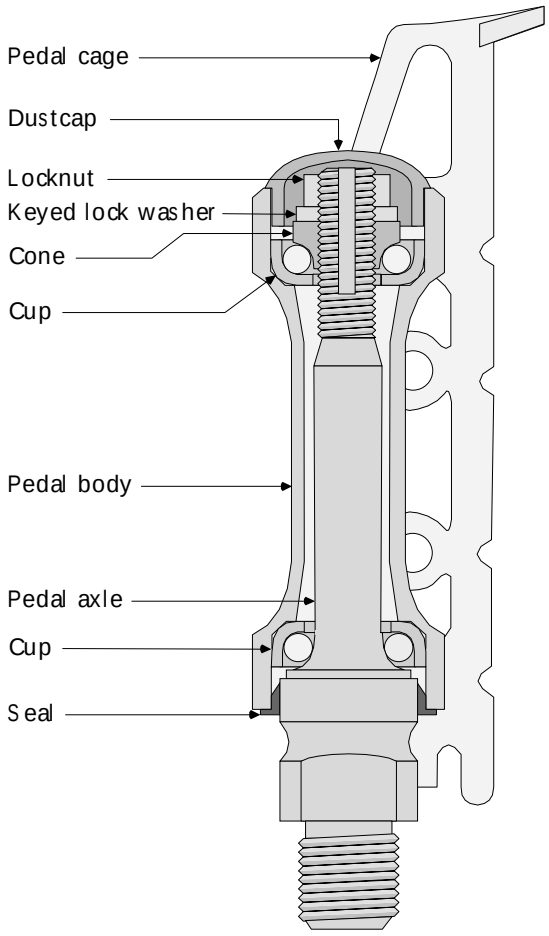
14 – ADJUSTABLE-CONE/CUP PEDALS

ABOUT THIS CHAPTER

This chapter is about pedals with conventional bearings. Conventional bearing systems have loose balls, cones, and cups. Most pedals use an adjustable cone threaded on the end of the pedal axle. These closely resemble hubs in principle. Another variety uses an adjustable cup threaded into the pedal body. These closely resemble adjustable-cup bottom brackets in principle. This chapter has separate procedures for service of these two types, which are called "Adjustable-cone" pedals and "Adjustable-cup" pedals. A troubleshooting chart that covers both of these pedal types follows at the end of the chapter.



14.1 Diagram of a common adjustable-cone pedal.

GENERAL INFORMATION

TERMINOLOGY

Pedal body: The main structure of the pedal. The pedal body includes the housing for the bearings and can also include a *pedal cage* or a *retention mechanism*.

Pedal cage: The one-piece or two-piece plate of metal that is on the front and back, or just the back, of the pedal. The pedal cage supports the shoe and may be the point to which a toe clip mounts.

Retention mechanism: This mechanism is similar to a ski binding. Usually by means of springs, the retention mechanism engages some sort of clip to the cleat that is attached to the rider's shoe.

Pedal axle: The shaft that threads into the crank arm and about which the pedal rotates.

Cone: A surface that bearings roll on that is positioned inside the circle of balls. A pedal cone may be a built-in feature on an axle, or it may thread onto an axle.

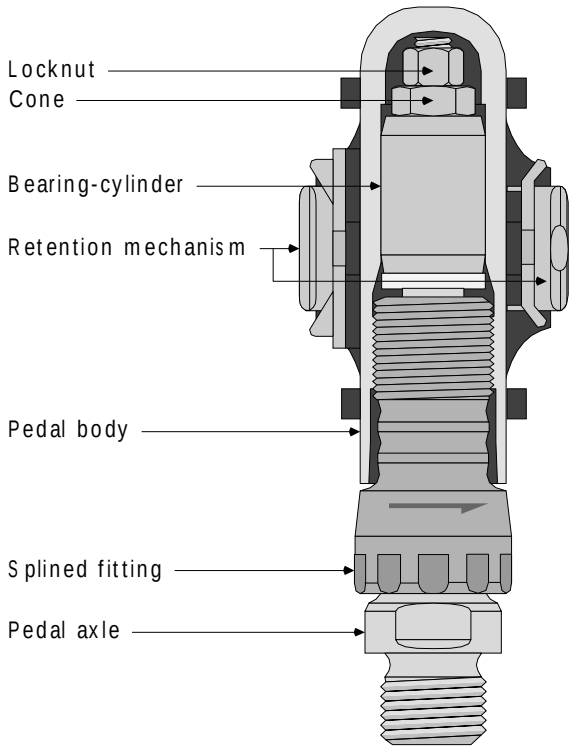
Cup: A surface that bearings roll on that is positioned outside the circle of balls. A cup may be pressed permanently into the pedal body or it may be threaded into the pedal body.

Locknut. A nut that threads onto an axle against a threaded-on cone, to lock the position of the cone relative to the axle, or it may thread onto a threaded-in cup against the pedal body, to lock the position of the cup relative to the pedal body.

