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Revisions			
Rev.	Description	Date	Approved
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Jeep JK Adjustable Ball Joints

Installation Instructions

Applications:

2007-2018 Jeep Wrangler (JK)



TITLE:

**JEEP JK ADJUSTABLE BALL JOINT
INSTALL INSTRUCTIONS**

SIZE	DWG NO:	REV
A	4127-INST	C
SCALE: N/A		PAGE 1 OF 16



JEEP JK ADJUSTABLE BALL JOINT INSTALLATION INSTRUCTIONS

Thank you for purchasing the best aftermarket products available for your vehicle. We strongly feel that the parts you are about to install should meet or exceed your expectations for performance. Proper assembly is critical to the performance of these components and the vehicle as a whole. Please take the time to carefully read these instructions and familiarize yourself with the installation procedure before working on your vehicle. If you have any questions PLEASE contact Synergy Manufacturing BEFORE beginning installation. Thanks again for supporting Synergy – enjoy the performance benefits of the best aftermarket products available for your vehicle!

Synergy Manufacturing

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Now for the lawyer part:

Modifying or otherwise altering vehicle components may cause the vehicle to handle differently than originally designed. It is the driver's responsibility to familiarize themselves with the performance and handling characteristics of the modified vehicle. Vehicles with larger diameter than stock tires must be driven carefully and cannot be expected to perform as stock or meet OEM performance with regard to handling, braking or crash performance. Ensure all replacement components are compatible with vehicle capacities so as not to overload components, especially tires. It is up to the individual to ensure that the vehicle and all components are compatible with the intended vehicle use, including load ratings, road conditions, and driver abilities. Thorough and frequent vehicle inspections are recommended to ensure a safe and reliable state of readiness, especially after off-highway use.

PARTS LIST

4127 Jeep JK Non-Knurled Ball Joints		
QTY	Part Number	Description
2	412701-02	Adjustable/Rebuildable Lower Ball Joint
2	412701-01	Upper Ball Joint
2	N/A	9/16-18 Zinc Plated Slotted Hex Nut
2	N/A	5/8-18 Zinc Plated Slotted Hex Nut
4	N/A	1/8 x 1.25 Zinc Plated Cotter Pin
4	N/A	1/4-28 Straight Zerk Fitting
2	N/A	1/4-28 Flush Zerk Fitting
1	412702-01-PL	Ball Joint Adjuster Wrench

4127KN Jeep JK Knurled Ball Joints		
QTY	Part Number	Description
2	412701-02KN	Adjustable/Rebuildable Lower Ball Joint
2	412701-01KN	Upper Ball Joint
2	N/A	9/16-18 Zinc Plated Slotted Hex Nut
2	N/A	5/8-18 Zinc Plated Slotted Hex Nut
4	N/A	1/8 x 1.25 Zinc Plated Cotter Pin
4	N/A	1/4-28 Straight Zerk Fitting
2	N/A	1/4-28 Flush Zerk Fitting
1	412702-01-PL	Ball Joint Adjuster Wrench

GENERAL NOTES

- These instructions are also available on our website; www.synergymfg.com. Check the website before you begin for any updated instructions and additional photos and videos for your reference.
- Worn front end components can quickly wear out other components. When replacing ball joints, check the condition of the tie rod ends in the steering and the track bar and suspension bushings, especially if 'death wobble' was ever experienced. Replace all worn components all at once.
- These Synergy ball joints are designed as a lifetime part. As they wear, the joint can be adjusted to accommodate for this wear. This adjustment can be performed with the vehicle on the ground without removing any parts from the vehicle. If no more adjustment is possible, the joints can be re-built without removing the ball joint body from the axle housing.
- Rebuild kits are available from Synergy Mfg. Part number 4127-100.
- Replacement hardware kits are available from Synergy Mfg. Part number 412701-HDW.
- While these ball joints are designed as a lifetime part, they are not maintenance free. The joints require lubrication with fresh grease occasionally. We recommend re-greasing the joints after every 20,000 road miles. If harsh conditions are encountered, such as a dusty, salty, or wet environment, then we recommend re-greasing the joints more frequently.
- Ball joint installation should be done by qualified professionals. Incorrect ball joint installation can cause severe problems and safety issues.
- The upper ball joints are a plunge type – the stud should move freely up and down before installation. This is normal.
- These Synergy ball joints have a break-in period. This can be from a couple hundred to a couple thousand miles, depending on the vehicle and driving conditions. Until the joints have properly broken in, the steering can feel 'tight' and the vehicle will not return to center well. This is a typical characteristic of metal on metal joints.
- If non-knurled ball joints are removed from the vehicle, they should be replaced with non-knurled ball joints unless the vehicle has had several replacement sets and the ball joints are no longer a press fit. Installing knurled ball joints into an axle that is brand new or has only had non-knurled ball joints can cause extremely tight steering or difficulties adjusting preload on the lower ball joints.

