



Introduction

Pipefall is a robotics game developed by Spectrum FRC#3847. Many of the rules are copied, paraphrased, or referenced from the 2011, 2012, & 2013 FIRST Robotics Competition Game Manuals. This game is meant to simulate a real FRC game and prepare teams for future FRC games. This game is designed to be used as a tool for brainstorming simulations or building off season prototype robots. We believe that the best way to become better at something is to do it many times. Having a mock game for teams to design and build robots for will make teams stronger in future years. We are not planning to hold any competitions for this game or anything like that. However we would like to see other teams come up with solutions to the design challenges.

Contact: team@spectrum3847.org with any questions about the game.

Introduction

PIPEFALL is played by two competing alliances on a flat, 27 x 54 ft field. Each alliance consists of three robots. They compete to score as many of their pipes onto the scoring poles as they can. The longer the pipe, the more points the alliance receives. The match ends with robots attempting to elevate on platforms located near the middle and sides of the field. The robots earn points based on how high they elevate. Scoring for the match is summarized below.

PIPE	POINTS
6"	1
12"	2
24"	4
48"	8

Elevation Level	Elevation Height	POINTS
0	>= 0"	0
1	> 6"	10
2	> 18"	20
3	> 30"	30

The Arena

2.1 Overview

The ARENA includes all elements of the game infrastructure that are required to play PIPEFALL: the FIELD, the ALLIANCE STATIONS, the PIPES, and all supporting communications, ARENA control, and scorekeeping equipment.

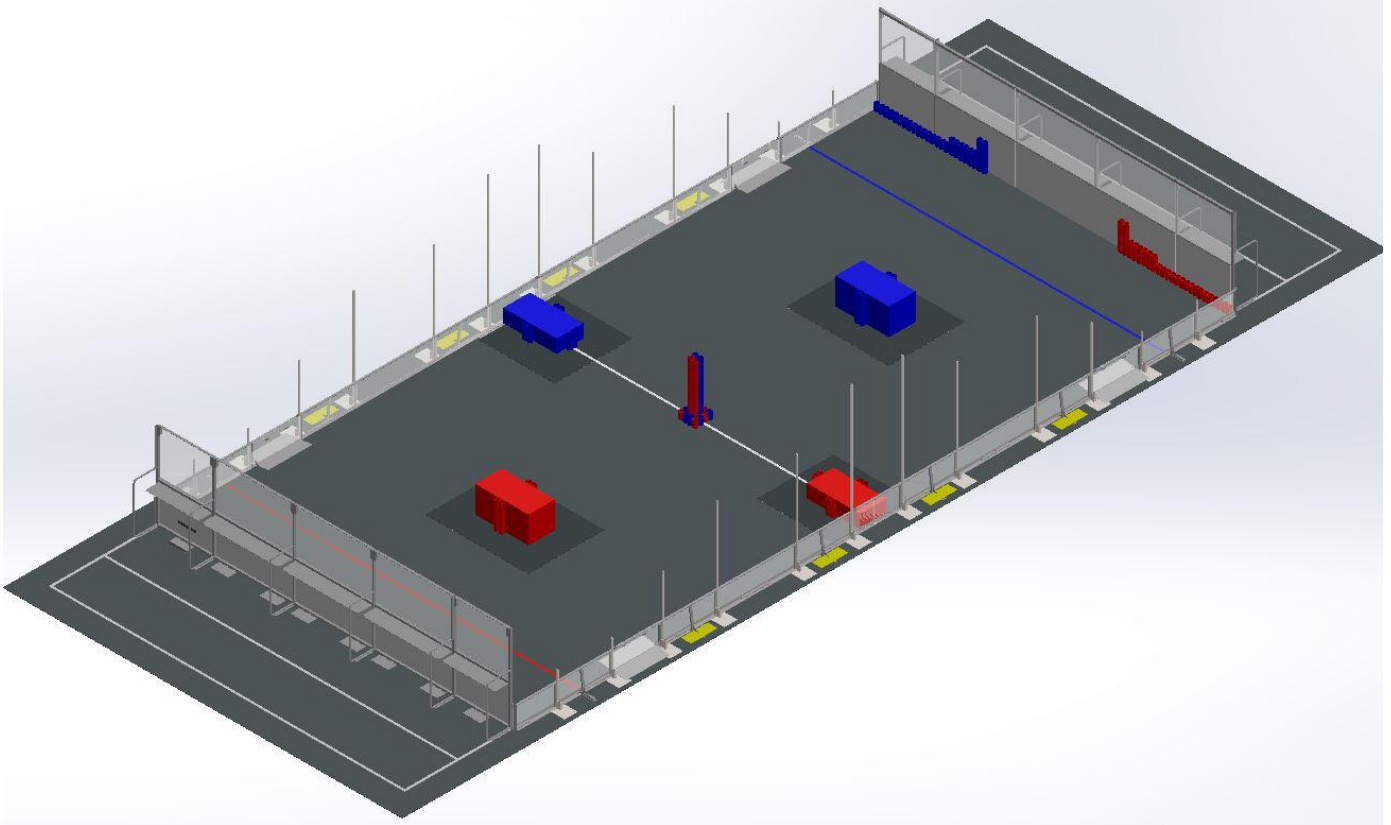
ROBOTS play PIPEFALL in a rectangular space known as the FIELD. During MATCHES, ROBOTS are controlled from ALLIANCE STATIONS located outside the ends of the FIELD. Each ALLIANCE STATION consists of three PLAYER STATIONS that provide connectivity between the controls used by the DRIVERS and the ROBOTS. There are GOALS mounted along the entire length of the FIELD sides.

The competition ARENA is a modular construction that is assembled, used, disassembled, and shipped many times during the competition season. It may undergo wear and tear. The ARENA is designed to withstand rigorous play and frequent shipping, and every effort is made to ensure that the ARENAS are consistent from event to event. However, as the ARENA is assembled in different venues by different event staff, some small variations do occur. Fit and tolerance on large assemblies (e.g. the PLATFORMS) are ensured only to within 1/4 in. Overall gross dimensions of the entire FIELD may vary up to 4 in. Successful teams will design ROBOTS that are insensitive to these variations.

2.2 The Arena

2.2.1 The Field

The FIELD for PIPEFALL is a 27 by 54 ft. carpeted area, bounded by ALLIANCE WALLS, and GUARDRAILS. The FIELD floor is covered with carpet (Shaw Floors, Philadelphia Commercial, Neyland II, 20, 30550, "Ground Pepper"). 12 SCORING POLES are located along each side of the field. Four PLATFORMS are located on the field. Two 12" platforms are located on the sides of field on the CENTER LINE. Two 24" tall platforms are located on the midline of Alliance Stations and half way between the alliance station wall and the field CENTER LINE.