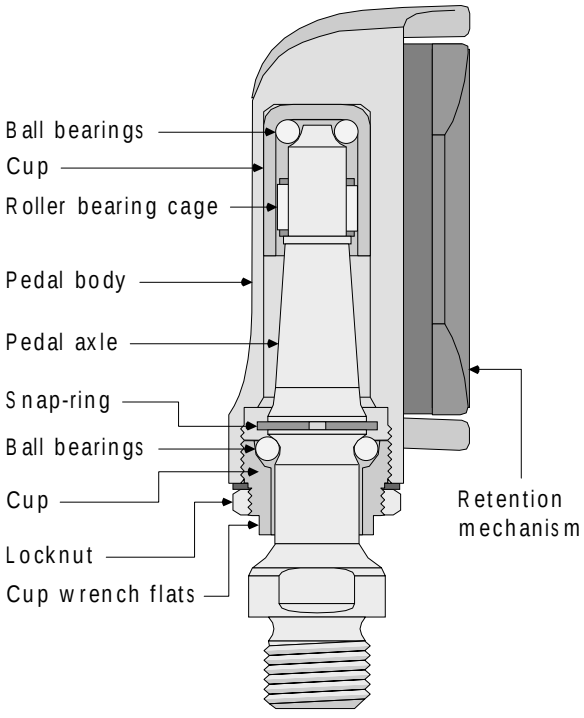
Dustcap: A piece of plastic, metal, or rubber that threads or presses onto the outer end of the pedal body to cover the hole through which the bearings are accessed.

Spline: A cylindrical fitting that has alternating ribs and grooves on its surface that are parallel to the axis of the cylinder. Splines are usually engaged by a tool with the opposite spline pattern. A spline is used as an alternative to a standard six- or eight-sided wrench fitting.

Bearing-cylinder: A complete bearing-system housing that is cylindrical-shaped and includes two cup races. When the bearing-cylinder is assembled to the axle with cones and bearings, it is a complete bearing unit that can be inserted and removed from the pedal body with the bearings intact.



14.2 *Diagram of a adjustable-cone pedal with bearing unit removable from pedal body.*



14.3 *Diagram of an adjustable-cup pedal.*

LIMITATIONS

The design of pedals varies more than conventional hub, bottom bracket, and headset bearings. For this reason, the procedural steps are somewhat more generalized, and may not apply directly to the make and model of pedal being serviced.

This chapter does not cover pedal installation or bearing service on cartridge-bearing pedals. See ***PEDAL REMOVAL, REPLACEMENT, AND INSTALLATION*** (page 24-1), or ***CARTRIDGE-BEARING PEDALS*** (page 15-1).

PREREQUISITES

Pedal removal and installation

It is optional, but strongly recommended, to remove the pedals from the crank arm to service the bearings. The procedures are written as though the pedals are removed from the crank arms. It is strongly recommended to overhaul only one pedal at a time, so as not to mix parts between pedals.

Other prerequisites

It is optional, but recommended, to be familiar with servicing hubs and/or bottom brackets. Due to the greater variation in design of pedals, the following instructions are generalized to a greater degree than other bearing service information in this book. If already familiar with servicing other bearings, then apply that sense of knowledge about the other bearings to the variations that might be encountered with pedals. This keeps the more generalized instructions for pedals from being a handicap.

INDICATIONS

There are several reasons pedals require an overhaul, and several reasons they require adjustment. An overhaul should be done as part of a regular maintenance cycle, the duration of which will change depending on the type of riding, the amount of riding, and the type of equipment. Adjustments should be done on the basis of need.

MAINTENANCE CYCLES

If starting out with the pedals(s) known to be in good condition with good quality grease, they should be able to be ridden thousands of miles without needing an overhaul. If the equipment sees little wet-weather riding, then an appropriate maintenance cycle would be 2000–3000 miles in most cases. If a lot of wet-condition riding is done, then the maintenance

cycle might need to be as often as every 750–1000 miles. Parts rust whether being ridden or not, so another factor is how long the bike may be sitting before it will be used again; for example, if the bike is ridden 200 miles in the rain in the fall, then put away four months for the winter, it would be a good idea to overhaul the pedal(s) before putting the bike away.

Some other factors affecting pedal maintenance cycles are whether there is grease injection and whether there are seal mechanisms. *Grease-injection systems do not eliminate the need for overhaul.* Grease injection only increases the acceptable time between overhauls. Grease-injection systems are only as good as the customer is consistent and thorough about pumping in new grease. Seal mechanisms (conventional bearings with rubber seals between the cone and dustcaps) *are not effective water-tight seals.* Their effectiveness varies with the brand and model. At best, they can lengthen the acceptable time between overhauls. With seal mechanisms or grease-injection systems, the best policy is to initially overhaul the pedal(s) on a normal-length maintenance cycle, and if the grease is found to be in good condition, then extend the cycle the next time.

Symptoms indicating need of overhaul

What symptom would lead to feeling that the pedal(s) should be overhauled? One is that when performing an adjustment, the looseness (free-play) in the bearings cannot be eliminated without the bearing becoming excessively tight (does not turn smoothly). The lack of smoothness could be caused by dry grease, contaminated grease, or worn parts. Another symptom indicating a need for overhaul is that when removing the pedal and rotating the axle, the end of the axle oscillates, indicating a bent axle (which should always be replaced).

