

Motive Engineering

Hub Stand Alignment System

Congratulations on your purchase of the Motive Engineering Hub Stand Alignment System. While there are numerous hub stands on the market, the Motive Engineering system is the only one that is designed to be used on vehicles that have a locked, or spooled differential. The rotating adapter plates allow each hub stand to independently rotate so that the base sits flat on the ground regardless of the orientation of the wheel studs. We have designed in more features and measurements than any other hub stand on the market. These are precision tools and should be treated as such. With proper use and care the Motive Engineering Hub Stand Alignment System will provide many years of precision alignment and chassis setup.

Caution: All instructions and Safety Precautions must be followed!

Improper use and failure to follow safety precautions can result in **serious injury, bodily harm, or death**. In addition to dangers to persons, vehicle and property damage may result. Read and understand all instructions prior to using this product. It is not possible to cover all possible circumstances in these instructions so it is the user's responsibility to use wise judgment for their own safety and the safety of others.

Safety Precautions:

- Hub stands are only to be used on hard, flat, level surfaces. The low friction rollers will allow the vehicle to roll away if not used on a level surface.
- DO NOT WORK UNDER VEHICLE WHEN USING HUB STANDS! It is possible for hub stands to “tip over” if the vehicle is pushed or power is applied to the drive train.
- Place back up jack stands under the vehicle while using hub stands to prevent the vehicle from falling if something were to happen.
- Disconnect battery and disable starting the vehicle.
- When lowering the vehicle onto the hub stands, do so SLOWLY!
- Tighten all hardware before placing weight on the hub stands.
- Do not use hub stands if under the influence of alcohol, drugs or otherwise impaired.
- Do not use around minors or other people not familiar with the safe use of hub stands.
- Do not use hub stands if parts are missing or damaged in any way.
- Do not modify hub stands.
- Do not disconnect or remove any component of vehicle that supports the weight of the vehicle while the weight of the vehicle is on the hub stands.
- Tighten all vehicle hardware to recommended torque settings.
- Be mindful of other potential dangers and take precautions as needed.

Instructions:

With the vehicle parked on the hard, flat and level surface that the alignment is to take place on, disconnect the battery and disable the car from starting. Before the wheels are removed from the vehicle, measure the centerline height of your tires. (At proper air pressure) This measurement will be used later for setting ride height.

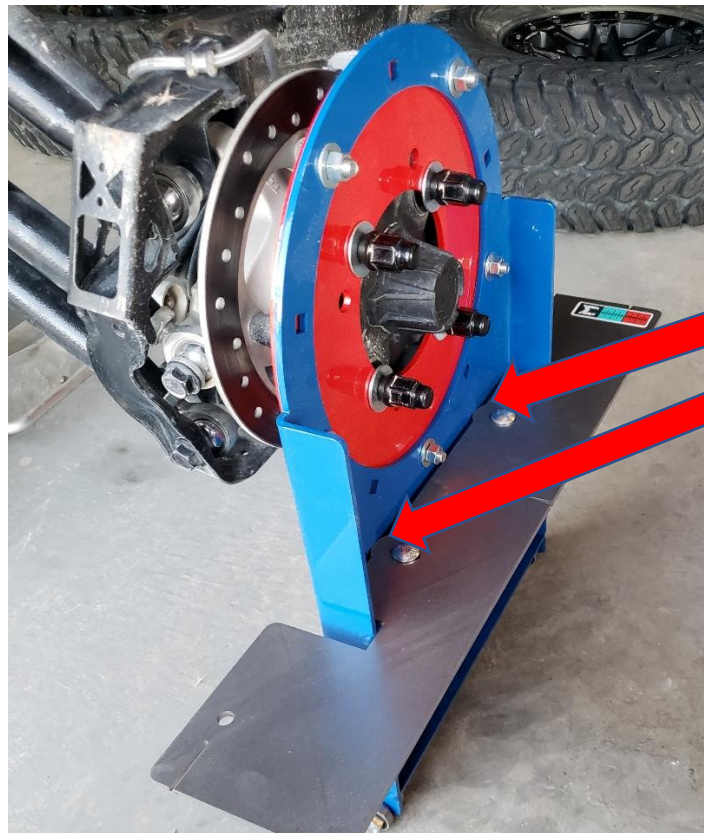
The rollers of the hub stands can be set up to accommodate lateral movement or wheel base changes as the suspension settles. The front hub stands should always be set up to accommodate lateral movement and for steering. The rear stands should be set up depending on the type of suspension. Solid rear axles and traditional swing arms should be set up with the hub stand rollers orientated to roll forward and back. Rear A-arm or trailing arms with radius rod suspension should be orientated for lateral track width changes.