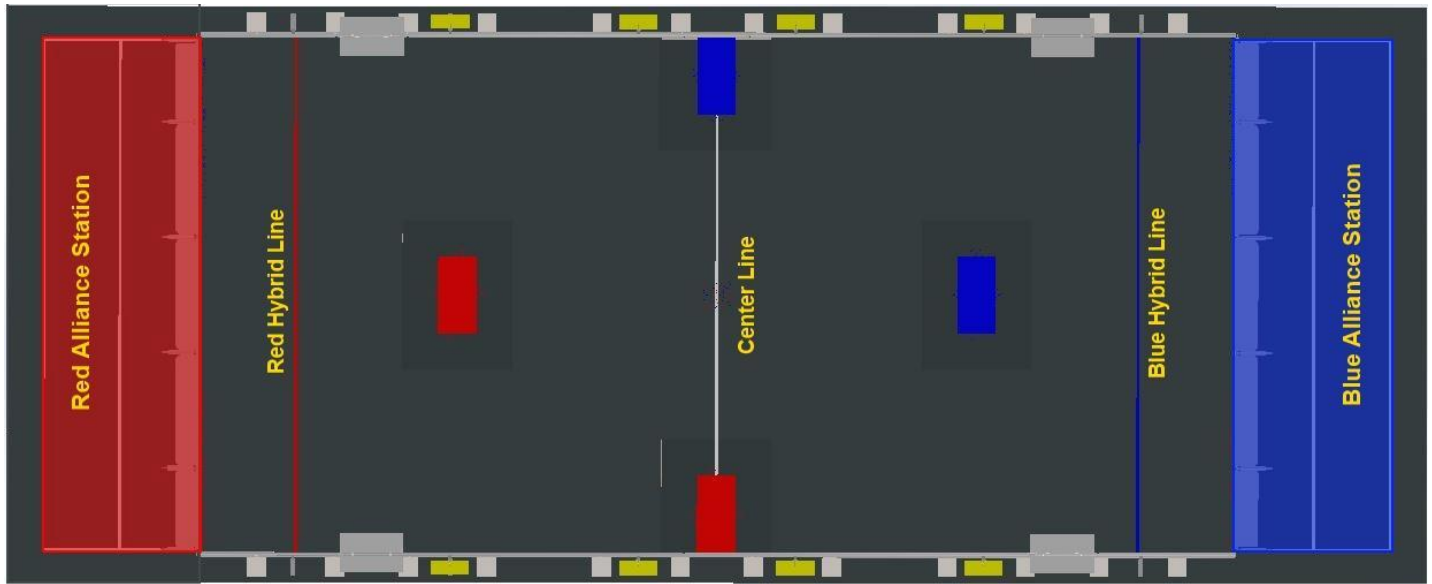
The ALLIANCE WALLS are 6 ½ ft high, 27 ft wide, and define the ends of the FIELD. The ALLIANCE WALL protects the PLAYER STATIONS, and is composed of a 3 ft high base of diamond plate aluminum topped with a 3 ½ ft high transparent polycarbonate panel.

The GUARDRAIL is a system that consists of horizontal pipes that are 20 in. above the floor and supported by vertical struts mounted on a 3 in. aluminum angle. A transparent polycarbonate shield is attached on the inside of the GUARDRAIL, extending from the floor to the top of the GUARDRAIL, and running the length of the GUARDRAIL. The shield is intended to help prevent ROBOTS, in whole or in part, from inadvertently exiting the FIELD during a MATCH. The GUARDRAIL defines the borders of the FIELD, except where it is bounded by the ALLIANCE WALLS.

Four gates in the GUARDRAIL allow access to the FIELD for placement and removal of ROBOTS. The gates are 38 in. wide, and are closed and shielded during MATCHES.

2.2.2 FIELD Markings

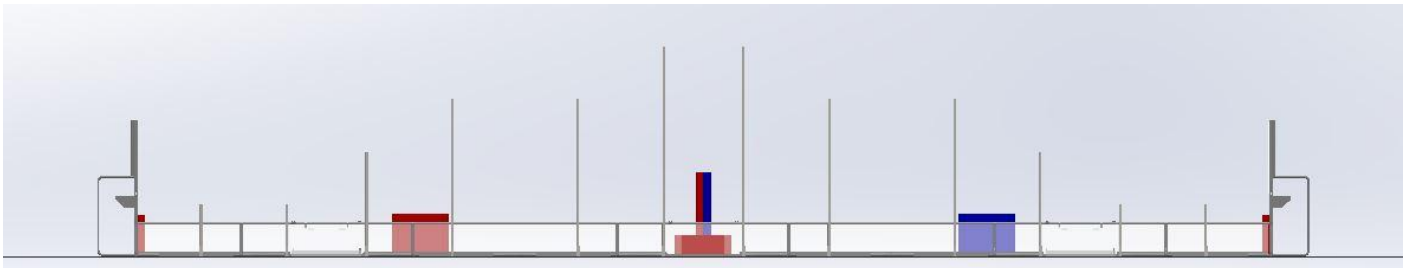
FIELD markings are shown below are for illustrative purposes only.



Three lines (Red, White, and Blue) span the width of the FIELD. The White line is the CENTER LINE, marked with 2 in. White gaffers tape. The Red and Blue lines are HYBRID LINES, located 60 in. from the ALLIANCE WALLS. These are marked with 2 in. red or blue gaffers tape.

2.2.3 The SCORING POLES

The SCORING POLES are used to receive PIPES placed by the ROBOTS as they play PIPEFALL. There are 24 SCORING POLES located along the sides of the FIELD. The SCORING POLES are made from 1-1/4" Nominal Thin-Wall Rigid Steel Conduit (EMT) (Actual Dimensions 1.38" ID, 1.51" OD). The tops of the SCORING POLES are four different heights 2.5', 5', 7.5' and 10' tall. The SCORING POLES are attached to the GUARDRAILS in a way that the PIPES will not fall down past the approximate 20" height of the GUARDRAILS. The SCORING POLES are mounted to bases that are zip-tied to the GUARDRAILS and attached to the carpet with hook and loop tape ("hook" side) on the bottom.



2.2.4 The VISION TARGETS

Each SCORING POLE has a VISION TARGET made of retro-reflective material (3M 8830 Silver Marking Film). Starting 22" from the carpet there is a 2in wide wrap of retro-reflective material every 12" going up each pole.

