## **VEX Nameplate Holder**

By Team 5106C

If you're on a competitive VRC team, you've probably forgotten you license plates at least once. You get to a match, only to realize that you're team is on the red alliance, not the blue one. Then you have to run to the pits to pick up the red plates you left sitting on your team's table, sometimes finding that by the time you get back your match is already setting up on the field without your team. Through several seasons of competitions, my team has made this silly mistake many times, but we intend to solve this problem with a neat license plate holder that can be 3D printed for any team to use.

The VEX Nameplate Holder holds one doubled-up license plate. This solves the issue of forgetting plates because the robot will always have both sets on hand. This holder also blocks the back license plate, preventing violations of VRC Robot Rule R28a, so referees will have no doubts as to which alliance your robot is on. These holders are also easy to use, as there are no screws securing the license plate itself, so flipping the plates takes mere seconds.

As of the current Tower Takeover Game Manual, 3D prints of the VEX Nameplate Holder are legal for competition use. Under VRC Robot Rule R12, non-functional decorations are allowed on competition robots, provided that they are in "the spirit of the competition". In VRC Robot Rule R28b, the "VRC license plates are considered a non-functional decoration", and in R28ai the manual itself suggests using tape to cover the backside of license plates, as "this is a legal non-functional use of tape" because of R28b. If non-functional tape can be used on the license plate, than 3D prints can too. Therefore, 3D prints holding the VEX license plates on the robot are considered legal 3D prints.

To get the VEX Nameplate Holder, the .ipt or .stl files can currently be downloaded off of this entry and 3D printed. For personalization, a message can be put in place of the "5106 - KennettCoders" text using most CAD software. To attach to a competition robot, secure the base of the holder to your robot using a combination of the eight screw holes provided on the base. The cover can be slid over the base to complete the setup. As shown in the VEXNameplateHolder Animation, the holder can be used by sliding off the cover, flipping the license plate, and replacing the cover onto the holder. This animation also shows that the holder is quick and easy to use, so your robot won't be running late to a match because of its license plates. The slider on the holder has a tolerance of 0.02 inches, which, when printed on a Stratasys UPrint with soluble support material, is smooth enough to move the cover but sticky enough that the cover won't come off without human intervention. Although my team hasn't had a problem with falling over this year, this tolerance should be able to prevent the license plates from coming off if your robot falls a lot.





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The VEX Nameplate Holder was made using Autodesk Inventor Professional 2019. It took three different designs to get to the base and cover connection seen today. This arc connection allows for the cover to slide off towards the outside of the robot, which allows the cover to avoid hitting any parts directly above it, such as the motors on team 5106C's robot. The edges on the holder are fillets, so they are smooth to the touch. Although this is not a print that needs to be extremely strong, this also strengthens connections that could break off, such as the arc slider on the base of the holder. There are four screw holes on the back of the holder and four on the bottom to allow many options for mounting the holder onto a robot. These screw holes are counterbored, meaning that there is a wide shallow hole for the screwhead to sit in so it doesn't scrape on the license plates sitting inside the holder. This type of hole can be seen in the seventh rendered picture, as this is a rendered section view that cuts right through the screws, holes, holder, and plates. Text was added on the bar at the bottom of the holder base to personalize the holder, as the space looked empty. Through test printing small sections of the holder, a tolerance of 0.02 inches was added to the holder, so the cover could slide onto the holder base. Additionally to many pictures and renders of the holder, technical drawings of the holder parts are included to show how to make the VEX Nameplate Holder.

From doing this project, I learned how to make fancy renders using Inventor Pro. This is something I've never done before, as I usually just take screenshots if I want to share pictures of my creations. Even after several years of experience with Inventor Pro, I have never made animation. I've made presentations, but those aren't the same thing. My first animation was the VEXNameplateHolder Animation, and even though it took five hours to render thirteen seconds of footage, I am really proud of myself. I will probably use Inventor Pro in the future for personal use, as I have enjoyed making and printing models in the past, but I probably won't use this software in my career, as I am interested in software development. For competitive VRC teams, Inventor Pro can help model robot designs using CAD models provided by the VEX Robotics website. It's a bummer that functional 3D prints aren't allowed on VRC robots, but maybe next year I'll be on a VEXU team, 3D printing custom parts until my heart's content.





## Robot Rules R12 & R28

Taken directly from the Tower Takeover Game Manual for easy reference

<R12> Decorations are allowed. Teams may add non-functional decorations, provided that they do not affect *Robot* performance in any significant way or affect the outcome of the *Match*. These decorations must be in the spirit of the competition. Inspectors will have final say in what is considered "non-functional". Unless otherwise specified below, non-functional decorations are governed by all standard *Robot* rules.

In order to be "non-functional," any guards, decals, or other decorations must be backed by legal materials that provide the same functionality. For example, if your *Robot* has a giant decal that prevents *Cubes* from falling out of the *Robot*, the decal must be backed by VEX material that would also prevent the *Cubes* from falling out.

a. Anodizing and painting of parts is considered a legal nonfunctional decoration.

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- b. If using the VEX speaker (276-1504), the chosen audio must not be distracting and must be in good taste. The Head Inspector and *Head Referee* will make the final decision on the appropriateness of the audio.
- c. Small cameras are permitted as non-functional decorations, provided that any transmitting functions or wireless communications are disabled. Unusually large cameras being used as ballast are not permitted.
- d. VEX motors, or components of VEX motors, may not be used as non-functional decorations.
- e. Decorations that visually mimic field elements or could otherwise interfere with an opponent's Vision Sensor are considered functional and are not permitted. This includes lights, such as the VEX Flashlight. The Head Inspector and *Head Referee* will make the final decision on whether a given decoration or mechanism violates this rule.
- f. Internal power sources (e.g. for a small blinking light) are permitted, provided that no other rules are violated and this source only provides power to the non-functional decoration (e.g. does not directly or indirectly influence any functional portions of the *Robot*).
- g. Decorations which provide feedback to the *Robot* (e.g. by influencing legal sensors) or to *Drive Team Members* (e.g. status indicators) would be considered "functional" and are not permitted.

<R28> Robots must have team identification plates. License Plates with VEX Team ID# must be clearly visible and legible at all times on a minimum of two opposing sides. License Plates must not be in a position that would be easily obstructed by a *Robot* mechanism during standard *Match* play.

- a. Robots must use the colored plates that match their Alliance color for each Match (i.e. red Alliance Robots must have their red plates on for the Match). It must be abundantly clear which color Alliance the Robot belongs to.
  - i. If the plates are attached to opposite-color plates, then the incorrect color must be covered, taped over, or otherwise obscured to ensure that the correct Alliance color is abundantly clear to Head Referees during a Match. Since License Plates are considered non-functional decorations, this is a legal non-functional use of tape.
- b. The VRC License Plates are considered a non-functional decoration, and cannot be used as a functional part of the *Robot* per <R12>.
- c. License Plates must fulfill all *Robot* rules (i.e. they must fit within the 18" cube per <R4>, they cannot cause entanglement, etc.)

The intent of this rule is to make it very easy for *Head Referees* to know which *Alliance* and which *Team* each *Robot* belongs to. Being able to "see through" a *Robot* arm to the wrong color License Plate on the opposite side of the *Robot* would be considered a violation of <R28>.