Raise the vehicle and remove the wheels. Select the proper adapter plate for your lug pattern and install it to the back of the hub stand frame with 5 carriage bolts. Do not tighten the carriage bolts at this time. Install the hub stand onto the vehicle with the adapter plate against the mounting surface of the vehicle hub. If the brake caliper protrudes past the face of the hub it will need to be unbolted from its mounting and set aside. Install the proper washers under the lug nuts. Tighten the lug nuts to 30 ft-lbs. Over tightening the lug nuts will deform the washer and could damage the face of the lug nuts. Standard hex nuts may be used in place of lug nuts with the hub stand. This is recommended with universal adapter plates that have slots instead of holes for the wheel studs.

Repeat installation of hub stands onto each corner. With the vehicle in **NEUTRAL and the parking brake OFF**, **SLOWLY** lower vehicle until the hub stands just touch the ground. Make sure each hub stand is clocked so that all the rollers evenly touch at the same time. Tighten the 5 carriage bolts on each hub stand that hold the adapter plate to the stand frame. Leave

the vehicle in neutral so that the hubs may rotate as the steering and suspension moves. **SLOWLY** lower the vehicle until its weight rests on the hub stands. Place jack stands under the vehicle at recommended positions and at a height just short of touching the vehicle. (Some vehicles with electronic shocks may need the key turned on to allow the shocks to settle to the proper ride height. Use extreme caution not to start the vehicle!)

The toe plate can now be bolted to the hub stand with 2 carriage bolts and nuts. Each toe plate has a calibration sticker on it. It is important that each of the toe plates used on the rear of the vehicle has the sticker on the forward side of the toe plate. The calibration sticker should be on the rear of the front toe plates. Switch around toe plates as needed to get this arrangement. There are two heights that the toe plate can be installed at. Either can be used as needed but set all toe plates at the same height. Make sure the rounded “ears” are tight against the hub stand frame before tightening the bolts. (see arrows in photo below)



Measuring Ride Height

The Motive Engineering Hub Stand Alignment System is designed with the hub center at 15" from the ground. If your tire centerline measured 13.25", your ride height will be 1.75" HIGHER with the hub stands in place than with the tires. (15-13.25=1.75)

If your tires measured 17.5" to the centerline, your ride height will be 2.5" LOWER with the hub stands than with the tires. (15-17.5= -2.5)

You will find that with the low friction rollers of the hub stands on a smooth surface, ride height will be sensitive to weight changes. This is especially true with light vehicles and vehicles with soft springs. For the most accurate alignment set ride height with the driver/co-driver or substitute weights in the vehicle and approximately a half tank of fuel.

Measuring Camber

Camber can be measured directly off the face of the hub stand with a digital angle meter, smart phone app or a magnetic caster/camber gauge. Make sure to zero whatever device is used with an accurate level prior to taking measurements. If using a smart phone be careful of buttons that may prevent the edge of the phone from sitting flat against the hub stand.



Measuring Caster

If you do not have a caster/camber gauge, caster can be measured with a digital angle gauge or smart phone. The vehicle corner being measured will need the CAMBER measured with the steering turned 18 degrees to the right and 18 degrees to the left. These two measurements are added together to calculate the CASTER.

Alternately you can turn the steering 18 degrees to one side and zero the angle gauge. Turn the steering the opposite direction 18 degrees and take the reading directly off the gauge.