2.2.5 The PLATFORMS

Each ALLIANCE has two PLATFORMS. Each platform is a 24" x 48" steel box. There are two different PLATFORM heights. One 12" high (as measured from the floor protectors or steel bases) PLATFORM centered on the CENTER LINE and touching the GUARDRAIL. The Red ALLIANCE 12" PLATFORM is nearest the scoring table while the Blue ALLIANCE 12" PLATFORM is on the opposite GUARDRAIL. Each ALLIANCE also have a 24" high (as measured from the floor protectors or steel bases) PLATFORM that is centered between the CENTER LINE and their ALLIANCE WALL and centered between the two GUARDRAILS. The exterior of the PLATFORMS are made of welded 0.12 Cold Rolled Steel powder coated Red or Blue.

The PLATFORMS have four (4), 24 in. square, 11 GA. (.120 in.) steel bases with hook and loop tape ("hook" side) on the bottom. These bases secure the PLATFORMS to the carpet. To prevent damage to venue floors, these metal bases are surrounded by floor protectors. These floor protectors are made from $\frac{1}{8}$ in. thick hardboard. The floor protectors begin outside of all the PLATFORM bases and continue to cover the floor around the PLATFORMS (not including the bases themselves). Additional carpet covers both bases and floor protectors and is held to the carpet using 2 in. wide, Black gaffers tape. The protectors and carpet create a $\frac{1}{4}$ - $\frac{3}{8}$ in. lip around the PLATFORMS.

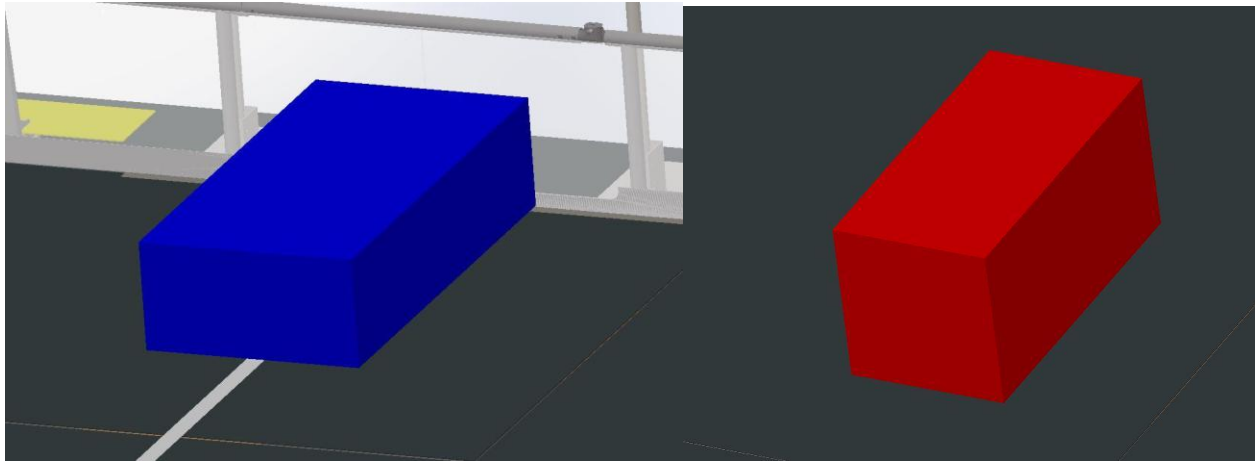


Figure 2-5 Blue 12in Platform and Red 24in Platform

2.2.6 The ALLIANCE STATIONS

The ALLIANCE STATIONS are located at either end of the FIELD, behind the ALLIANCE WALLS. The ALLIANCE STATION extends 10 ft. back from the ALLIANCE WALL, and spans the entire width of the wall. The ALLIANCE STATION includes the three (3) PLAYER STATIONS, and two (2) KINECT STATIONS. The STARTING LINE is marked with White 2 in. wide gaffers tape 4 ft. behind the ALLIANCE WALL.

2.2.7 The PLAYER STATIONS

Attached to the ALLIANCE WALL in each PLAYER STATION is an aluminum shelf to support the OPERATOR CONSOLE for the FRC Team in that PLAYER STATION. The support shelf measures 69 in. wide by 12 in. deep. There is a 54 in. long by 2 in. wide strip of hook-and-loop tape ("loop" side) along the center of the support shelf that may be used to secure the OPERATOR CONSOLE to the shelf. Each setup location includes a competition cable (to provide Ethernet connectivity) that attaches to the Ethernet Port of the OPERATOR CONSOLE. The cable provides communications with the ROBOT via the ARENA network.

Each PLAYER STATION also includes a power adapter cable that may be used to power the Classmate laptops that were provided to teams in the Kit of Parts starting in 2010. Emergency Stop (E-Stop) buttons for each ROBOT are located on the left side of each PLAYER STATION shelf. ARENA components (including team number displays, competition ARENA hardware, ALLIANCE lights, control hardware cabinets, and clock displays) are also located above the PLAYER STATIONS and below the shelf.

Once plugged in to the Field Management System (FMS) via the Ethernet cable provided, the only open ports in the ARENA network are as follows:

- 1 TCP 1180: This port is typically used for camera data from the cRIO to the Driver Station (DS) when the camera is connected to port 2 on the 8-slot cRIO (P/N: cRIO-FRC). This port is bidirectional.
- 2 TCP 1735: SmartDashboard, bidirectional
- 3 UDP 1130: Dashboard-to-ROBOT control data, directional
- 4 UDP 1140: ROBOT-to-Dashboard status data, directional
- 5 HTTP 80: Camera connected via switch on the ROBOT, bidirectional
- 6 HTTP 443: Camera connected via switch on the ROBOT, bidirectional

Teams may use these ports as they wish if they do not employ them as outlined above (i.e. TCP 1180 can be used to pass data back and forth between the ROBOT and the DS if the team chooses not to use the camera on port 2).

