

Thank you for purchasing our **Patent Pending** 16mm 1/8th scale Hybrid pistons with adjustable top plates. This write up will include installation instructions, baseline recommendations for Buggy and Truggy, along with the background and history of these pistons. This concept was a development between a colleague of mine Scott Fredrickson (Mechanical Engineer with a fluid dynamics background) and myself back in the 2015-2016 time frame. The goal was getting the pack on jump landings correct (not chassis slapping or being too stiff) along with low speed traction and bump handling. During this time frame, emulsion shock caps were beginning to emerge and the racers were trying to compare emulsion shocks to shocks with bladders. Multiple companies were coming out with non-stock kit flat pistons listed below:

- Tapered pistons - If you installed with the taper up would have 1 effect and installed with the taper down would have a different effect.
- O-rings on the outer diameter of the piston - These were to eliminate the blow by of the oil around the piston creating a more consistent shock.
- Steel balls - To create a system that features a bump stop effect going up and more rebound coming down.
- Brass Pistons - To slow down the piston movement due to the extra weight of the piston.
- Shock Valving - To speed up or slow down shock rebound or compression

To effectively test these piston configurations listed above and to understand if and how they worked, a shock dyno was built. The shock dyno would allow us to test Force, Velocity, and Displacement and from these 3 three measurements. From this data, two useful plots can be produced to interpret damper performance listed below:

- Force vs Displacement
- Force vs Velocity

With this data collected, the Damping Coefficient and the Damping Ratio can be calculated, but it only really tests the damper (shock piston (# of holes and sizes), shock oil, shock with bladder or emulsion) and doesn't take into account the Critical Damping Coefficient (mass, springs, motion ratio, etc.)

To really understand the complete picture of changes to the shock package, a Impact tester was built to simulate the Critical Damping Coefficient. This unit gave us the final data needed to really understand the effects of how shock pistons (holes sizes and # of holes), oil, and springs all work together to form the pack on jump landings, low speed traction, and bump handling. Numerous runs and data were collected on this unit changing pistons (# of holes and sizes), oils, emulsion or bladders, and etc. The data was compiled into a database to store, organize, analyze, and create reports. After additional testing and analyzing the data, we had a better understanding of what is actually going on inside the shock. We found a multi hole configuration that not only gave a constant pack on jump landings, good low speed traction, and bump handling. This configuration was then track tested and showed the same result as the impact tester. A few sets

of these pistons were handed out to some racers to try and experiment with. Some people and companies have seen some of these pistons used by testers and have created multi-hole pistons, but don't have the understanding and data behind how they work. Due to the growth of the Bones Brew Fuel business, I didn't have time to further develop the piston, so the project was shelved to a later date. In June 2023, I closed up the Bones Brew Fuel part of the business and became a dealer for another R/C Fuel company, freed up some of my time in August 2023 to resurrect the piston project. Changing pistons or drilling additional holes in the piston at the track can be time consuming, so we took the project to the next level. Having changeable top plates to increase or decrease low speed grip and bump handling along with the ability to swap out the top plate without having to disassemble the shock. This allowed the racer to change the top plate, top off the shock fluid, re-bleed the shock and mount them back on the vehicle. These pistons and top plates are made in the USA from 150 Delrin (The best you can get) and will stand up to the use of silicone oil, pressure, and temperature. There will be continued R&D on this project and possible additional top plates in the future that would work on these pistons. They will be sold in the following configurations:

1. A complete set - Give you (4) pistons with each of the larger hole sizes. (8) of each top plate configuration (all open, 12 holes open, 9 holes open). (8) low profile lock nut or (8) washers if for a Losi vehicle. The Kyosho and Mugen would use their 2.6mm shock piston nuts from their kit at a reduced price. This would allow you to outfit (2) vehicles or (8) shocks with the complete set.
2. A set - The customer will get 4 pistons of the outer large hole size they want. (4) of each top plate configuration (all open, 12 holes open, 9 holes open). (4) low profile lock nut or (4) washers if for a Losi vehicle. The Kyosho and Mugen would use their 2.6mm shock piston nuts from their kit at a reduced price. This would allow you to outfit (1) vehicles or (4) shocks with the complete set.
3. Pistons, top plates, low profile lock nuts, and washers for Losi vehicles will also be sold separately