TOOLS NEEDED

- Ball Joint Press
- Wrenches and Sockets: 18, 21, 22, 27mm wrenches and sockets, 13mm 12 point socket
- 5mm allen wrench
- ¼ Drive Torque Wrench (For preload adjustment)
- Red (high strength) threadlocker

ESTIMATED INSTALLATION TIME

4-6 Hours

LOWER BALL JOINT OVERVIEW

1. These ball joints are adjustable for preload and are rebuildable. **Figure 1** identifies the components of the ball joint and the assembly order.

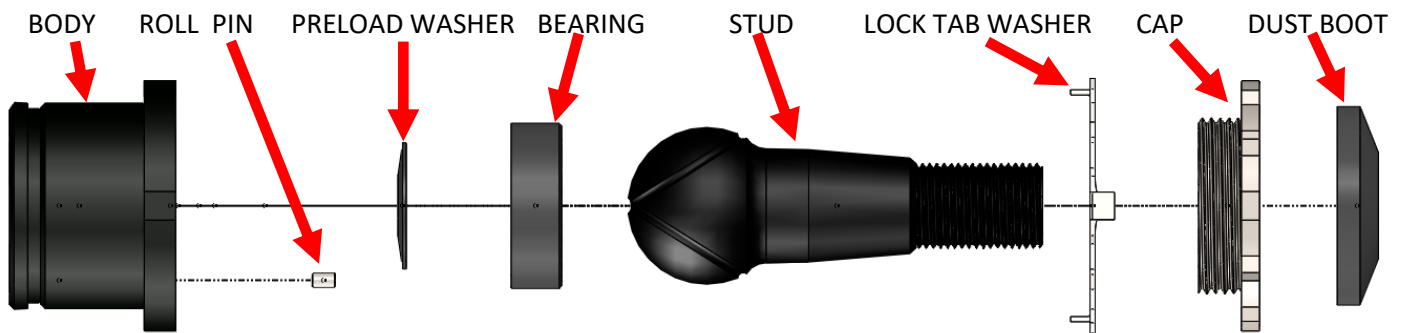


Figure 1. Ball Joint Components and Assembly Order

2. We recommend installing the joints assembled.
3. If the joint is to be disassembled for any reason, it is important to keep all the parts of specific joints together. We recommend only disassembling one joint at a time or keeping them in separate left/right trays or boxes.
4. In order to disassemble the joints, the tabs from the lock tab washer that engage the cap must be bent down. The cap can then be unthreaded from the body, and the stud removed from the body. The bearing will usually come out with the stud. Be careful not to lose the preload washer, it will usually remain 'stuck' in the body due to the grease. It is fine to leave the bearing in the body.
5. When re-assembling the joints, make sure they are assembled in the order shown in Figure 1. The bearing has a machined slot that needs to engage with the roll pin in the joint body. If the roll pin does not correctly engage the bearing, then the threaded cap will not thread on far enough. Use grease and 'stick' the bearing to the stud and insert them up into the body, and slowly rotate until you feel the pin engage with the bearing. After the preload washer, bearing, and stud have been installed, next install the lock tab washer and cap. Thread the cap on until hand tight, then follow the ball joint preload instructions on **page 14**.

INSTALLATION

1. Park the vehicle on a flat, level surface, or safely raise the vehicle on a lift. Chock the rear wheels, make sure the vehicle is in park or in gear, and set the parking brake. Raise the front end, place the front axle housing on jack stands and remove the front wheels.
2. Unhook the abs sensor lines from the flexible brake lines. Remove the brake calipers from the knuckles (21mm) and hang them from the frame with caliper hangers or straps of some sort. See **Figures 2 and 3**. Do not allow the calipers to hang by the brake lines.



