

10 Quick and Easy Ways to Fail Inspection (... and how to avoid them)

Presented by:

Jeff Pahl

Mentor - Teams 1379, 2530, 2861

Lead Robot Inspector- 10,000 Lakes Regional
Newton Division, 2009 World Championship



2009 MN Splash

Overview:

- A discussion of the most common problems observed during robot inspection
- Rules are subject to change each year, so I have avoided using specific numbers, etc.



1) Weight

- Contrary to what some teams seem to believe, there is a weight limit!
- It is much easier to manage weight as part of your design than it is to try and remove it later
 - It is far easier to drill holes in a part before it is assembled onto the robot than to do it at the competition
 - Have someone responsible for allocating the weight budget to the various subsystems on the robot, and track the weight of each piece
 - Use the capabilities of your 3D CAD software
 - Buy a scale!!!



2) Size

- There is a defined size limit, too!!
- The robot must slide in and out of the sizing box without touching the sides, in the configuration it will start each match in
- A good rule of thumb is to start 1" less than the max size with your frame design, so that screw heads, zip ties, etc. do not exceed the limits
- Check your size with a wall and a large square, not just with a tape measure
- Robots can be re-checked at any time, so make sure your design is robust enough to not get bent out of shape



3) Bumpers

- Bumpers may or may not be required this year....
- Must be built to the requirements shown in the rules
 - Use $\frac{3}{4}$ " Plywood. Not particle board, etc.
 - Bottom edge between 1" & 2" from the floor
- Bumpers have their own weight limit, and are weighed separately from the robot
- Must be rigidly attached to the robot
- Bumpers have to come off the robot for sizing and weight
 - As a guideline, Bumpers should be removable and installable by one person in less than 10 minutes



4) Sharp Edges

- “Inspectors will be looking for sharp corners and edges that could cause injury, pinch points, entanglement hazards, and impaling projections. Please mitigate all such hazards. This is for the protection of team members and field personnel as well as game equipment.”
- Debur all cut metal edges, especially outside corners
- Use care when cutting plastic cable ties (zip-ties) to avoid leaving a pointed, protruding end



5) Bill of Materials (BoM)

- You have to have one
 - With you, to give to the inspector, not “back at the hotel”
- List everything you used in the robot that did not come in the Kit of Parts, that cost more than \$1
 - Even if it was donated. Use the cost if you had bought it.
- Don't include stuff that is not part of the robot:
 - Tools, Buttons, Food, Driver Station Parts, etc.
- There are templates available online
- This is also a good place to keep track of your weight!



6) Team Name / Number / Sponsors

- This is one of the leading causes of teams failing inspection!!
- The team number must be on all 4 sides of the robot, using numbers that are at least 4" tall, with a minimum stroke width of $\frac{3}{4}$ "
 - This is so the announcers can identify your robot!
 - On the bumpers is OK
- The name of the school (or sponsoring organization) and your primary sponsors needs to be on at least 2 sides.
 - These are the people who paid for your robot, be proud of them and give them the appropriate credit!



7) Electrical

- Make sure the battery is securely fastened in place
 - Even if the robot tips over...
- Use the appropriate size and color wires, per the rule requirements
- Only use the allowable motors from This Year's Kit of Parts
 - In particular, the Fisher Price motors from previous years are generally all different



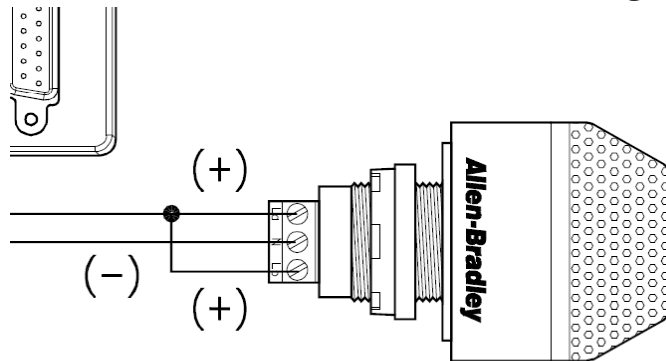
7) Electrical

- The electrical system must be isolated from the robot frame
 - The cRIO and the camera both have internal connections between the mounting holes and the power return!
 - They must be mounted with a non-conductive material between them and the robot frame.



8) Robot Signal Light

- The Robot Signal Light (Orange Blinky Light) must be placed such that it is visible from in front of the robot
- The light must be wired correctly: there needs to be a jumper wire between the 'La' and 'Lb' terminals for the light to work properly



- Fast Blink: System Error / No Communications
- Steady On: Everything OK
- Fast - Slow Blink: Low Battery and System Disabled
- Slow Blink: System Disabled



9) Pneumatics (Air Compressor)

- Improper operation of the air compressor is one of the most common problems observed at inspection.
- The pressure sensor switch must be wired to the cRIO Digital Sidecar, not to the compressor
- The cRIO must control the compressor by software, using a Spike Relay
 - This is so that when the robot is disabled, the compressor is also disabled
- The compressor must shut off at < 125 psi
- Recommended to replace the 20A fuse in the Spike relay with a 20A circuit breaker



9) Pneumatics

- Do not use more than the number of pressure storage tanks allowed in the rules
- The pressure relief valve provided in the KoP must be attached to the compressor
- There must be an easily accessible vent valve, that vents the entire pneumatic system
- All pneumatic components must meet the minimum pressure rating given in the rules
- **DO NOT MODIFY ANY PNEUMATIC COMPONENT,** except as may be specifically allowed in the rules



10) Firmware Versions

- The cRIO must have the correct (latest) firmware image loaded
 - If it is necessary to update the cRIO at the competition, you will also have to load the latest set of libraries for whatever programming environment you are using, and re-compile.



Summary

- The inspection checklist will be released prior to ship day. Use it to pre-inspect your robot.
- The inspectors will only talk to students during the inspection, not mentors. Make sure your team members that know the answers to the questions are available when you come for inspection.
- The inspectors are there to help. If your robot has a problem, they will try to work with you to get it fixed, or help you find another team that can assist.
- Please help us out by not waiting until the last minute to get in line for inspection.



Summary

- If you disagree with the inspector, please politely ask to get a second opinion from the Lead Robot Inspector.
- The decisions of the Lead Robot Inspector are final.
- We will do everything we possibly can to make sure your robot passes inspection before your first match!
- Remember- the inspectors are your friend 😊