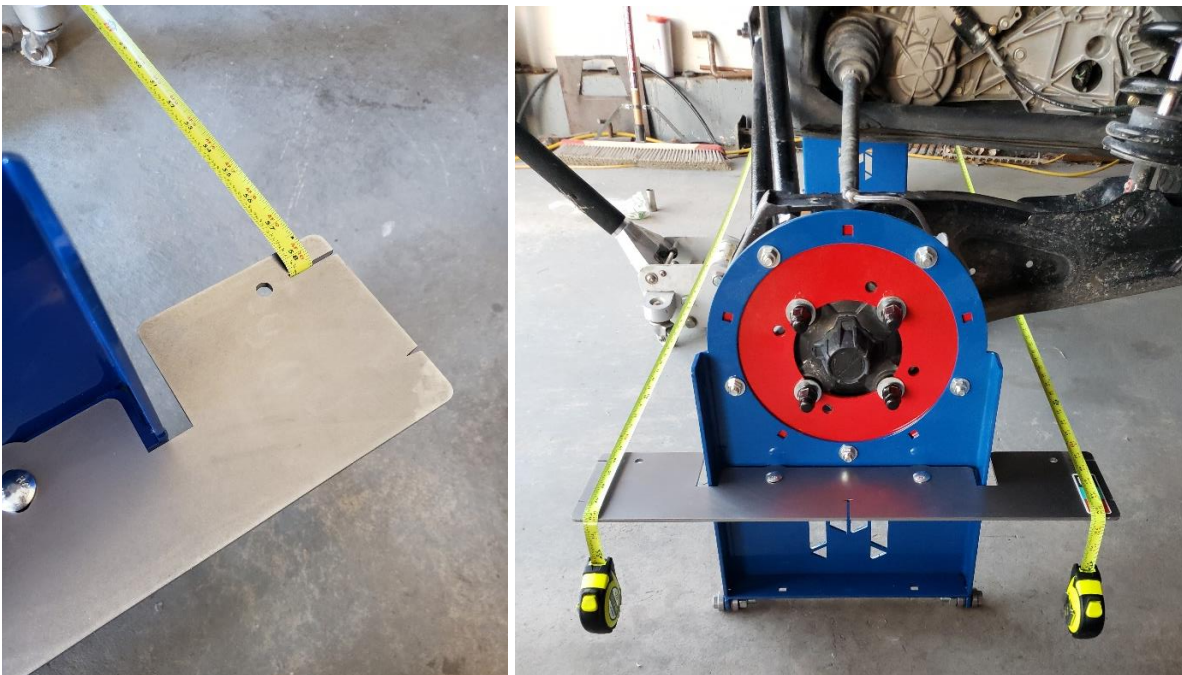
Don't be surprised to find it takes more revolutions of the steering wheel to turn one way than the other. This is due to a principle called Ackerman that causes the inside tire to follow a tighter radius than the outside tire. Due to this design in the steering do not rely on simple turning the steering wheel the same distance. Either mark out the angles on the floor or use a magnetic compass to determine steering angle.



Measuring Toe

Measuring toe is done by measuring across the vehicle from one toe plate to the other toe plate. This is done both in front of the hub and behind it. The difference between the two measurements is your toe measurement. A larger measurement on the front indicates “toe out”. A smaller measurement on the front is “toe in”.

Extend a tape measure under the vehicle and hook the end in the slot of the toe plate on the opposite side of the vehicle. Hang the tape over the toe plate on the side of the vehicle you are working on. Repeat with a second tape measure on the other side of the toe plate. Take the measurements to the slots on the toe plate and calculate the difference between the measurements to get the toe measurement.



Hub Face to Hub Face

The AVERAGE between the two measurements used to find tow is the distance from hub face to hub face. While this isn't a measurement that is used for alignment it may be used when determining track width with different wheel combinations.

After adjusting all alignment measurements on the front of the vehicle to the desired specs, the rear can now be aligned. Start by setting camber and toe on the rear as you did with the front. Remember that adjusting any one measurement will affect the other measurements.

Measuring Wheel Base

Measure from center slot to center slot on the toe plates. This measurement should be the same on both sides of the vehicle.