2.2.8 The BOUNDARY

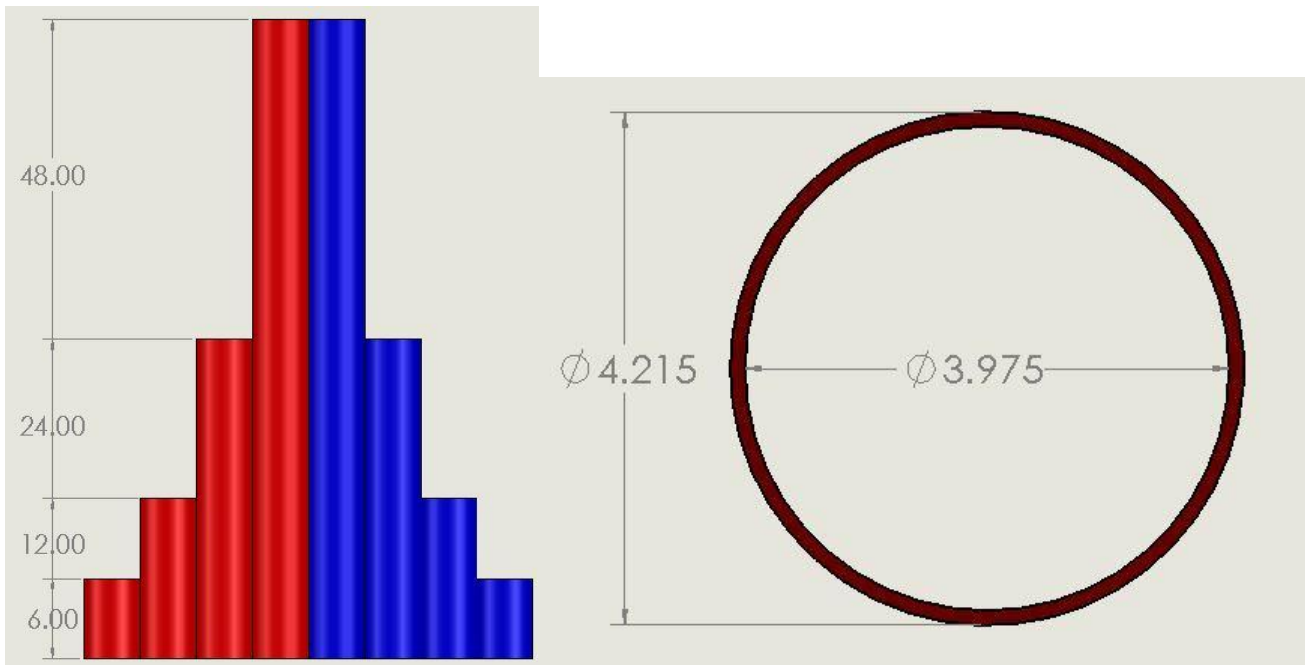
Due to the nature of the game, robots will be interacting with the edges of the field. For safety a BOUNDARY will be maintained at all events of no less than two (2) feet from the GUARDRAILS. This BOUNDARY must remain clear during matches.

2.2.9 The Kinect Stations

Two Kinect Stations are located in each ALLIANCE STATION. Each Kinect Station has a Microsoft Kinect mounted to shelf that is approximately 44 in. off the floor. A feedback monitor is located on a separate shelf directly below the Microsoft Kinect.

2.2.10 The PIPES

Game pieces are different lengths of 4" PVC Sewer Main pipe (Charlotte Pipe MFG Part # : S/M 06004 0600) . The pipes are painted with Red or Blue spray paint (Krylon Fusion Red Pepper 2328 & Patriotic Blue 2329). 6", 12", 24", and 48" PIPES are included in PIPEFALL (all lengths are +/- 1/2"). Each PIPE is cut at a 90 degree angle (+/- 2 degrees). The PIPES have an actual size of 3.975" inside diameter (ID), & 4.215" outside diameter (OD). A 12" PIPE weighs approximately one (1) pound.



Can be bought at Home Depot in [10ft lengths](#) do not use the belled end
Charlotte Pipe 4 in. x 10 ft. PVC Sewer Main Solvent-Weld Pipe

3 The Game

Teams playing PIPEFALL use their ROBOTS to collect and score PIPES on the SCORING POLES. Teams earn additional points by elevating their robots by the end of the MATCH. This chapter contains two sections: the first section describes the game and what Teams may expect, and the second section covers the detailed rules by which competitors must abide.

3.1 Game Details

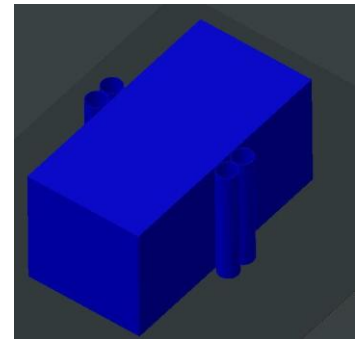
Details such as the FIELD set up, MATCH execution, point values, etc. are defined in this section.

3.1.1 MATCH Setup

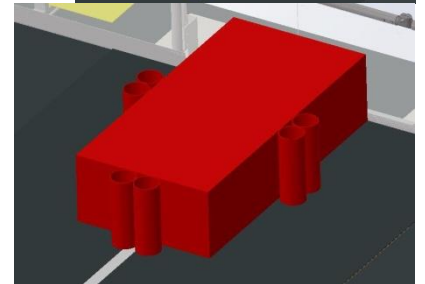
Before the start of each MATCH, the ARENA is populated with **42 x 6"**, **20 x 12"**, **9 x 24"** and **2 x 48"** PIPES of each color.

A. Each ALLIANCE must preload 4 x 6", 2 x 12", & 1 x 24" PIPE of its color. (See G05 for details)

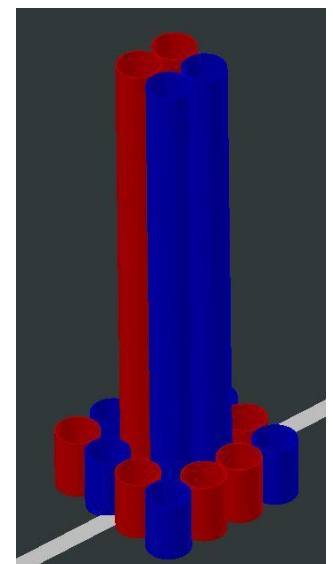
B. four (4) x 24" PIPES are located near the 24" PLATFORMS of the corresponding color. Two PIPES are centered along the two sides of the PLATFORMS parallel to the ALLIANCE WALLS.



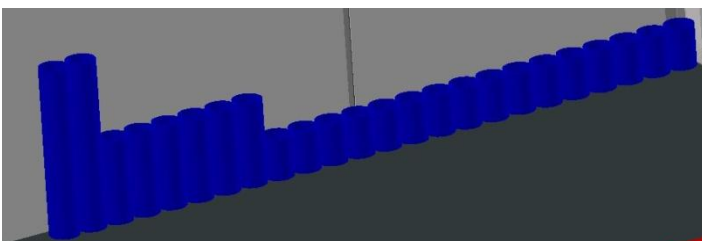
C. six (6) x 12" PIPES are located near the 12" PLATFORMS of the corresponding color. Two (2) PIPES are centered along each side of the PLATFORMS that do not contact the GUARDRAILS.



D. In the center of the field two (2) 48" PIPES of each color are placed on opposite sides of the CENTER LINE touching the 48" PIPE of its own color and one of the opposite colors. Six (6) x 6" PIPES of each color surround the 4 48" PIPES. The pattern of PIPES is such that no PIPE is ever touching more than one PIPE of its own color. Please see drawing for PIPE location details.