Symptoms indicating need of adjustment

The primary symptom that will be experienced indicating that pedal(s) needs adjustment is looseness in the bearings. This can be detected by grasping the pedal and jerking it side-to-side while feeling for a knocking sensation. Inspect for loose bearings and loose locknuts every 300–500 miles. The only way to check for a loose locknut is to put a tool on the locknut and see if it is secure. Another possible symptom indicating need to adjust the pedal(s) is that the pedals simply feel tight when removed and the axle is turned. If tightness is felt when rotating the pedal body on its axle while the pedal is attached to the crank arm, the bearing is extremely tight.

One other case in which pedal-bearing adjustment is recommended is on any new bike. Most retail outlets assume the factory has done the job correctly, and don't check the adjustment. Factory adjustments are not very reliable. Hubs may be completely worn out after as little as 1000 miles of use, due to poor factory setup.

TOOL CHOICES

The design or brand of pedal(s) will determine the tools needed. The following list covers tools for adjustable cone/cup pedals only.

In addition to these specialized tools, a variety of spanners used on brakes, hubs, and bottom brackets are needed for the cones and adjustable cups. These include the Park HCW-3, Park OBW-1, Park OBW-2, and 14–17mm cone wrenches.

ADJUSTABLE-CONE/CUP-PEDAL BEARING TOOLS (table 14-1)

Tool	Fits and considerations
Campagnolo 7130025	Campy adjustable-cup "Three-bearing" models called TBS, SGR, Record, and Croce deAune
Campagnolo 7130034	Campagnolo QR pedals with removable bearing unit
Campagnolo 710	Dustcap spanner for classic Campagnolo Nuovo Record and Super Record road quill-style pedals
Shimano TL-SH-PD73	Socket-in-socket tool required for Shimano adjustable-cone pedals with no lock washer between locknut and cone including: Deore XT PD-M735, Deore DX PD-M650, PD-M525, Ultegra PD-6402, PD-A525
Shimano TL-SH-PD40	Bearing-unit-removal tool for accessing bearings on following models: Dura-Ace PD-7410, Ultegra PD-6400, Ultegra PD-6401, Ultegra PD-6402, 105SC PD-1055, 105SC PD-1056, PD-M737, PD-M525, PD-A525, and any other models w/20.7mm diameter 10-tooth spline just outward of the mounting-wrench flats
Shimano TL-SH-PD30	Lockring tool for adjustable-cup models including Dura-Ace PD-7400 and Dura-Ace PD 7401, or any other model with a 8-face locknut with concave faces
Park HCW3	25mm bottom-bracket adjustable-cup spanner for Shimano adjustable-cup models with 25mm locknut including: Ultegra PD-6400, 105 PD-1050, Exage PD-A450, PD-A550

TIME AND DIFFICULTY RATING

Overhauling a pedal including pedal removal, disassembly, cleaning, assembly and bearing adjustment is a 20–30 minute job of moderate difficulty. Double this for two pedals. Adjusting the pedal alone is a 5–8 minute job of moderate difficulty.

COMPLICATIONS

Limited parts availability

Many pedals have limited parts availability or no parts availability. This is because the value of the labor required to service the pedal often exceeds the replacement value of the pedal. Before beginning service of a pedal, make sure there is a source for parts.

Damaged body parts

Pedals are extremely exposed to damage. If the main structure of the pedal is damaged, there is usually no point in overhauling the pedal. If body parts are loose and cannot be tightened, it will interfere with checking whether the bearing adjustment is loose.

Mixing left and right pedal parts

Parts are often similar, but not interchangeable, between left and right pedals. Even experienced mechanics do not overhaul pedals frequently, so it is a good idea to have only one pedal apart at a time, to eliminate any possibility of mixing parts between the left and right pedals.

Trial-and-error adjustments

Unlike bottom brackets, headsets, and hubs, there is no convenient way to mark and calibrate the increments of adjustment when adjusting a pedal bearing; furthermore, there is usually no way to hold the cone while securing the locknut, making the adjustment a frustrating trial-and-error process.

ABOUT THE REST OF THIS CHAPTER

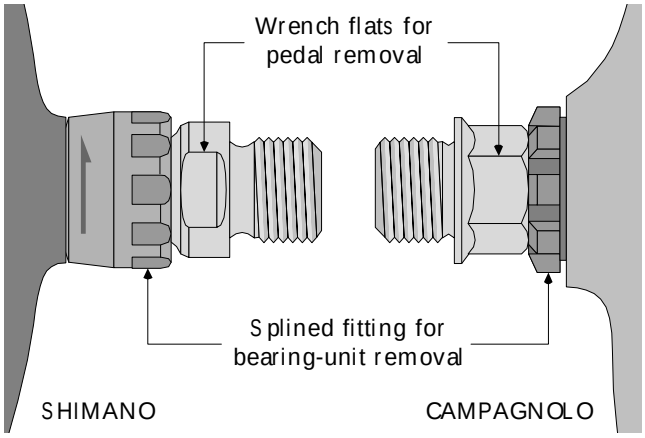
There are three sections to the rest of this chapter: the first section is ***ADJUSTABLE-CONE PEDALS***, which starts with a description of the type of pedals this section covers, some common models and styles, what to look for if uncertain about the type of pedals being serviced, and a list of some particular styles this section does not cover; the second section is ***ADJUSTABLE-CUP PEDALS***, which begins with a description of the type of pedals it covers, some common models and styles, what to look for if uncertain about the type of pedals being serviced, and a list of some particular styles it does not cover; the third section is the ***ADJUSTABLE-CONE/CUP-PEDALS TROUBLESHOOTING*** table that applies to both styles of pedals.

