

6 THE ROBOT

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6 THE ROBOT

6.1 Overview

This section of the Junior Robotics League Competition Manual provides rules applicable to the design and construction of the robot. Robots will be inspected at the event to verify compliance with these rules before being allowed to compete.

COMPLIANCE WITH ALL RULES IS MANDATORY

6.1.1 What is a Junior Robotics League Robot?

A Junior Robotics League robot is a remotely operated vehicle designed and built by a Junior Robotics League team to perform specific tasks associated with the game.

6.1.2 Getting Started

Please be sure to thoroughly read and understand sections 3, 4, 5, 6, and 7 of this manual before designing your robot. In particular, pay attention to *Section 6.2 Robot Rules* before proceeding. The following are just a few important points offered to help teams in getting started:

1. Evaluate the game's physical challenges and identify those that the robot will have to overcome.
 - Will it have to pick and place items, push/pull objects or robots, have a low profile, extend its height, lift items, etc.?
 - What are the game's implications regarding the robot's center of gravity?
 - Are the unique field surface characteristics important when determining robot driving mechanism design?
 - Are there any particular offensive or defensive capabilities important to the robot?
2. Inspect all items provided in the VEX kit and review their basic features.

6.2 Robot Rules

6.2.1 Safety & Damage Prevention

<R01> Junior Robotics League competition robots shall be powered only from one of the following sources:

- Electrical energy derived from an onboard 7.2 volt rechargeable battery and 9 volt backup battery.
- The battery pack that comes in the kit which holds six (6) 1.5 volt (AA) batteries and 9 volt backup battery.

<R02> Robot parts shall not be made from hazardous materials, be unsafe, or cause an unsafe condition. Items specifically PROHIBITED from use on the robot include:

- Shields, curtains, or any other devices or materials designed limit the vision of any drivers and/or interfere with their ability to safely control their robot.
- Speakers, sirens, air horns, or other audio devices that generate sound at a level

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- sufficient to be a distraction or hindrance affecting the outcome of a match
- Lasers of any type
 - Hydraulic fluids or hydraulic components
 - Magnets of any type
 - Tape used as a fastener
 - Custom circuits and electronics
 - Flashlights or any lighting device that has a separate battery source.

<R03> Robots may only use VEX sensors and electronics (including but not limited to controllers, communication devices, motors, servos, switches, and other sensors) provided on the VEX website,
<https://www.vexrobotics.com/vexedr/products/accessories>.

<R04> Protrusions from the robot shall not pose hazards to game pieces, field elements, team members, or event staff. If, in the judgment of the inspectors or referees, a device on the robot poses a hazard (particularly puncture or impalement hazards), the team will be required to remedy the situation before the robot will be allowed to compete. If the robot includes protrusions that form the “leading edge” of the robot as it drives, and are less than one square inch in surface area, it will invite detailed inspection.

6.2.2 General Robot Design

<R05> Each registered Junior Robotics League team can enter ONE robot into the tournament.

<R06> All robots entered in the JRL competition must have a flag holder securely attached to the robot. The flag holder must sufficiently retain the red and blue alliance-specifying flags provided at the competition.

- Flag holders must have a hole at least an 3/8 inch in diameter and be at least 2 inches deep with a closed bottom.
- There may not be any part of the robot directly above the flag holder.

<R07> Robots must have a two inch tall team number that has a stroke width of 0.25 inches, and is in a contrasting color from their background. The Robot must have two team numbers on two opposite sides of their robot (180 degrees apart) for easy team identification while on the field. Team numbers should be easy to read from a distance of 15 to 20 feet while the robot is moving.

<R08> Prior to the beginning of the match, the robot must fit into a starting configuration of the following:

1. The length shall not exceed 14 inches (Figure R081)
2. The width shall not exceed 14 inches (Figure R081)
3. The height shall not exceed 14 inches (Figure R081)

During a match, a robot can extend beyond 20” in any one direction with no height limit in the vertical direction.

