

East Coast Outlaws Summer Series – Build Session Notes



Version 2.1 – July 2024

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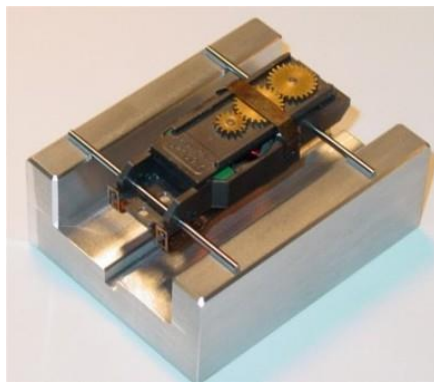
June 15, 2024 – Chassis and Top Plate Setup

Motor Brush Springs and [Electricals](#) (bottom of chassis)

- Make sure all rivets are tight that are holding electricals plates to chassis
- Use a rivet replacement/tightening tool to tighten rivet/electrical plates.

Check for Chassis Squareness

- Insert [0.0635” extended drill blanks](#) through front and rear axles holes and place bare chassis on a [tech block](#) (see picture below). Make sure the drill blanks are snug in the axle holes. If they are not snug, it can mask the fact that the chassis is not flat. **Note:** For other size drill blanks you can purchase from [Travers Tool](#) or [McMaster-Carr](#).



- Tap on each drill blank end. If any ends of the drill blanks are not in contact with the tech block a slight tap sound will be heard. This indicates the chassis is not square. **Note:** As the chassis is built up (i.e. adding top plate, etc.), continue to check for chassis squareness.
- If the chassis is slightly out of alignment, the chassis can still be used but you will need to place different size front tires on either side to compensate for the chassis warpage. **Note:** Do not use different size rear tires on either side of the chassis.
 - For these types of chassis, it may be best to use for the Indy class since they use the largest front tires which can allow more room for adjustment.
- For chassis that are severely warped (i.e. putting different size front tires on either end do not make a difference), there are tooling jigs available to straighten out the chassis.

Top (Gear) Plate

- Early manufactured top plates had a domed idler gear center post. Later chassis had a flat idler gear center post. While ECO has no rules limiting the use of either post type, the following are recommendations:
 - Flat top idler posts are preferred.
 - Domed idler posts are OK to use in more stock classes (i.e. Hobby Stock, Grand National, and Indy)
- On T-Jets, the top plate should fit tight on the chassis. On WizJets the top plates may have some play. It is best to minimize any movement between the top plate and chassis. To do this, bend the front tabs on the bottom of the top plate.
 - To bend tabs, have a glass of hot water and a glass of cold water on your work bench. Bend the tabs on the top plate and insert into the hot water **TBD** seconds. Then remove the top plate from the hot water and immediately place it in the cold water. This will help to set the tabs in place and reduce any memory in the plastic to return the tabs to their original position.
 - There should be no back and forth or side to side movement of the top plate.
- Attach the empty top plate to the chassis and insert the drill blanks through the armature shaft holes in top plate and chassis and the cluster shaft holes in the top plate and the rear of the chassis.
 - Looking at both drill blanks from the side, they should be in parallel with each other.
 - Chassis with attached top plate can also be placed on its side in the tech block and checked for squareness by tapping on the ends of the drill blanks, similar to what was done when checking the axle holes (above).

Top 2 Reasons for Chassis Warpage:

- Top Plate: As mentioned above, adjust tabs on top plate so that top plate fits tightly on the chassis without any warpage to the chassis (use drill blanks and tech block to check for warpage).
- Magnets: A tight-fitting magnet will cause the chassis to warp.
 - Either replace magnet with one that fits better or lightly hand sand the magnet (do not use a Dremel).
 - Be careful when using (magnet) shims as you still need a somewhat loose fit of the magnet in the chassis.

Front and Rear Axles

- Neither axle should have any wobble (up or down and front to back motion) when placed into axle holes of chassis.
- If there is wobble, use a [chassis hole peening tool](#) to peen (make the axle holes smaller) the axle holes.
- To determine if axle hole is right size, insert axle (or drill blank) into chassis axle holes. Tilt chassis and hold sideways. If axle falls out, then hole is still too loose and needs to be peened.
- It is okay to peen one side of axle holes.
- **Note on Peening:** The plastic used to make the chassis, and top plate, have “memory”. That is, when peening a hole in the chassis to make it smaller, the plastic over time will expand the hole back to a slightly larger size. With that said, take your time when peening and let the chassis sit for a day or two after peening to let the plastic settle. Take your time when peening!