ADJUSTABLE-CONE PEDALS

PEDALS THAT THIS SECTION COVERS

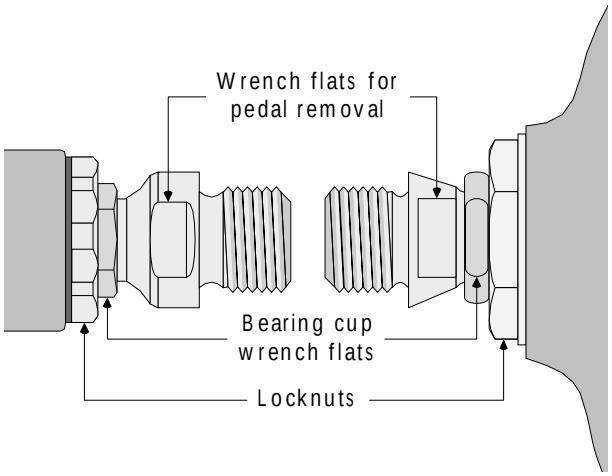
The most common type of pedal has an adjustable cone. This adjustable cone is located at the outside end of the axle. All traditional pedals have a dustcap that can be removed at the outside end of the pedal. If there is such a dustcap, then it is certain that the pedal is an adjustable-cone type.

Shimano and Campagnolo make pedals that have adjustable cones but no dustcap on the outside end of the pedal. This includes all Shimano "SPD" type pedals, and all "Look-retention-system compatible" models except Dura-Ace. Specific Shimano models include Dura-Ace model PD-7410; Ultegra models PD-6400, PD-6401, and PD-6402; 105SC models PD-1055 and PD-1056; model PD-A525; and off-road models PD-M737 and PD-M525. The distinguishing characteristic of these above-listed Shimano models and any unlisted Shimano models is that on the inside face of the pedal body there is a 10-spline, 20.6mm cylinder. This spline rotates with the pedal body. The Campagnolo pedals of this type are the "Look-retention-system compatible" QR models including Record. The distinguishing Campagnolo feature is an octagonal-splined fitting on the inside face of the pedal body measuring 21mm across the flats. This octagonal fitting rotates with the pedal body.



14.4 *Shimano and Campagnolo adjustable-cone pedals that have removable bearing cylinders.*

Shimano and Campagnolo both make pedals that have no dustcap on the outside end that *are not* the adjustable-cone type. The distinguishing feature in each case is that there are places to put two different spanners on the inside face of the pedal body. These two fittings both rotate with the pedal body, and are in addition to the wrench fitting that is on the pedal axle that is used to install and remove the pedal from the crank arm. All of these have an adjustable cup that fits a 15mm or 17mm cone wrench and a locknut of a much larger size threaded onto the cup.



14.5 *Shimano and Campagnolo adjustable-cup pedals.*

Look makes a pedal that is similar in appearance and external configuration to the Shimano and Campagnolo models that has no dustcap on the outside end of the pedal, but once the pedal-axle assembly is extracted from the pedal body, it will be found to have cartridge bearings instead of adjustable-cone/cup bearings.

NOTE: If just adjusting pedal bearings and not overhauling them, skip to step 33.

PEDAL REMOVAL AND PRELIMINARY INSPECTION

1. **[ ] Do steps 1–6 of *PEDAL REMOVAL, REPLACEMENT, AND INSTALLATION* procedure (page 24-3).**
2. **[ ] Spin pedal axles and observe whether there is any oscillation in the end of the pedal axles, indicating that they are bent.**

ACCESS PEDAL BEARING

It is strongly recommend from this point on that only one pedal is disassembled at a time. There are parts that are unique to each pedal. If both pedals are disassembled at the same time and parts get mixed from right to left, each overhaul will have to be done all over again (at best); at worst, getting the parts mixed up between left and right pedals will damage some parts.

If there is access to the adjustable cone through a dustcap on the outside end, then the cups will be pressed directly into the pedal body. If the pedal is the type that has bearings accessed by threading an assembly out of the pedal body, then the cups will be at either end of a cylinder that rotates on the pedal axle. This "bearing-cylinder" will not be evident until the bearings have been accessed. After accessing the bearings, there is no great difference in how to treat each system. The only difference will be the terminology used to refer to the piece that includes the bearing cups and either the pedal body or the bearing-cylinder. From this point on, the portion including the bearing cups will be called the "pedal-body/bearing-cylinder."