Figure 2. Removing Brake Caliper Carrier Bolts



Figure 3. Hanging Brake Caliper

3. Remove the brake rotors.

4. Loosen the ABS sensors by unscrewing the 5mm allen head bolt and then pulling the sensor carefully up and out. It will not be possible to pull the sensors through the brake backing plates until the unit bearings are removed and the brake backing plates can move. **See Figure 4.**



Figure 4. ABS Sensor in Knuckle

5. The ball joints may be installed without removing the drag link or tie rod. If you would like to remove the drag link and tie rod, do so now. The following installation images are of a vehicle where the drag link and tie rod were left installed.
6. Remove the wheel bearing bolts from the back side of the steering knuckle with a 13mm 12 point socket. It can be helpful to rotate the axle shafts to orient the u-joint so that you have access to the bolt heads. **Figure 5** shows two of the three bolts on the back side of the knuckle.



Figure 5. Unit Bearing/Hub Bolts on Back Side of Knuckle

7. With the wheel bearing bolts removed, remove the wheel bearing unit assembly and the axle shaft as one piece. Carefully knock the assembly loose from the knuckle with a soft mallet. Older jeeps may require some penetrating lube like PB Blaster or a large pry bar to get the unit bearing out of the knuckle. Carefully pull the axle shaft out and through the knuckle. Be careful not to damage the brake backing plates. Use care when pulling the ABS sensor through the hole in the brake backing plate. The complete assembly is **heavy**. Be careful not to damage the splines on the end of the axle shaft. See Figure 6.



Figure 6. Passenger (Right) Side Axle and Unit Bearing Assembly

8. Remove cotter pins from old ball joints. Loosen the nuts (27mm) on the lower ball joints. Remove the nuts (21mm) and ABS line clips from the upper ball joints. Knock the knuckles loose by either striking the knuckle with a ball peen hammer in the area of the ball joint stud taper or using an air hammer. Separate the lower ball joint taper first, then the upper. Remove the nuts and the knuckles. If the tie rod and drag link were not removed, be sure to hang the knuckle so that the tie rod ends and boots are not damaged. See Figure 7.



Figure 7. Knuckle Removed, Hanging from Axle Housing

9. Remove dust boots from all the ball joints and wipe up all old grease. Press out the upper ball joints first, 'up' out of the housing. Then press the lowers out 'down' out of the housing. **See Figures 8 and 9.**



Figure 8. Pressing Out Upper Ball Joint



Figure 9. Pressing Out Lower Ball Joint

10. Inspect knuckle tapers and inner 'C' bores. Ensure they are not deformed and are clean and free of burrs. Damaged parts should be replaced or repaired as necessary.
11. We will press in the new lower ball joints first. We recommend pressing the joints in assembled. Remove the rubber boot so it does not get damaged while pressing the joint in. It is important that the press adapters do not rest on the locking tabs on the outside of the cap. If the press adapters are too large, they may damage the locking tabs machined into the cap. Most ball joint presses should have an adapter that fits the lower ball joint correctly. Care must be used, do not use an impact or 'force' the joints into the housing, the threaded cap may break if overloaded.
12. Orient the Synergy lower ball joints - Depending on the wheel offset, axle trusses and gussets, axle shaft size and other factors, the orientation of the zerk will need to be decided by the installer. We recommend orienting the zerk fitting so that it is pointing towards the rear of the vehicle, slightly toward center. **See Figure 10.**