E. The remaining PIPES of each color (32 x 6", 12 x 12", & 4 x 24") are divided along the two ALLIANCE WALLS. The Red PIPES are located nearest the scoring table. The first 6" PIPE starts each row touching the GUARDRAIL and the ALLIANCE WALL. Each sequential PIPE is touching the PIPE before it and the ALLIANCE WALL. The PIPES are arranged by height from the GUARDRAIL with 16 x 6" PIPES, followed by 6 x 12" PIPES and lastly 2 x 24" PIPES. Please see drawing for PIPE location details.



3.1.2 MATCH Timing

A MATCH is two (2) minutes and twenty (20) seconds long. The HYBRID Period is the first twenty (20) seconds of the MATCH. The Teleoperated Period (TELEOP) is the remaining two (2) minutes. Each Period ends when the ARENA timer displays zero (0) seconds.

3.1.3 MATCH Logistics

PIPES that are ejected from game play during a MATCH will NOT be placed back in the FIELD.

3.1.4 Penalty Assignment

Upon a rule violation, 10 FOUL points will immediately be credited to the opposing ALLIANCE.

3.1.5 Scoring

Points are awarded to ALLIANCES per the details below. Final scores will be assessed five (5) seconds after the ARENA timer displays zero (0) or when all elements come to rest, whichever event happens first.

3.1.5.1 PIPE Points

Points are awarded for PIPES SCORED on the SCORING POLES per Table 3-1. The PIPE score is calculated at the end of the Hybrid period and at the end of the MATCH. These scores are cumulative. Any PIPES scored in Hybrid that remain scored at the end of the match will be counted for both periods.

Table 3-1: PIPE Point Values

PIPE	POINTS
6"	1
12"	2
24"	4
48"	8

A PIPE is considered SCORED if the PIPE is encircling a SCORING POLE or is supported by a SCORING POLE or another SCORED PIPE. A PIPE is not considered SCORED if it is in contact with any ROBOT from the ALLIANCE of its color.

Most PIPES that are SCORED in HYBRID will be worth double points. The exceptions are PIPES which are accidentally descored before the end of the match.

3.1.5.2 Elevation Points

Points are awarded for the highest Level achieved for every ALLIANCE ROBOT. The Level to which a ROBOT has elevated is determined by the lowest point of the ROBOT (in relation to the carpet of the FIELD) at the point in which final scores are assessed per Section 3.1.5. Elevation point values and levels are defined in Table 3-2.

Table 3-2: ELEVATION Point Values

Elevation Level	Elevation Height	POINTS
0	$\geq 0''$	0
1	$> 6''$	10
2	$> 18''$	20
3	$> 30''$	30

To be considered scored a robot must not be touching any of its ALLIANCE PARTNER ROBOTS that are touching any field carpet or tape. For the purposes of ELEVATION Points all PIPES touching a robot are considered part of the robot.

ELEVATION Points will only be counted at the end of the MATCH. NO ELEVATION POINTS will be awarded at the end of the HYBRID PERIOD.

3.2 Game Rules

The rules in this section legislate game play and define the consequences for rule violations.

3.2.1 Safety

G01

Teams may only enter the FIELD if the PLAYER STATION LED strings are green.

Violation: YELLOW CARD

G02

Team members may not climb on the PLATFORMS.

Violation: YELLOW CARD

G03

ROBOTS whose operation or design is unsafe are not permitted.

Violation: FOUL & DISABLED. If the issue is due to design: Re-Inspection.

ROBOTS that intentionally throw PIPES will be considered unsafe.

3.2.2 Pre-MATCH

G04

When placed on the FIELD, each ROBOT must be:

- 1 in compliance with all ROBOT rules (i.e. have passed Inspection),
- 2 confined to its STARTING CONFIGURATION,
- 3 fully supported by the floor, and
- 4 fully within in the boundary defined by its ALLIANCE WALL, the GUARDRAILS, and it's HYBRID LINE (the side of the tape nearest the ALLIANCE WALL).

Violation: If fix is a quick remedy: the MATCH won't start until all requirements are met. If it is not a quick remedy: the ROBOT will be DISABLED and must be re-Inspected.

G05

ALLIANCES must PRELOAD all of their PRELOAD PIPES. PRELOADED PIPES must be touching an ALLIANCE robot or touching another legal PRELOAD. PRELOADED PIPES must not start the match breaking the plane of the GUARDRAILS.

Each ALLIANCE is given 4 x 6", 2 x 12", and 1 x 24" PIPE of its own color to PRELOAD.

Violation: The situation must be fixed before the start of the match

G06

TEAMS may not cause significant or repeated delays to the start of a MATCH.

Violation: ROBOT will be DISABLED

G07

TEAMS may not leave items other than ROBOTS on the FIELD prior to or during the MATCH.

Violation: The MATCH will not start until the situation is corrected.

G08

Each TEAM member must be:

- 1 in the ALLIANCE STATION and
- 2 behind the STARTING LINE.

Violation: MATCH will not start until the situation is corrected.

3.2.3 General Rules

G9

Only TEAM members and their ROBOT may report to the ARENA for a MATCH. TEAM members are limited to:

- 1 1 COACH,
- 2 3 DRIVERS

Violation: MATCH will not start until the situation is corrected.

G10

The COACH must wear the designated "COACH" button while in the ARENA.

Violation: MATCH will not start until the situation is corrected.

G11

ROBOTS may not contact anything outside the FIELD or intentionally break the plane surrounding the BOUNDARY. The SCORING POLES are considered inside the FIELD.

Violation: ROBOT will be DISABLED. However, if it occurs during AUTO, and there is no safety concern, the Head Referee will allow a 10-second grace period at the beginning of TELEOP for the ROBOT to correct the situation.

G12

ROBOTS may not intentionally detach or leave parts on the FIELD.

Violation: FOUL

G13

The following actions are prohibited with regards to interaction with FIELD elements:

- 1 grabbing,
- 2 grasping
- 3 grappling
- 4 attaching to,
- 5 damaging,
- 6 becoming entangled

Actions 1-4 do not apply to ROBOT interactions with their ALLIANCE PLATFORMS.

Violation: FOUL. If the Head Referee determines that further damage is likely to occur, DISABLED. Corrective action (such as eliminating sharp edges, removing the damaging mechanism, and/or re-Inspection) may be required before the ROBOT will be allowed to compete in subsequent MATCHES.

ROBOTS may contact the SCORING POLES but they may not do any of the above listed actions to the SCORING POLES. Ramming a SCORING POLE at high speed may be considered damaging and will be called as a foul.