Cluster Shaft

- Two thoughts on how cluster shaft should be installed. Pick your poison.
 - Bottom of cluster shaft extends into cluster shaft hole in rear of the chassis. Pros: Minimizes any wear of cluster shaft hole in top plate. Will reduce maintenance over time. Cons: Another friction point with cluster shaft extending into chassis.
 - Bottom of cluster shaft is flush with pinion gear and does not extend into chassis hole. Pros: Eliminates a friction point. Cons: Will increase wear of cluster shaft hole in top plate, requiring more frequent maintenance (peen cluster shaft top plate hole) to eliminate top cluster shaft gear swaying.
- Similar to the axles the cluster shaft should fit in the top plate with no wobble. Use a [chassis hole peening tool](#) to peen the cluster shaft hole in the top plate (make the cluster shaft hole smaller).
- You should use a washer with the peening tool (washer goes around shaft post on bottom of the top plate).
- Don't over peen!

Current Draw

- The less current a car draws, the less friction it has, which means the chassis is set for optimal performance.
- It is important to measure the current draw of the car after every step of the build. Any dramatic increase in current draw will indicate the last step performed in the build is causing additional friction and should be fixed before proceeding any further with the

build. Failure to perform these incremental measurements will make it very difficult to determine the cause when a car draws too much current or is performing poorly.

- A couple of key current draw milestones to keep in mind:
 - With just the armature in the chassis and the chassis connected to 20 volts, current draw should be approximately 80 milliamps (will show on the power supply current meter as 0.080 amps).
 - A fully built chassis should ideally draw around 100 milliamps (0.100 amps).

Motor Brushes

- It is important to get the right tension for the motor brushes.
- Too little tension will cause poor electrical contact to the armature.
- Too much tension will apply more pressure to the armature, causing a slow response in acceleration.
- Ideal tension will have the motor sounding like a dentist drill with that high pitch whining sound.
- The brush spring portion of the electrical plate is very sensitive and will become more so over time as the spring is bent and adjusted. After too many adjustments, brush tension will become inconsistent. Replacing the brush spring electrical plate is necessary.
- The tops of new motor brushes should be very lightly sanded to remove a small ridge around the top edge of the brush. This can be done by rubbing the brush across very fine sandpaper, regular paper, or even cardboard. **Note:** Make sure you apply even pressure across the brush so that the top of the brush remains perpendicular to the sides (i.e. no slopping on top surface of brush).

Gears

- When buying used gears, it is best to buy well used gears. They should have a dark color to them.
- When installing gears onto the top plate, make sure they are centered. To check for this:
 - Lower voltage
 - Place a 0.013 gauge along the side rails of the top plate. Gear should not rub the gauge.
- Besides checking the amperage draw, another way to check for good free gear movement is to remove the brush and magnets from the chassis. Holding chassis with rear axle between fingers, the chassis should spin freely when pushed by your other hand.

Idler Gear

- In classes that allow this, the idler post on the top plate can be expanded to reduce gear wobble.
- When expanding post, use a brass washer that fits around base of post. DBL Racing sells these washers.
- You do not want to expand the post too much as the idler gear must be able to slip on and off.
- A pointed tip tool can also be used to “mushroom” the top of the post.

Pinion Gear

- Sometimes the pinion gear may be too tight of a fit between the top gear plate and chassis. **Note:** This seems to be more of an issue with the WizzJet chassis.
- Always check pinion gear fit between top plate and chassis before it is mounted on the cluster shaft.
- If the fit is too tight, sand down the pinion gear thickness.

Axles

- Always chamfer the end of the axles so that they have a very slight rounded edge.

Rear Axle

- There should be no lateral movement in the rear axle when it is mounted on the chassis with the crown, gear, wheels, and spacers (when allowed).
- When using brass spacers (washers), sand them to remove any lip created during the stamping process.
- As a reference, for those classes where the spacers can be placed inside the chassis (around the crown gear):
 - 0.013 spacers on crown side
 - 0.028 – 0.030 on teeth side
- Spacing should be tight as it will loosen up during break-in.
- Use a smaller drill blank (0.060) to test fit rear axle spacing with crown gear.
- DBL Racing makes [T-Jet Crown Installation tool](#) to help hold the crown gear and align the rear axle during spacing. Tool can be purchased directly from DBL Racing or online at Wizzard.

Front Axle

- There should be a little lateral movement on the front axle. This is to prevent any binding if the car hits a wall during racing.

Guide Pin

- [Mr. Aurora Bob Beers guide pins](#) are considered the best.
- When using a chamfered pin, you must use a flat head screw size 1-72.
- Mounting:
 - Roughen the surface on the back side of the guide pin plate (the side that will attach to the chassis), and the area on the bottom of the chassis will the guide pin will mount.
 - Use a contact type cement like Shoe Gu or E6000. E6000 can be purchased in [small tubes to minimize waste](#).
 - Dave Lockwood recommended [a nail file](#) from your favorite hobby tool supply store, CVS, that can be modified (square off the end so that it is the same width as the guide pin base). This tool can be used to roughen the surfaces of the guide pin and chassis and also be used to remove an old guide pin and remove any residual glue on the chassis. **Note:** You can also find this exact same nail files at “dollar stores” for significantly less cost..