There is one optional difference about how to treat the pedals with a bearing-cylinder design. Instead of overhauling this type of pedal to clean and grease the bearings, it is possible to pump fresh grease into the bearings without any further disassembly. In order to do this, a grease gun and a piece of flexible hose that fits snugly over the bearing-cylinder are needed. Attach the hose to the grease gun and to the outer end of the bearing-cylinder, then pump grease through the bearing-cylinder until nothing but clean grease comes out the other end. The only disadvantage to this shortcut is that the ball bearings cannot be replaced; usually the other parts that could be accessed by full disassembly are not available.

3. **[ ] *If pedal has dustcap on outside end* unthread or pry out dustcap.**
4. **[ ] *If pedal has no dustcap on outside end, and is a Shimano*, use TL-PD40 to remove bearing assembly from pedal body. Use large adjustable wrench to turn TL-PD40 counterclockwise on left-side pedals or clockwise on right-side pedals.**
5. **[ ] *If pedal has no dustcap on outside end and is a Campagnolo*, use Campagnolo 7130034 to remove bearing assembly from pedal body. Turn tool counterclockwise on left-side pedals or clockwise on right-side pedals.**

DISASSEMBLE BEARING

The pedal axle must be held securely from rotating while removing the locknut/cone, and when adjusting the bearing later.

6. **[ ] Clamp threaded portion of pedal axle in vise, using soft jaws to protect threads from steel jaws of vise.**

Step #7 measures the offset (if any) between the end of the pedal spindle and the face of the locknut. If bearing size is lost track of, or a guess must be made about bearing size, or if the pedal gets assembled with bearings out of position it will show up as a change in this number after putting the pedal back together.

7. [ ] Use depth gauge of caliper to measure offset between upper end of pedal axle and face of locknut and record here: _____ mm.

8. [ ] Hold cone stationary with cone wrench or special tool while breaking loose locknut with adjustable wrench or fit wrench.

9. [ ] Thread parts off pedal axle and onto bundling tie while maintaining order and orientation.

There are no standards for bearing quantities and sizes in pedals. There are usually different quantities in each cup, and there may be different sizes. Step #10 keeps track of the first set of balls encountered, so that there is no need to rely on trial-and-error when assembling. Step #11 records similar information for the second set of bearings encountered.

10. [ ] Use magnet to remove bearings from outer bearing cup. Count and measure ball-bearing size and record here:
Outer-bearing quantity _____
Outer-bearing size _____ mm.

11. [ ] Lift pedal-body/bearing-cylinder off axle, cupping hand below pedal to catch interior ball bearings. Count and measure ball-bearing size and record here:
Inner-bearing quantity _____
Inner-bearing size _____ mm.

Rubber seals on pedal bodies or axle cones may rotate relative to the part they are attached to. Seal effectiveness can be improved and seal drag reduced by lubricating between the seal and what it is attached to, so they will be removed at this time to enable greasing later. Seals can possibly be re-installed backwards, so note their orientation if removing them from a dustcap, or simply leave them on the bundle if removing them from a cone.

12. [ ] Remove rubber seals, if any, from pedal body (note orientation) or axle cone.

13. [ ] Pry dustcaps out of inside face of pedal body unless damage is likely. Were dustcaps very loose? Yes? No? (circle one)

14. [ ] Clean all parts, including outside of pedal.

INSPECTION

Pedal-body damage that will affect the bearings is rare. Some inexpensive pedal bodies made of multiple parts joined together can fail at the joints. Since the pedal body must grasped and jiggled vigorously to check for whether the bearing adjustment is too loose, it is important that there be no looseness in the structure of the pedal.

15. [ ] Inspect pedal body for unrepairable looseness. Good? Bad?

The bearing cups are supposed to be permanently pressed into the pedal body (except bearing-cylinder types). Occasionally, they work loose. If not inspected for, this might cause considerable trouble later when trying to eliminate play when making the adjustment. Firmly press a finger into a cup and try to force it to rotate. If it does rotate, it must be fixed. Drip Loctite 290 around the edge of the cup to fix a loose cup. It is designed to penetrate and flow behind the cup and then cure to lock the part securely in place.

16. [ ] Inspect pressed-in cups for looseness. See if they rotate or jiggle. Good? Bad?

By design, bearing cups wear out long after the cones have worn out. This is good because they cannot be replaced. A new pedal or axle assembly is needed. Check for cup wear by looking in the cups for the wear line left by the balls. Trace this wear line with the tip of a ball point pen. If it snags on anything, the cup is shot.

17. [ ] Trace ball path in cups with a ball point pen to check for pits. Good? Bad?

If the cups were worn out, the cones are virtually certain to be. If not, be sure to check the cones carefully so that a worn-out one will not damage a cup, leading to a pedal replacement. One cone is threaded off the outside end of the pedal axle. The other cone is built into the pedal axle and is only replaceable if the pedal axle is replaceable. Cones wear out by developing pits (galling). Find the shiny wear line left by the balls on the conical portion of the cone. Trace this wear line with the tip of a ball point pen to check for pits.

18. [ ] Trace ball path on cones with a ball point pen to check for pits. Good? Bad?