G14

ROBOTS may not intentionally eject PIPES from gameplay.

Violation: FOUL per PIPE.

G15

TEAMS and/or ROBOTS may not employ strategies that use PIPES to either aid or inhibit a ROBOT ELEVATION.

Violation: FOUL. If the PIPE(S) inhibits an opponent's ELEVATION attempt, the opponent ROBOT'S ALLIANCE will be granted credit for a Level 3 ELEVATION at the end of the MATCH.

G16

TEAMS and/or ROBOTS may not employ strategies aimed at intentionally removing PIPES from SCORING POLES.

PIPES that are removed from scored positions do to vigorous game play will not be penalized.

Violation: FOUL per PIPE

G17

All Teams must be civil towards other Teams, competition personnel, and event attendees.

Violation: Potential RED CARD for violations in the ARENA.

G17-1

Strategies aimed solely at forcing the opposing ALLIANCE to violate a rule are not in the spirit of this game and are not allowed. Rule violations forced in this manner will not result in assessment of a penalty on the target ALLIANCE.

Violation: FOUL

3.2.4 AUTO Rules**G18**

During AUTO, a ROBOT may not cross the CENTER LINE such that it is no longer in contact with the carpet on its starting half of the FIELD and contact an opposing robot.

Violation: FOUL.

G19

During AUTO, TEAMS must remain behind the STARTING LINE.

Violation: FOUL if contact with their operator console or intentional/repeated

G20

During AUTO, any control devices worn or held by the DRIVERS must be disconnected from the OPERATOR CONSOLE and not connected until TELEOP.

Violation: FOUL

3.2.5 ROBOT Actions**G21**

While not in contact with one of its PLATFORMs a ROBOT'S horizontal dimensions may never exceed an 80 in. diameter vertical cylinder.

Violation: FOUL

G22

Robots may not deliberately contact or otherwise interfere with the opposing Alliance PLATFORMs. Incidental contact will not be penalized.

Violation: Foul. If the act of ELEVATING is interfered with each affected opponent ROBOT will be granted credit for a LEVEL 3 ELEVATION at the end of the MATCH.

Accidentally touching an opposing Alliance PLATFORM is not a penalty but interacting with the PLATFORM in an intentional way is against the rules. ROBOTS should not violate G13 with respect to their opposing Alliance PLATFORMs nor should they contact their opponent's PLATFORM to prevent their opponents from gaining access to it.

3.2.6 ROBOT-ROBOT Interaction

G23

Strategies aimed at the destruction or inhibition of ROBOTS via attachment, damage, tipping, or entanglement of ROBOTS are not in the spirit of the FRC and are not allowed.

Violation: FOUL and YELLOW CARD

G24

Deliberate or damaging contact with an opponent ROBOT on or inside its FRAME PERIMETER is not allowed.

Violation: FOUL

G25

A robot may not initiate contact with any opponent ROBOT that is attempting to score a PIPE while the opponent ROBOT is in contact with a SCORING POLE or in contact with a SCORED PIPE. Incidental contact will not be called.

Violation: Foul

This rule is to protect the field from too much damage. The SCORING POLES should not be used as safety zones. Only robots that are attempting to score should be in contact with the scoring POLES and no penalties will be called unless a scoring attempt is in progress. Brushing bumpers will not be called but all defensive moves will be called.

G26

A ROBOT may not interfere with an opponent's ELEVATION attempt.

Interfering with

- a. an opponent ROBOT that is touching one of their PLATFORMS
- b. an opponent ROBOT that is contacting one of their ALLIANCE PARTNERS that is touching one of their PLATFORMS

while they are attempting to ELEVATE are not permitted.

Violation: FOUL and each affected opponent ROBOT will be granted credit for a LEVEL 3 ELEVATION at the end of the MATCH.

G27

An ALLIANCE may not pin an opponent ROBOT for more than five (5) seconds. A ROBOT will be considered pinned until the ROBOTS have separated by at least six (6) ft. The pinning ROBOT(S) must then wait for at least three (3) seconds before attempting to pin the same ROBOT again. Pinning is transitory through other objects.

Violation: FOUL

G28

Fallen (i.e. tipped over) ROBOTS attempting to right themselves (either by themselves or with assistance from an ALLIANCE partner) have one (1) ten (10)-second grace period per fallen ROBOT in which the fallen ROBOT may not be contacted by an opposing ROBOT.

This protection lasts for either ten (10) seconds or until the protected ROBOT has completed the righting operation, whichever comes first.

Violation: If intentional or consequential, FOUL.

3.2.7 Human Actions

G29

During the MATCH, TEAMS must be within their ALLIANCE STATION. Exceptions will be granted for inadvertent or inconsequential infractions and in cases concerning safety.

Violation: FOUL

G30

TEAMS may not extend any body part into the FIELD or contact any ROBOT at any time during the MATCH.

Violation: FOUL

G31

During a MATCH, the ROBOT shall be operated solely by the DRIVERS of that TEAM. COACHES may not enter the KINECT STATIONS.

Violation: FOUL

4. Robot Rules

All Robot Rules are the same as the 2013 FRC Ultimate Ascent manual except as below.

R03-C is removed ***Updated 2-10-2013**

R04
In the STARTING CONFIGURATION, no part of the ROBOT may extend outside the vertical projection of the FRAME PERIMETER, with the exception of minor protrusions such as bolt heads, fastener ends, rivets, etc. In the STARTING CONFIGURATION no part of the robot may be higher than 72" when measured from the floor.

R07
ROBOTS must allow removal of PIPES from the ROBOT and the ROBOT from FIELD elements while disabled and powered off.

R10, R16, R17, R18, R21 are removed

R32
The only motors and actuators permitted on 2013 FRC ROBOTS include the following:

Table 4-1: Legal Motors

Motor Name	Part Numbers Available	Max Qty Allowed
CIM	FR801-001 M4-R0062-12 AM802-001A 217-2000 PM25R-44F-1005 PM25R-45F-1004 PM25R-45F-1003 PMR25R-45F-1003 PMR25R-44F-1005	6
BaneBots	M7-RS775-12 / RS775WC-8514 M7-RS775-18 / RS775PH-6221 M5-RS555-12 / RS555PH-4136F M5-RS550-12 / RS550VC-7527 M5-RS550-12-B / RS550VC-7527L M5-RS545-12 / RS545PH-5125F M5-RS540-12 / RS540BA-5040 M3-RS395-12 / RS395PH-3328 M3-RS390-12	4
AndyMark 9015	am-0912	4
Denso Throttle Control	AE235100-0160	4
VEX BAG	217-3351	4
Mini CIM	217-3371	4
AndyMark PG	am-2161 am-2194	4
Window Motors/Snow Blower Motor	262100-3030/262100-3040 am-2235	4
VEX 2-wire Motor 393	276-2177	4
Electrical solenoid actuators, no greater than 1 in. stroke and rated electrical input power no greater than 10 watts (W) continuous duty at 12 volts (VDC)		Unlimited
Drive motors or fans that are part of a motor controller or COTS computing device		Unlimited
Fans included in the 2013 Kickoff Kit, <i>FIRST</i> ® Choice, or as a Talon motor controller accessory		Unlimited
COTS servos with a maximum power rating of 4W each at 6VDC		Unlimited

5. Tournament Rules

The tournament rules are the same as the 2013 FRC game Ultimate Ascent except as noted.