July 14, 2024 – Pick Up Shoes

Two Main Functions of Pick Up Shoes

- Deliver Power
- Effect Handling

Set Up Goals

- Pick up shoe should lay flat on rail, front to back
- Pick up shoe should be perpendicular to rail, side-to side
- Minimizing front to back movement of pick up shoe
- Pick up shoe travel restrictions (when allowed – check class rules)
- Pick up shoe spring tension

The following section will describe how to set up each of the pick up shoe settings.

Set Up Tips – Flat on Rail, front to back

Shoe Sanding

- Use 1500-2000 grade sandpaper to sand rail contact area of shoe flat.
- Sand shoe from side-to-side. Do not sand length wise, front to back.
- When sanding, lightly press on the back of the shoe that contacts the rail with one finger.
- Look for entire rail contact area to be sanded (flat pattern).
- May need to tweak shoe to get flat pattern across entire shoe contact area.

- Wizzard shoes are typically flat and require minimal sanding versus “stock” T-jet shoes that may require more sanding.
- Do not sand too much such that the thickness of the shoe is compromised and becomes too thin.

Flat on Rail

- Good contact will create a thin, hour-glass shaped wear pattern across the entire length of the pick up shoe contact area, from toe to heal.
- Tip:
 - With shoe attached to chassis, use a dry erase marker to color the entire rail contact area of the shoe.
 - Run the car several feet on the track.
 - **Note:** You can also use a permanent marker but you may have to run a few laps to get a good indication on the shoe.
 - You should see an even wear line along the entire length (heel to toe) of the shoe.
- To adjust flatness of shoe, use a smooth, flat plier (Note: You want to make sure the inside of the jaws of the pliers are smooth so as not to damage the pick up shoe) and attach the pliers to the rear (heel) of the pick up shoe contact area (Note: Do not grab the shoe in the middle or front, toe, of the pick up shoe).
- Now bend the back part of the shoe (the portion with the hook on it) either up or down. Do this lightly as a little pressure makes a big difference.
 - Press up on the back part of the shoe to get the heal (rear) of the shoe in contact with the rail.
 - Press down on the back part of the shoe to get the toe (front) of the shoe in contact with the rail.
- Use a rail height gauge, aka T-Jet Rail Pad Block (either home made or from [Wizzard](#), [Scale Engineering](#), or [RT-HO](#)) to check for shoe flatness – entire length of shoe lies flat across rail or gauge with no (air) gaps).



T-Jet Rail Pad Block

- This will probably take a little time to get this adjusted right, so take your time and be patient. This adjustment is critical to your car’s performance.

Set Up Tips – Perpendicular to Rail, side to side

- Adjust shoe so that looking from the front, the shoe is perpendicular to the rail and lies flat on the rail from side to side
- Make sure pick up shoe spring is lying flat inside its cup in the chassis bottom
- Make sure pick up shoe hanger (electrical plate on bottom of chassis the pick up shoe hook connects into) is parallel and flat to the chassis.
 - If it is not and the plate is loose, tighten or replace the rivet that attaches the plate to the chassis.
- Tweak side to side flatness of shoe
 - Using a smooth, flat plier (Note: You want to make sure the inside of the jaws of the pliers are smooth so as not to damage the pick up shoe), attach the pliers to the rear (heel) of the pick up shoe contact area (Note: Do not grab the shoe in the middle or front, toe, of the pick up shoe).
 - Now tweak back part of shoe (part with hook on it) by twisting it one way or the other to flatten out the side-to-side contact of the shoe.
 - Reinstall shoe on chassis and check for side-to-side flatness. **Note:** Remember to make sure pick up shoe spring is lying flat inside its cup in the chassis.

Set Up Tips – Front to Back Pick Up Shoe Movement

- Any front to back movement of the pick up shoe in the chassis should be minimized.
- To minimize this movement, the rear hook of the pick up shoe should be tighter (more closed down).
- To close down hook, use a nail clipper and attach clipper to both sides of hook from the bottom of the shoe. Squeezing the nail clipper will close down the sides of the hook, reducing front to back movement of the pick up shoe.
- Note: After making this adjustment, make sure the pick up shoe still moves freely, up and down, when in the chassis.
 - **Tip:** Reinstall pick up shoe in chassis **without** pick up shoe spring. Now flip chassis over to make sure pick up shoe moves freely (up and down).