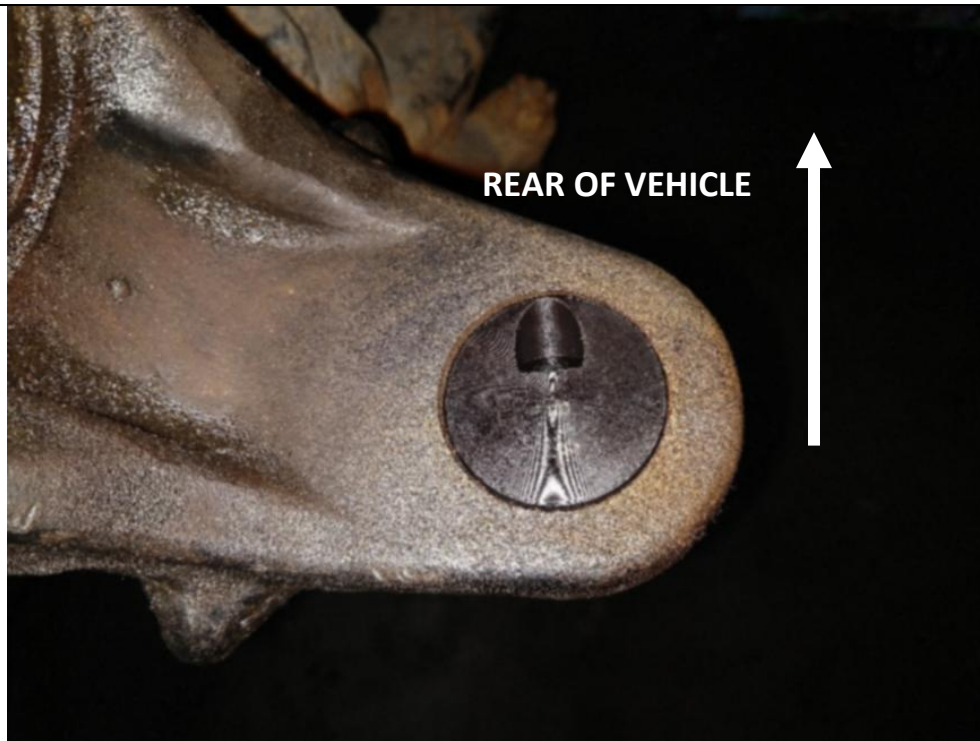


Figure 10. Lower Ball Joint Orientation

13. Once the lower ball joints are correctly oriented, press the joints into the axle housing. It is critical that the body is pressed in evenly and smoothly. Grease is not necessary but can be used if desired. The joint must sit flat and flush against the lower surface of the inner 'C'. See Figure 11.

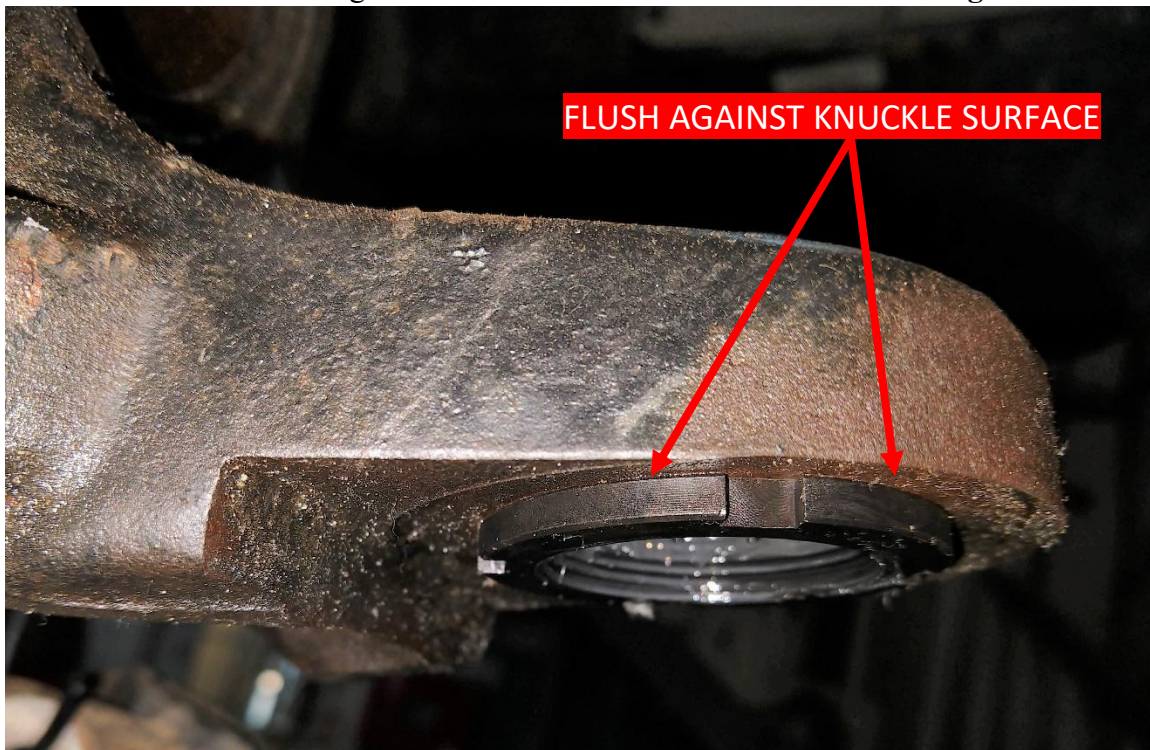


Figure 11. Lower Ball Joint Body Pressed In. Joint Shown Disassembled for Clarity, Recommend Pressing in Assembled.