The process to install the Hybrid piston with tops is as follows:

1. Press the piston on the shaft
2. Put on the top plate and twist it until it fits into the keyway (Note: The all holes open top doesn't have a keyway)
3. Install and tighten the low profile lock or the stock screw and provided washer for a Losi vehicle
4. If you need to change the top plate that is installed in the shock, you can do the following:
 - Remove the shock off the vehicle
 - Remove the shock spring retaining collar, spring, shock cap

- Compress the shock all of the way moving the piston to the top of the shock (some brands you may need to unscrew the shock end a little)
- Remove the low profile lock nut or the stock screw and provided washer for a Losi vehicle
- Use an exacto knife and pop the current top plate.
- Put on the new top plate and twist it until it fits into the keyway
- Put on the low profile lock nut and tighten it, use the stock screw and provided washer for a Losi vehicle, and the Kyosho and Mugen would use their 2.6mm shock piston nuts from their kit.
- Top off the shock fluid and bleed the shock

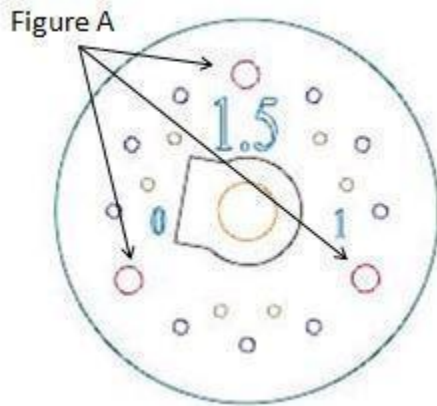


Figure A: These 3 larger holes that your shock oil and hole size will generate the pack on jump landings. It is critical to get the correct pack you are looking for with the hole diameter and shock oil. We offer 4 different hole options of 1.5mm, 1.6mm, 1.7mm and 1.8mm. Typically the 1.5 thru 1.7 are used for 1/8 buggy and 1.6 thru 1.8 are used for 1/8 truggy.

Figure B

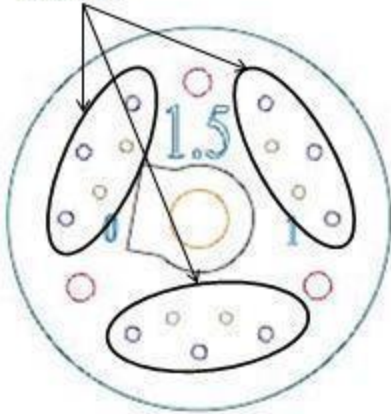


Figure B: These holes control the low speed grip and rough section handling. The more holes you have open, the more low speed grip and bump handling you will have. These holes will not negatively affect the pack on jump landings

Figure C

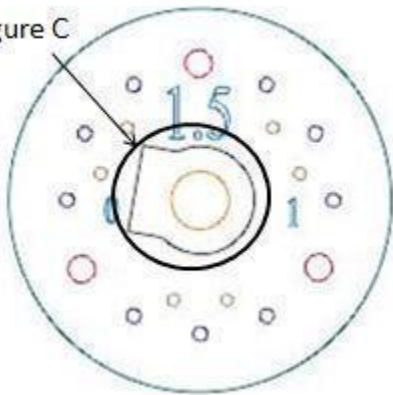


Figure C: This is the keyed notch that the top plate will lock into.