Next, inspect the axle for bends. This inspection was already done in step #2, but this is another way of looking at the axle and is worth doing. Roll the axle on a flat smooth surface such as a Formica counter top or a glass counter top. Look under the axle as it rolls for a humping up and down that indicates it is bent. A bent axle is an axle in the process of breaking, and should be replaced.

19. [ ] Inspect for a bent axle. Good? Bad?

Some axles have slots along their length. A tab on the lock washer engages the slot. The function of the tab is to enable adjusting the pedal without a cone wrench, a necessity in some cases; however, the

washer often rotates around the axle and the tab damages the threads as well as itself. If a tab is damaged, the washer is sure to rotate again. Replace washers with damaged tabs.

20. [ ] Inspect keyed lock washers for damaged keys. Good? Bad?

Inspect the locknuts for damage, usually resulting from being over-tightened, or from poor wrench fit or use. Locknuts have to match the original thread and thickness. If the new nut is thicker, it may interfere with the dustcap.

21. [ ] Inspect locknuts for damaged threads, cracks, warpage, and rounded off flats. Good? Bad?

Inspect the dustcaps for looseness and damage. If they were loose (determined during removal), then re-install them with Loctite 242. If they are bent, try to straighten them out. Bends in dustcaps are only critical if the dustcaps are deformed to the point that the rub on the part of the axle that they overlap.

22. [ ] Inspect dustcaps for looseness (done) and damage. Good? Bad?

ASSEMBLY

Preparation of pedal-body/bearing-cylinder for assembly

Put a light coating of grease in each bearing cup and put the balls into the grease. If unsure of the ball quantity, fill the cups with balls without forcing any in. Cover the balls with a light coating of grease.

Some pedals have dustcaps pressed into the inside end of the body. The most important thing about dustcap installation is to make sure that they end up level rather than tipped. Tap the dustcap in with a rubber or plastic mallet. Level the dustcap as well as possible at this point; when the pedal is completely re-assembled, give it a spin and check whether the dustcaps wobble as they spin. Straighten them as necessary.

23. [ ] Lightly grease bearing cups.

24. [ ] Place correct quantity and size of ball bearings in each cup.

25. [ ] Cover balls with a light coating of grease.

26. [ ] Press dustcap (if any) into inside end of pedal body.

27. [ ] Grease seals, if any, and install on pedal body or pedal axle.

Assemble bearings

28. [ ] Clamp threaded portion of pedal axle in vise, using soft jaws to protect threads from steel jaws of vise.

29. [ ] Drop pedal-body/bearing-cylinder (inside-end down) onto pedal axle.

30. [ ] Thread on cone until it presses against bearings, slip on lock washer (if any), and thread locknut down fully.

31. [ ] Measure offset between end of pedal axle and face of locknut and record: _____ mm.

32. Compare measurement in step 7 to measurement in step 31 and check *one* of following choices.

[ ] *If step 7 and step 31 are equal or different by less than .5mm,* then balls are in correct position and are correct size and quantity.

[ ] *If step 31 is less than step 7*, balls are out of position in cup(s), balls are too large, or too many balls installed.

[ ] *If step 7 is less than step 31*, balls are too small.

PRELIMINARY ADJUSTMENT

NOTE: If just adjusting pedal only, do steps 1–8.

33. [ ] Position cone so that it gently contacts balls then turn it counterclockwise 90°.

FINAL ADJUSTMENT

Adjusting a pedal can be challenging. The first challenge of adjusting a cone is that adjustment calibrations like the ones used with other bearings cannot be used. This is made further challenging by the fact that some cones need to be turned only a fraction of the distance that a hub cone is turned, which is a small adjustment to start with. If that were not enough, there is sometimes no access to the cone with a wrench while tightening the locknut. The tabbed washer between the cone and locknut must be relied on entirely on to keep the cone from turning while securing the locknut. Since the washer almost always has some rotational free-play, this can become very frustrating. Unfortunately, there are no tricks. A lot of patience and hand control is needed. If relying on the tabbed washer to maintain the cone position, then allow for rotation of the cone when setting its position.

34. [ ] Hold cone stationary (if accessible) and tighten locknut to it to 60–70in-lbs (20–25lbs@3").

35. [ ] Jiggle the pedal-body/bearing-cylinder side-to-side and check for *obvious* knocking. If the adjustment is not adequately loose, go back to step 33 and start even looser.

In the next step, hold the cone stationary while breaking loose the locknut. If the cone and locknut both turn counterclockwise simultaneously, the axle

will turn with them. This will cause the frame of reference for the cone to be lost so there will be no idea if a small or large adjustment has been made. Avoid this if possible by *keeping the cone absolutely stationary while breaking loose the locknut.*

36. [ ] Holding cone absolutely stationary, loosen locknut.

37. [ ] Adjust cone 10° tighter, hold cone absolutely stationary and secure locknut to 60–70in-lbs (20–25lbs@3").

The next step is to jiggle the pedal-body/bearing-cylinder and feel if there is knocking that indicates the adjustment is too loose, then reset the cone additional 10° clockwise. This adjustment needs to be very precise. If the mark is under- or over-shot, try again. The adjustment needs to repeated over and over again until the knocking is eliminated.

