser devices are prohibited.

H. Hydraulic fluid systems are not permitted.

15. Recommended Robot Controllers

A. Teams must use an appropriate Robot Controller.

B. It is recommended (not required) that all teams use 2.4 GHz "non-crystal" control systems on Tele-operated Robots.

C. Teams are allowed the use of an unlimited number of channels, but only two separate tele-operated robots.

    a. Teams assume full responsibility if any interference is to occur with their respective communication systems that could render the robot(s) useless.

D. Robots may not transmit audio/visual information to the robot devices. (Ex: Having a camera transmit images real time to a computer near the driver, etc.)

16. Pit Area

A. Competitors MUST wear safety glasses when doing fabrication work involving material removal processes (grinding / cutting).

B. Only registered competitors are permitted in the contest space.

C. 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.

D. Designated teacher/industry team advisors are not allowed in the pit area during tournament play.

E. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.

F. Teams will be provided with a 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.

G. It is required that teams fabricate a tabletop stand for holding their robot(s) in the pit area. This stand or these stands should hold the robot(s) securely and be capable of preventing the robot(s) from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

17. Pre-Inspection for Compliance with Safety and Design Rules

- Mandatory Wiring Diagram provided;
- Tabletop Robot Stand(s);
- Overall volume less than or equal to 4 ft^3 or 6,912 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;
- Safety Data Sheets available for all batteries
- Total voltage in any individual circuit does not exceed 24 V;
- No circuit **branch** exceeds 240 W (Voltage x Fuse Current Rating, easily accessible);
- All circuits have a fuse or breaker (breakers must have **DC rating**) and all Fuses/Breakers must be readily accessible;
- Mandatory Pressure System Circuit Diagram provided;
- 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(s) can be turned off with a single motion**. Radio receivers / Logic circuits may be independent of the kill switch. This includes all tele-op and autonomous robots;
- Control unit to support operator to robot communication are being used; and
- Demonstration of robot functionality.

Additional Concerns:_____
_____

Robot Evaluator Signature	Team Representative Signature