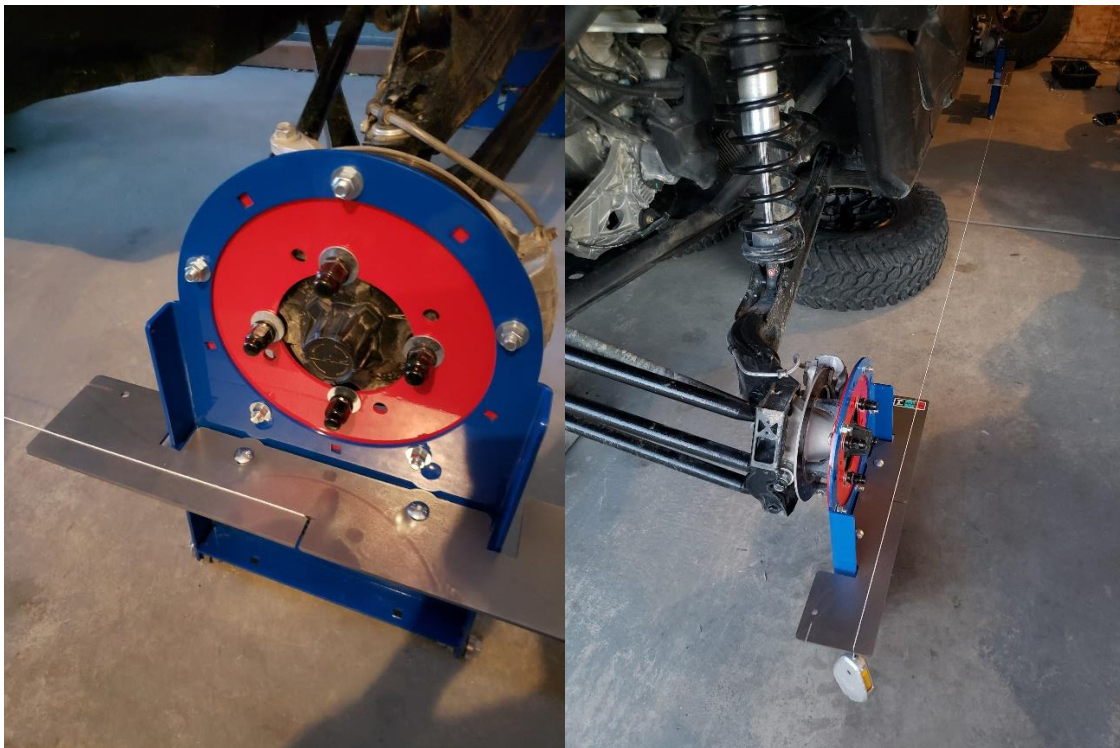


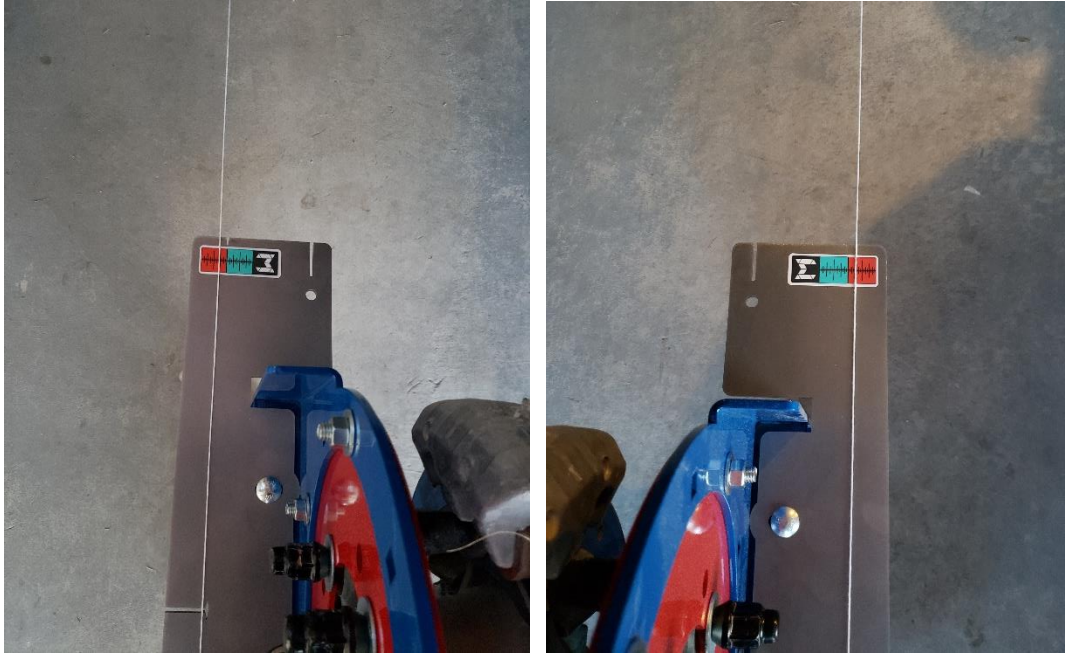
Measuring Thrust Angle

Thrust angle is how square the rear of the vehicle is to the front. Possible thrust angle issues can happen because the rear axle is offset to one side, rear toe set to the correct spec but aimed to one side, or the rear axle is not square to the centerline of the chassis. It is measured by stretching string lines between the front toe plates and the rear toe plates. The measurement is then taken on the color-coded sticker on the front edge of the rear toe plates. The actual measurement does not matter as long as the reading on both the left and right side are the same. The strings should both cross through red or both strings cross through blue, the same number of calibration lines from the center.

Hook a string line in the V notch at the end of the center slot of a front toe plate. Hook the string line real in the rear V notch of the rear toe plate. The weight of the string line real should provide tension on the string. Repeat on the other side.

Note where the strings cross the calibration stickers on the front of the rear toe plates. Make adjustment to the REAR of the car only. You are aligning the rear of the car to be square to the front. Not the other way around.





Remember that making adjustments to one thing will effect others. This system was designed to have minimal error if the steering is not perfectly straight but it is still a good idea to make sure the steering is pointed straight. This can be done by noting where the string crosses the calibration stickers on the front toe plates.

After all adjustments are made, make sure to torque all hardware to factory recommended specs. Double check everything before reinstalling the wheels and don't forget to reinstall the brake calipers if they had to be moved. Pump the brakes.

Other Measurements: Bump Steer

Measure toe with no weight on the suspension. (full droop) The difference between this toe measurement and toe at ride height is the amount of bump steer in the droop portion of the suspension travel. With the shock springs removed you can lower the vehicle until it rests on bumpstops. The difference between the toe measurement at full bump and at ride height is the amount of bump steer in bump portion of the suspension travel.

Thank you for choosing Motive Engineering. For technical help please email to motiveengineering@gmail.com