38. [ ] Jiggle the pedal-body/bearing-cylinder side-to-side and check for knocking.

39. Check one of two following choices depending on result of step 38.
[ ] No knocking is felt, adjustment is done.
[ ] Knocking is felt, repeat steps 36–39.

40. [ ] Install dustcap or insert pedal-axle assembly into pedal body.

INSTALL PEDAL

41. [ ] Do steps 14–23 of *PEDAL REMOVAL, REPLACEMENT, AND INSTALLATION* procedure (page 24-4).

ADJUSTABLE-CUP PEDALS

PEDALS THAT THIS SECTION COVERS

Non-cartridge-bearing pedals that do not have an adjustable cone have an adjustable cup. This adjustable cup is located at the inside face of the pedal body. This type of pedal never has a dustcap on the outside end of the pedal body and always has two fittings on the inside face of the pedal body where spanners can attach. These two fittings rotate with the pedal, and should not be confused with a third fitting on the pedal axle that the pedal-mounting wrench mates to.

Shimano and Campagnolo make pedals that have adjustable cups. Specific Shimano models include: Dura-Ace models PD-7400 and PD 7401; 105 model PD-1051; and Exage models PD-A450 and A550. The distinguishing characteristic of these above-listed Shimano models and any unlisted Shimano models is that on the inside face of the pedal body there is a octagonal locknut that fits a 25mm spanner (except Dura-Ace, which has an octagonal locknut with concave faces). The Campagnolo pedals of this type are the TBS models including Record, SGR, and Croce deAune. The distinguishing Campagnolo feature is an octagonal fitting on the inside face of the pedal body measuring 23mm across the flats.

Shimano and Campagnolo both make pedals that have no dustcap on the outside end that *are not* the adjustable-cup type. The distinguishing feature in each case is that there is a *single* spanner fitting on the inside face of the pedal body that rotates with the pedal.

NOTE: If only adjusting pedal bearings and not overhauling them, skip to step 29.

PEDAL REMOVAL AND PRELIMINARY INSPECTION

1. [ ] Do steps 1–6 of *PEDAL REMOVAL, REPLACEMENT, AND INSTALLATION* procedure (page 24-3).

2. [ ] Spin pedal axle and observe whether there is any oscillation in the end of the pedal axle, indicating that it is bent.

DISASSEMBLE BEARING

3. [ ] Clamp pedal body in vise, using soft jaws to protect pedal from steel jaws of vise.

4. [ ] Use depth gauge of caliper to measure offset from face of locknut to face of adjustable cup and record here: _____ mm.

5. [ ] Use 15mm or 17mm cone wrench to hold adjustable cup stationary while using special spanner to turn locknut counterclockwise to break it loose.

6. [ ] Thread locknut off of adjustable cup.

7. [ ] Thread adjustable cup counterclockwise until it is out of pedal body, but do not lift axle assembly out of pedal body.

8. [ ] Lift adjustable-cup/pedal-axle assembly out of pedal body by pulling up on pedal axle and carefully lay assembly down on rag to collect any loose bearings that may drop out of the cup.

9. [ ] *Dura-Ace models only*, examine pedal shaft and inside pedal body for caged cylindrical roller bearing and remove.

10. [ ] *Dura-Ace models only*, use snap-ring plier to remove external snap-ring from pedal axle.

11. [ ] Remove loose balls from adjustable cup and record quantity and size here:
Inside-end-bearing quantity: _____
Inside-end-bearing size: _____ mm.

12. [ ] Remove outside-end ball bearings from depth of pedal body and record quantity and size here:
Outside-end-bearing quantity: _____
Outside-end-bearing size: _____ mm.

13. [ ] Clean all parts, including pedal body.

INSPECTION

One bearing cup is supposed to be permanently pressed into the pedal body at the deep end of the hole in the pedal body. The bearing cup's inaccessible location makes it virtually un-inspectable for looseness, unless it is so loose that it falls out.

14. [ ] Inspect pressed-in cup for looseness. See if it falls out. Good? Bad?

By design, bearing cups wear out long after the cones have worn out. This is good because they cannot be replaced, and a new pedal or axle assembly is needed. Check for cup wear by looking in the cups for a wear line left by the balls. The cup fixed in the pedal body can only be inspected visually. The adjustable cup can be inspected normally; trace the wear line in the cup with the tip of a ball point pen. If it snags on anything, the cup is shot.

15. [ ] Visually inspect fixed cup inside pedal body, and trace ball path in adjustable cup with a ball point pen to check for pits. Good? Bad?

If the cups are worn out, the cones are virtually certain to be. If not, be sure to check the cones carefully so that a worn-out one will not damage a cup, leading to pedal replacement. One cone is at the outer end of the pedal axle. The other cone is built into the pedal axle towards the inner end and is only replaceable if the pedal axle is replaceable. Cones wear out by developing pits (galling). Find the shiny wear line left by the balls on the conical portion of the cone. Trace this wear line with the tip of a ball point pen to check for pits.

16. [ ] Trace ball path on cones with a ball point pen to check for pits. Good? Bad?