5.3.4 Qualification Seeding

All Teams in attendance are seeded during the Qualification MATCHES. If the number of Teams in attendance is 'n', they are seeded '1' through 'n', with '1' being the highest seeded Team and 'n' being the lowest seeded Team. The FMS ranks all Teams in decreasing order, using the following sorting criteria:

1 st order sort	Qualification Score
2 nd order sort	Cumulative sum of HYBRID points
3 rd order sort	Cumulative sum of ELEVATION points
4 th order sort	Cumulative sum of TELEOP points and FOUL points
5 th order sort	Random sorting by the FMS

5.4.4 Elimination Scoring

In the Elimination MATCHES, Teams do not earn Qualification Points; they earn a Win, Loss, or Tie. Within each series of the Elimination MATCH bracket, the first ALLIANCE to win two MATCHES will advance.

6 Glossary

6.1 PIPEFALL Terms

ALLIANCE: a set of three Teams (four if counting a BACKUP ROBOT) who play PIPEFALL together.

ALLIANCE CAPTAIN: a designated student representative from the ALLIANCE Lead.

ALLIANCE STATION: the area bounded by the ALLIANCE WALL, white tape, and carpet perimeter.

ALLIANCE WALL: a 6 ½ ft high, 27 ft wide, wall that defines the ends of the FIELD.

ARENA: all elements of the game infrastructure required to play PIPEFALL: the FIELD, the ALLIANCE STATIONS, the PIPES, and all supporting communications, ARENA control, and scorekeeping equipment.

BOUNDARY: The area outside the field that is off limits to all team members, media and event personnel (with the exception of the Head Referee, FTA, and Field Supervisor in limited circumstances) during matches.

BACKUP TEAM: a Team used to replace an inoperable ROBOT on an ALLIANCE during Elimination MATCHES per Section 5.5.6.

BUMPER: a protective assembly designed to attach to the exterior of the ROBOT and constructed as specified in Section 4.1.6, BUMPER Rules.

BUMPER ZONE: the volume contained between two virtual horizontal planes, 2 in. above the floor and 10 in. above the floor.

CENTER LINE: the line, marked in White gaffers tape, which bisects the length of the FIELD.

COACH: a student or adult Mentor identified as the person wearing the designated "COACH" pin or button during a MATCH.

COMPONENT: any part in its most basic configuration, which cannot be disassembled without damaging or destroying the part or altering its fundamental function.

COTS: a "Commercial, Off-The-Shelf" COMPONENT or MECHANISM, in its unaltered, unmodified state. A COTS item must be a standard (i.e. not custom order) part commonly available from the VENDOR, available from a non-Team source, and available to all Teams for purchase.

Example 1: A Team orders two ROBOT grippers from RoboHands Corp. and receives both items. They put one in their storeroom and plan to use it later. Into the other, they drill "lightening holes" to reduce weight. The first gripper is still classified as a COTS item, but the second gripper is now a "custom part" as it has been modified.

Example 2: A Team obtains openly available blueprints of a drive component commonly available from Wheels-R-Us Inc. and has local machine shop "We-Make-It, Inc." manufacture a copy of the part for them. The produced part is NOT a COTS item, because it is not commonly carried as part of the standard stock of We-Make-It, Inc.

Example 3: A Team obtains openly available design drawings from a professional publication during the pre-season, and uses them to fabricate a gearbox for their ROBOT during the build period following Kickoff. The design drawings would be considered a COTS item, and may be used as "raw material" to fabricate the gearbox. The finished gearbox itself would be a FABRICATED ITEM, and not a COTS item.

Generally available software modules obtained from open sources (e.g. professional publications, commonly used FRC community-accessible web resources, industry source code repositories, etc.) that are not specifically affiliated with individual FRC Teams are considered COTS items.

DISABLED: a state in which a ROBOT has been commanded by the Driver Station to deactivate all outputs.

DISQUALIFIED: the status of a TEAM, as determined by the Head Referee, in which they receive zero (0) Qualification Points in a Qualification MATCH or receive zero (0) points in, and lose, an Elimination MATCH.

DRIVER: a pre-college student TEAM member responsible for operating and controlling the ROBOT.

ELEVATING/ELEVATE: the action of ascending a ROBOT above the carpet.

FABRICATED ITEM: any COMPONENT or MECHANISM that has been altered, built, cast, constructed, concocted, created, cut, heat treated, machined, manufactured, modified, painted, produced, surface coated, or conjured partially or completely into the final form in which it will be used on the ROBOT.

FOUL: a penalty assessed by a Referee which credits the opponent with ten (10) points.

FIELD: the area bounded by and including the GUARDRAILS, and ALLIANCE WALLS.

FIELD TIMEOUT: a TIMEOUT called by the Head Referee.

FRAME PERIMETER: the polygon defined by the outer-most set of exterior vertices on the ROBOT (without the BUMPERS attached) that are within the BUMPER ZONE. To determine the FRAME PERIMETER, wrap a piece of string around the ROBOT at the level of the BUMPER ZONE - the string describes this polygon.

Note: to permit a simplified definition of the FRAME PERIMETER and encourage a tight, robust connection between the BUMPERS and the FRAME PERIMETER, minor protrusions such as bolt heads, fastener ends, rivets, etc are excluded from the determination of the FRAME PERIMETER.

GUARDRAIL: a system that borders the length of the FIELD and consists of horizontal pipes, vertical struts, and polycarbonate shields.

HYBRID: the first 20 seconds of the MATCH in which ROBOTS operate without direct DRIVER control except for the KINECT STATIONS.

HYBRID LINE: a line, marked in Red or Blue gaffers tape, located 60 in. from and parallel to the ALLIANCE WALLS.

HYBRID ZONE: an area on either end of the FIELD bounded by the ALLIANCE WALL, GUARDRAILS, and the nearest HYBRID LINE.