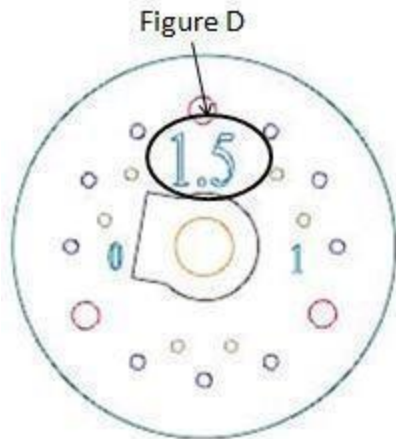


Figure D: This etched number is the size of the larger 3 holes. The size of holes in conjunction with your shock oil will determine the pack.

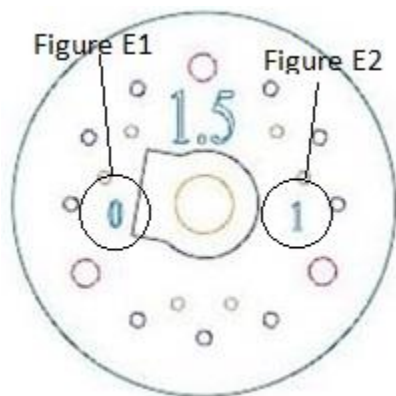
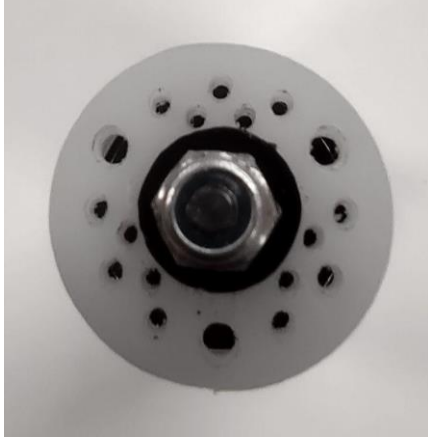


Figure E1: This is the revision number of the piston. The current Revision number is 1 as of 12/20/2023

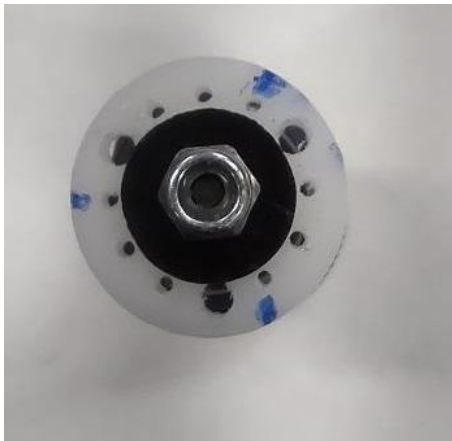
Figure E2 : This is the part # of the piston. #1 for Losi and Hot Bodies and #2 for Tekno, Associated, Sworkz, Kyosho, Mugen, Xray

Please note the pistons might be a little tight to put on the shafts the 1st time, if so use a small nut driver to pop them on.

Below is a look at each of the piston tops installed. You will not need to use any washers under the pistons. For Losi pistons, you will replace the TLR243046 washer that is provided with the piston kit. The Kyosho and Mugen would use their 2.6mm shock piston nuts from their kit. All other brands will replace the lock nut on the piston shaft with the provided low profile lock nut.



The picture above shows the all holes open top plate that will provide you the maximum low speed grip and bump handling. You will note that this top plate does not have a keyed notch since it doesn't cover any holes. To install press the piston on the piston shaft, install the top plate onto the piston and tighten the nut or screw. This configuration will not negatively affect the shock pack on jump landings.



The picture above shows the 12 holes open top plate that provides a reduction in low speed grip and bump handling compared to the all holes open top plate. You will note that this top plate does not have a keyed notch. To install press the piston on the piston shaft, install the top plate onto the piston and tighten the nut or screw. This configuration will not negatively affect the shock pack on jump landings.



The picture above shows the 9 holes open top plate that provides the least amount of low speed grip and bump handling, and makes the steering more reactive. To install press the piston on the piston shaft, install the top plate onto the piston and rotate the top plate until it locks into the piston keyed notch and tighten the nut or screw. This configuration will not negatively affect the shock pack on jump landings.