14. Press the upper ball joints into the axle housing. We recommend leaving the dust boot on the upper ball joint, it can be difficult to install on the joint after the joint has been pressed into the housing. It is critical that the body is pressed in evenly and smoothly. Grease is not necessary but can be used if desired. The press tool should sit on the lip on the outside of the ball joint body. A short piece of 2.25" x .188" wall DOM tubing is the ideal size for a sleeve for pressing in the upper ball joint if a good sleeve is otherwise unavailable. The joint must sit flat and flush against the upper surface of the inner c. See Figure 12.



Figure 12. Pressing the Upper Ball Joint into Housing

15. At this time on the lower ball joints, bend **out** the locking tabs that interface with the cap so that the cap may be rotated. The threaded cap should be left hand tight for now. **Important** - If the threaded cap will not thread in by hand, it is possible that the ball joint is too tight of a press fit in the 'C'. This can be caused by using knurled joints when non-knurled joints should have been used or if the 'C's have been damaged or in some cases deformed by welding on gussets. In general, if the press fit is too tight, it may be remedied by removing and reinstalling the lower ball joint housing a couple times in order to 'resize' the bore in the 'C's. If there are questions or concerns, please contact Synergy Manufacturing before proceeding.
16. Install the zerk fittings and dust boots onto the lower ball joints and install the zerk fittings into the uppers. We recommend using the flush style zerk fitting in the lower ball joint to eliminate clearance issues with aftermarket axle shafts.

17. Note the orientation of the cotter pin holes in the ball joint pins. We recommend aligning the cotter pin holes so that they are perpendicular to the axle, aligned front to back on the vehicle. **See Figure 13.** If the cotter pin holes need to be relocated, spin the ball studs with a pin through the cotter pin hole. This will make cotter pin installation easier.



Figure 13. Cotter Pins Aligned Front to Back

18. Install steering knuckles. Tighten lower ball joint castle nut slightly (no more than 30 lb-ft).
19. Re-install abs line clips under upper ball joint nut if so equipped. Torque upper ball joint castle nuts to 70 lb-ft with a 7/8" or 22mm socket.
20. Torque lower ball joint castle nuts to 70 lb-ft with a 1 1/16" or 27mm socket.
21. Rotate the knuckles from lock to lock by hand. They should be stiff, but able to rotate by hand with the steering disconnected. Ensure there are no clearance issues anywhere. If the knuckles are too tight to be turned by hand, it could be due to too tight of a press fit from the incorrect joints being used. Make sure that if non-knurled joints were removed, non-knurled joints were installed to replace them. Stiff upper joints can also be caused by damage to the 'C's or deformation of the 'C' bore due to welding. As an option to improve the press fit, the upper ball joints may be pressed into and out of the 'C' a couple times in order to 'resize' the 'C'.

22. Install cotter pins, See **Figure 14**. If the castle nut slots do not line up with the cotter pin holes, continue to tighten the castle nuts until they align. Never loosen a castle nut to align the cotter pin. If using WJ knuckles, you may have to flap disc some material off the bottom of the nut in order to get the cotter pin through the ball joint hole, see **Figure 15**. If the cotter pin hole is above the top of the castle nut, this is usually an indication that the knuckle taper has been worn out and the knuckles should be replaced. Alternatively, the castle nuts may be removed and a washer placed under the castle nut to make sure the pin engages with the nut.

**Figure 14. Cotter Pin Installed****Figure 15. WJ Knuckle Cotter Pin Alignment**

23. Set preload on the lower ball joints. See the **ADJUSTING LOWER BALL JOINT PRELOAD** section on **page 15**.
24. With the joints preloaded, bend down two tabs from the lock ring into the cap. Be sure the tabs bent down will be accessible when the vehicle is re-assembled and back on the ground. If the tabs do not align with slots on the cap be sure to tighten the cap in order to make them align. Do not loosen the cap to align the tabs. **Figure 16** shows a tab bent down into the cap in an accessible location.