Kit of Parts (KOP): the collection of items listed on any *Kit of Parts Checklist*, available in *FIRST*[®] Choice, or obtained via a Product Donation Voucher (PDV)

MATCH: a two (2) minute and twenty (20) second period of time in which ALLIANCES compete in PIPEFALL.

MECHANISM: a COTS or custom assembly of COMPONENTS that provide specific functionality on the ROBOT. A MECHANISM can be disassembled (and then reassembled) into individual COMPONENTS without damage to the parts.

OPERATOR CONSOLE: the set of COMPONENTS and MECHANISMS used by the DRIVERS to relay commands to the ROBOT.

PIPE: the game pieces used in PIPEFALL.

PLAYER STATION: a position behind the ALLIANCE WALL from where a TEAM operates their ROBOT.

PLAYING CONFIGURATION: The physical configuration and orientation of the ROBOT while playing the game (i.e. after the MATCH has started, and the ROBOT has deployed mechanisms, moved away from the starting location, and/or interacted with the field, GAME PIECES, or other ROBOTS). This configuration is dynamic, and may change multiple times during the course of a single MATCH.

PLATFORM: the Red or Blue steel structures on which ROBOTS may use to aid them in gaining ELEVATION points.

RED CARD: a penalty assessed which DISQUALIFIES a TEAM, see Section 5.5.4.

ROBOT: an electromechanical assembly built by an FRC Team to perform specific tasks when competing in PIPEFALL. It includes all of the basic systems required to be an active participant in the game: power, communications, control, mobility, and actuation. The implementation must obviously follow a design approach intended to play PIPEFALL (e.g. a box of unassembled parts placed on the FIELD or a ROBOT designed to play a different game would not satisfy this definition).

SCORED: A PIPE is considered SCORED on a SCORING POLE if the PIPE is surrounding the SCORING POLE or if the PIPE is supported by the SCORING POLE or another SCORED PIPE. If the PIPE is in contact with a ROBOT of its own color it will not be considered SCORED. If it is questionable whether a game piece is being touched by a ROBOT of its own color and a definitive answer cannot easily be obtained, the referees will default to the PIPE being contacted. The PIPES will be scored at the end of HYBRID and at the end of the MATCH.

SCORING POLE: a FIELD element in which PIPES are SCORED on to earn points for an ALLIANCE.

STARTING CONFIGURATION: The physical configuration and orientation of the ROBOT when the MATCH is started. This is the state of the ROBOT immediately before being Enabled by the Field Management System, before the ROBOT takes any actions, deploys any mechanisms, or moves away from the starting location. This configuration is static, and does not change during a single MATCH (although it may change from MATCH to MATCH). In the STARTING CONFIGURATION, no part of the ROBOT may extend outside the vertical projection of the FRAME PERIMETER, with the exception of minor protrusions such as bolt heads, fastener ends, rivets, etc. No part of the robot may be higher than 72" when measured from the floor.

If a ROBOT is designed as intended and pushed up against a vertical wall (in STARTING CONFIGURATION and with BUMPERS removed), only the FRAME PERIMETER (or minor protrusions) will be in contact with the wall.

STARTING LINE: the line, marked in White tape, located 4 ft. behind the ALLIANCE WALL behind which TEAM members must stay during HYBRID.

SURROGATE: a Team randomly assigned by the Field Management System to play an extra Qualification MATCH, detailed in Section 5.3.2.

TEAM: 1 COACH, and 3 DRIVERS from the same FRC Team.

TELEOP: the remaining two (2)-minutes of a MATCH in which ROBOTS may be directly controlled by DRIVERS.

TIMEOUT: a period of up to six (6) minutes, which an ALLIANCE can use to pause Elimination MATCH progression.

VENDOR: a legitimate business source for COTS items that satisfies all of the following criteria:

- 1 has a Federal Tax Identification number. In cases where the VENDOR is outside of the United States, they must possess an equivalent form of registration or license with the government of their home nation that establishes and validates their status as a legitimate business licensed to operate within that country.
- 2 is not a "wholly owned subsidiary" of an FRC Team or collection of FRC Teams. While there may be some individuals affiliated with both an FRC Team and the VENDOR, the business and activities of the Team and VENDOR must be completely separable.
- 3 must be able to ship any general (i.e., non-*FIRST* unique) product within five business days of receiving a valid purchase request. It is recognized that certain unusual circumstances (such as 1,000 *FIRST* Teams all ordering the same part at once from the same VENDOR) may cause atypical delays in shipping due to backorders for even the largest VENDORS. Such delays due to higher-than-normal order rates are excused.
- 4 should maintain sufficient stock or production capability to fill Teams' orders within a reasonable period during the build season (less than 1 week). (Note that this criterion may not apply to custom-built items from a source that is both a VENDOR and a fabricator. For example, a VENDOR may sell flexible belting that the Team wishes to procure to use as treads on their drive system. The VENDOR cuts the belting to a custom length from standard shelf stock that is typically available, welds it into a loop to make a tread, and ships it to a Team. The fabrication of the tread takes the VENDOR two weeks. This would be considered a Fabricated Item, and the two weeks ship time is acceptable.) Alternately, the Team may decide to fabricate the treads themselves. To satisfy this criterion, the VENDOR would just have to ship a length of belting from shelf stock (i.e. a COTS item) to the Team within five business days and leave the welding of the cuts to the Team.)
- 5 makes their products available to all FRC Teams. VENDOR must not limit supply or make a product available to just a limited number of FRC Teams.

The intent of this definition is to be as inclusive as possible to permit access to all legitimate sources, while preventing ad hoc organizations from providing special-purpose products to a limited subset of Teams in an attempt to circumvent the cost accounting rules. *FIRST* desires to permit Teams to have the broadest choice of legitimate sources possible, and to obtain COTS items from the sources that provide them with the best prices and level of service available. Teams also need to protect against long delays in availability of parts that will impact their ability to complete their Robot. The FRC build season is brief, so the Vendor must be able to get their product, particularly *FIRST* unique items, to a Team in a timely manner. Ideally, chosen Vendors should have national distributors (e.g. Home Depot, Lowes, MSC, Radio Shack, McMaster-Carr, etc.). Remember, FRC events are not usually near home – when parts fail, local access to replacement materials is often critical.

VISION TARGET: a retro-reflective target made of 3M 8830 Silver Marking Film, that may be used by ROBOTS to sense FIELD elements.

YELLOW CARD: a warning for egregious ROBOT or FRC Team member behavior.

Revision Log

1. **G05** Original: "PRELOADED PIPES must not start the match in a scored position."
Change: "PRELOADED PIPES must not start the match breaking the plane of the GUARDRAILS."
2. **G03-C** is removed