Set Up Tips –Pick Up Shoe Restriction

Restricting pick up shoes, when allowed by the class rules, acts as a governor. As the car accelerates, the front end will lift. With the shoes restricted, the shoes will lose electrical contact with the rails, cutting power to the car while it is still in the slot, keeping the car in the slot and allowing power to come back on when the shoes make contact with the rail again (front of car comes back down). This prevents the car from de-slotting if it has too much power applied.

- Wizard pick up shoes allowed in most of the ECO classes come pre-bent (top part of pick up shoe “window” is bent) with some restriction. The restriction for these shoes can be adjusted by bending up or down the pre-bent portion of the window.
- Ideally, with the chassis flat on top of a tech block, when pressure is applied to the back of the chassis (using your finger), as the front tires come off the block surface, so should the pick up shoes. This is the ideal restriction setting for the pick up shoes.
- For “original” T-Jet pick up shoes, Scale Engineering makes a tool, [TGT-3](#), that allows you to make nice clean bends on the pick up shoe window for restriction settings.
- Couple of things to watch for:
 - You may have to bend back pick up shoe window so that it stays in contact with the plastic shoe guide at the front of the chassis.
 - Make sure the top of the shoe does not hit the body.
- If car stutters, pick up shoes may be too restricted.

Set Up Tips –Pick Up Shoe Spring Tension

Pick up shoe spring tension is what balances power (good electrical contact with the rail) with handling (too much spring tension will result in a poor handling car).

- **Goal:** Try to achieve the best electrical contact with the least amount of spring tension.
- Use a [Pick Up Shoe Spring Scale](#) to measure the pick up shoe spring tension. This scale provides tension in (negative) grams. **Note:** These scale measurements are not consistent from scale to scale, so keep this in mind when talking to other racers.
- Adjusting spring tension:
 - Decrease spring tension:
 - Place spring on a solid object. Bottom of tech block is good.
 - Press on top of spring with the bottom of an Xacto blade knife handle.
 - This will compress the spring and reduce tension.
 - Never, never, never, cut the spring.
 - Increase spring tension:
 - Use an Xacto knife blade or small screwdriver to get in between the first couple of spring coils at one end of the spring.
 - Now pull on the other end of the spring with a small set of pliers. Not too much.
 - This will expand the spring and increase tension.
 - Pick up shoe spring tension setting for various track manufacturers:
The following settings are recommended to get the car setup within “the ballpark”. Final tweaking may be necessary.
 - Bowman: 2.0 - 2.3 grams
 - Max Trax: 2.7 – 3.1 grams

- Viper: 2.5 grams
- TKO: 2.5 grams
 - **Note:** TKO rail spacing is slightly wider than all other tracks so make sure pick up shoes are laying flat (side-to-side) across the rails.
- Most tracks on average: 2.0 – 2.5 grams

General Pick Up Shoe Maintenance Tips

Following are general tips to maintaining pick up shoes and getting the most performance out of them.

- If contact area of pick up shoes have burn marks (caused by electrical arcing):
 - Contact patch on pick up shoe needs adjustment.
 - Increase spring tension.
- Too much spring tension is indicated by:
 - Car is fast on straights but does not handle well in corners.
- Tuning tip after spring tension is set:
 - Run car 2-3 minutes and note lap times.
 - Clean tires.
 - Run car again. If lap times do not come back to original lap times, then spring tension is too light.
 - Light cleaning of the pickup shoes between heats using a Dremel tool is OK. **Note:** The key word here is LIGHT, as applying too much pressure on the shoe with the Dremel tool may change spring tension on the car and knock the pickup shoes out of adjustment.
- Typically you want spring tension on both shoes to be the same. However, some drivers will setup a lighter spring tension on the non-driver's side (ground rail).
- There are no rules stating that pickup shoes need to be the same. Some manufacturers shoes are wider and these may be used on the non-driver's side (ground rail).
- Always setup your shoes the night before the race so that when you arrive on race day, your pickup shoe settings are in the ballpark. Final tweaking can be done during practice time on race day.
- Practice in every lane to make sure pick up shoe setup is good for every lane.
- Electrical contact tips:
 - Run a sandpaper strip through the pick up shoe hanger slot in the electricals of the chassis to remove any burrs and/or oxidation. Kind of like flossing your teeth.
 - Use your Dremel tool to buff the hook at the end of the pick up shoe to remove any foreign material or oxidation.

- Use electrical contact cleaner on these parts to complete cleaning process.
- Properly setting up pick up shoes is not a 2 or 3 minute job. Hours can be spent doing this. Time and effort devoted to this important part of the t-Jet chassis build/setup is critical to getting the maximum performance from your car
- Again, main goals:
 - Flat shoe contact with rail.
 - Balance speed with handling.