During inspection, the robot will be placed in its operating orientation (eg. on its

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wheels) and tested to make sure it fits within a 14"x14" sizing box. Teams will also be asked to demonstrate that none of the extensions on the robots extend over the 20" expansion size. If during a match, in the referee's judgment, a robot expands in a way that it would be beyond the 6" limit or if there were multiple extensions at once, a penalty may be issued and the robot may be subject to re-inspection before being allowed to compete again.

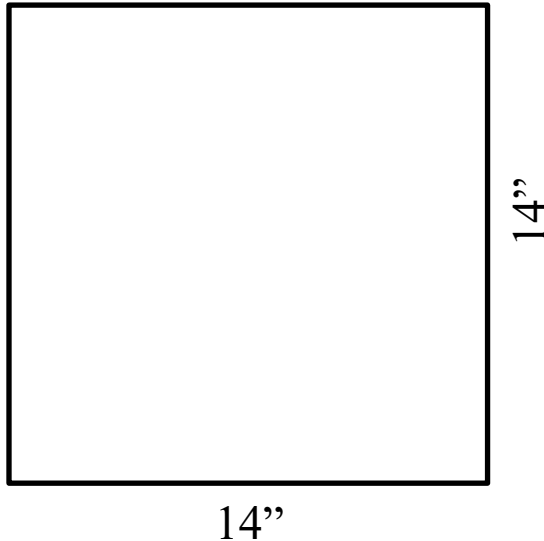


Figure R081

<R09> The Robot on/off switch must be accessible without moving or lifting the robot. The Robot Microcontroller lights should also be visible by competition personnel to assist in diagnosing robot problems.

6.2.3 Budget Constraints

<R10> The quantity and cost of all items not included in this year's Kit-of-Parts used in construction of a robot shall be recorded on the accounting sheet issued to teams at kickoff.

<R11> The costs of all additional parts purchased in constructing the robot shall not exceed \$400 US dollars.

<R12> The following extra parts will not be included in calculating the \$400 budget constraint on each robot:

1. EasyC programming kit
2. Fasteners including screws, nuts, bolts, zip ties, and collars
3. Batteries to power the robot
4. Material used to make the Flag Holder

6.2.4 Material Utilization

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<R13> Materials other than those received in the Kit-of-Parts are allowed. The use of non-Kit-of-Parts items or materials shall not violate any other robot design or fabrication rule.

<R14> Teams may replace lost or damaged Kit-of-Parts components only with identical components of the same material, dimensions, treatment, and part number.

6.2.5 Robot Power Supply

<R15> The only legal sources of electrical energy on the robot during the competition is a 7.2 volt battery pack or VEX Battery Pack (AA battery holder), and a 9 volt backup battery (for the VEXnet system only).

6.2.6 Motors & Actuators

<R16> The combined number of motors and servos used on the robot must not exceed eight.

6.2.7 Control, Command & Signals System

<R17> Robots must be controlled only using pre-programmed, student written software, and the wireless VEX controller provided in the Kit-of-Parts.

6.2.8 Robot Inspection

<R18> At the time of inspection, teams must present their official accounting sheet to the inspector.

<R19> Robots will be inspected for compliance with the maximum permissible dimensions while in its starting configuration. The robot must fit within a sizing device that has inside surface dimensions as specified in *Rule <R08>*. The robot must be self-supporting while in the sizing device and rest on its wheels.

<R20> Robots will be inspected for compliance with the maximum expansion dimensions while in its most expanded state. The robot must fit within the sizing device and must be self-supporting while resting on its wheels.

<R21> All robots shall pass inspection for compliance with these rules before being allowed to compete in qualification matches.

<R22> At any time during the tournament, if a competition official suspects any robot modifications may be in violation of any rule, the robot may be required to go through a re-inspection before the robot can compete again. If an observation is made that another team's robot may be in violation of the robot rules, please approach Team Driven officials to review the matter in question. This is an area where "*Gracious Professionalism*" is very important.