**Figure 16. Tab Bent Into Cap**

25. Re-install the unit bearing/hub/axle shaft assembly, being very careful when installing the axle shafts to ensure the splines line up in the differential and not to damage the inner axle seals. We recommend cleaning all the hub bolts with brake cleaner and a wire brush, and then using high strength threadlocker on installation. Carefully thread ABS sensors through the brake backing plates. Torque unit bearing/hub bolts to 75 lb-ft.
26. Re-install the ABS sensors with a 5mm allen. Torque to 40 lb-in (not too tight, inches not feet!).
27. Re-install the tie rod and drag link if removed.
28. Re-install the brake rotors and calipers. We recommend cleaning all the brake caliper bolts with brake cleaner and a wire brush, and then using high strength threadlocker on installation. Tighten caliper mounting bolts to 120 lb-ft. See **Figure 17**.



Figure 17. Finished Ball Joint Installation

29. The joints come pre-greased. If you are going to grease them after installation use no more than one 'pump' of grease from a grease gun. We recommend Synergy Lithium Complex Extreme Pressure grease. If this is not available, be sure to use an extreme pressure grease designed for metal on metal joints.
30. Re-install wheels and tires and torque lug nuts to 95 lb-ft.

Installation is Complete

ADJUSTING LOWER BALL JOINT PRELOAD

1. It is important to periodically check the lower ball joints for play. The easiest way to check for a loose joint is to place a jack under the axle housing on one side. Raise the jack so that the tire is just off the ground. Place a jack stand just behind the axle housing, next to the tire. Using a prybar or other lever, try and 'push' the steering knuckle upwards. **See Figure 18.** Per factory spec, there is up to .050" of vertical play allowable. We recommend keeping this number as close to zero as possible.



Figure 18. Checking Preload

2. If there is movement found in step one, or upon initial installation, the joints must be adjusted. In order to adjust the joint, you must first remove any jack stands supporting the vehicle and ensure the full weight of the vehicle is on the tires.
3. Next, bend back any tabs on the lock washer that are engaged with the slots on the cap. **See Figure 19.**



Figure 19. Bending Locking Tabs Back

4. We highly recommend setting preload by using a 1/4" drive torque wrench, see step 4. If no torque wrench is available, tighten the joint until there is no vertical play while using a large prybar to pry up on the steering knuckle as shown in **Figure 18**.
5. With the tabs bent out of the way, slowly turn the cap clockwise (threads are right hand) using the provided adjuster tool and a 1/4" drive torque wrench. Tighten the joints until 120 lb-in (10 lb-ft) is shown on the torque wrench. Our adjustment torque spec is the torque at the wrench, not at the joint (due to the included crows foot type adapter). It is important that the torque wrench is oriented parallel to the crows foot adapter, as seen in **Figure 20**. **Figure 21** shows the wrench oriented incorrectly, at a 90 degree angle to the adapter. Once the torque spec is achieved, verify that there is no vertical play in the joint, as shown in **Figure 18**. In some cases, due to too tight of a press fit, more torque may be required to eliminate vertical play in the ball joint. Tighten further until vertical play is gone. Once it has been adjusted properly, bend the tabs from the lock ring to engage with the cap. We recommend at least two tabs bent into the cap. Only bend up locking tabs that are accessible so that the joint may be adjusted again in the future.



Figure 20. Correct Wrench Orientation



Figure 21. Incorrect Wrench Orientation

6. If installing adjustable ball joints on a set of WJ knuckles, there may be clearance issues when trying to adjust the ball joints on the vehicle. It has been suggested to modify the adjustment tool by thinning out the forks and bending them slightly as pictured in **Figure 22**.



Figure 22. Crows Foot Adapter Adjuster Modified for WJ Knuckles

Table 1. Jeep JK Bolt Torques

Bolted joint Location	Wrench Size	Torque
ABS Sensor Bolt	5mm Allen	45 lb-in (Inch!)
Unit Bearing Bolt	13mm 12 Point	75 lb-ft
Lower Ball Joint Stud	22mm	70 lb-ft
Upper Ball Joint Stud	27mm	70 lb-ft
Drag Link TRE Stud to Knuckle (Factory)	21mm	63 lb-ft
Drag Link TRE Stud to Knuckle (Synergy)	27mm	55 lb-ft
Tie Rod TRE Stud (Factory)	21mm	63 lb-ft
Tie Rod TRE Stud (Synergy)	27mm	55 lb-ft
Caliper Mounting Adapter Bolts	21mm	120 lb-ft
Wheel Lug Nuts (Factory)	19mm	95 lb-ft