Campagnolo and Dura-Ace models have a cylindrical bearing surface on the pedal axle between the inner and outer cone. If this bearing surface is worn, it will appear scored. In this case, the pedal axle needs to be replaced.

17. [ ] *Campagnolo and Dura-Ace only*, inspect cylindrical bearing surface on pedal axle. Good? Bad?

Next, inspect the axle for bends. It was already inspected in step #2, but this is another way of looking at the axle and is worth doing. Roll the axle on a flat smooth surface such as a Formica counter top or a glass counter top. Look under the axle as it rolls for a humping up and down that indicates it is bent. Bent axles are axles in the process of breaking, and should be replaced.

18. [ ] Inspect axle for bends. Good? Bad?

Inspect the locknuts for damage, usually resulting from being over-tightened, or from poor wrench fit or use. Locknuts have to match the original thread and thickness. If the new one is thicker, it may interfere with the dustcap.

19. [ ] Inspect locknuts for damaged threads, cracks, warpage, and rounded off flats. Good? Bad?

ASSEMBLY

Preparation of pedal-body cup and adjustable cup for assembly

Put a light coating of grease in each bearing cup and put the balls into the grease. If unsure of the ball quantity, fill the cups with balls without forcing any in. Cover the balls with a light coating of grease. The balls can be difficult to position down in the pedal body. The pedal axle can be used to seat the balls correctly before covering them with grease.

20. [ ] Lightly grease cups and slide adjustable cup onto pedal axle.

21. [ ] Fill cups with appropriate size and quantity of ball bearings, then coat with grease.

22. [ ] *If Campagnolo pedal with roller bearing pressed inside pedal body*, coat roller bearings with grease.

Preparation of axle assembly for installation into pedal

Depending on the brand and model of pedal, some or all of the following steps will need to be done.

23. [ ] Lightly grease adjustable-cup threads.

24. [ ] Install locknut onto adjustable cup (unless not removed) and position at end of cup with spanner fitting.

25. [ ] *Shimano Dura-Ace pedals*, install adjustable-cup retainer snap-ring in slot in pedal axle.

26. [ ] *Shimano Dura-Ace pedals*, slip roller bearing cage onto end of pedal axle.

Installation of pedal-axle assembly into pedal body

27. [ ] Put pedal body in vise, open-end of bearing hole facing up.

28. [ ] Maintaining upward pressure on pedal axle (to keep balls trapped in adjustable cup), insert pedal-axle assembly in pedal body and thread adjustable cup fully into pedal.

BEARING ADJUSTMENT

This bearing system adjusts like a bottom bracket. Tightening the locknut that is threaded onto the cup actually draws the cup sllightly out of the pedal body. When a cup is set right up against the bearings so that rotating the axle might feel a little tight, the act of securing the locknut loosens the adjustment, even if the cup does not turn. There is no point to feeling the axle to check the adjustment except when the locknut is secure.

29. [ ] With locknut loose, adjust cup until it is gently pressing against bearings.

30. [ ] With felt-tip pen, put matching marks on adjustable-cup face and pedal body.

31. [ ] Use spanner to hold adjustable cup stationary and secure locknut.

32. [ ] Use depth gauge of caliper to measure offset from face of locknut to face of adjustable cup.

33. Compare measurement in step 4 to measurement in step 32 and check *one* of following choices.

[ ] *If step 4 and step 32 are equal or different by <.5mm,* then balls are in correct position and are correct size and quantity.

[ ] *If step 32 is less than step 4*, balls are out of position in cup(s), balls are too large, or too many balls installed.

[ ] *If step 4 is less than step 32*, balls are too small.

34. [ ] Jerk on end of pedal axle to check for knocking.

In the last step, either knocking in the bearings was felt, or it was not. If knocking is felt, then the adjustment is too loose. When knocking is not felt, it does not mean that the adjustment is correct. Step #29 is designed to create an initial adjustment that has knocking. If knocking is not felt, the adjustment could easily be too tight. For this reason, the "*If no knocking is felt*" option in step #35 suggests redoing step #29 (setting the adjustable cup slightly more counterclockwise).

35. [ ] *If no knocking is felt:* Redo step 29 with adjustable cup left in a slightly more counterclockwise position.

***If knocking is felt:* Loosen locknut and position adjustable cup 10° (1–2mm) further clockwise, remark, then secure adjustment.**

36. [ ] Repeat step 35 repeatedly until knock is not felt.

37. [ ] Do steps 14–23 of *PEDAL REMOVAL, REPLACEMENT, AND INSTALLATION* procedure (page 24-4).

ADJUSTABLE-CONE/CUP-PEDAL TROUBLESHOOTING (table 14-2)

Cause	Solution
SYMPTOM: *The axle feels tight or rough when play is first eliminated.*	
Last adjustment was too many degrees.	Try to find an in-between adjustment.
Mis-installed dustcap rubbing on axle.	Observe whether dustcap turns true as the pedal turns and reset if needed.
Bent axle causing a portion of the axle set to rub dustcap.	Inspect for bent axle and replace.
Dry grease.	Disassemble, inspect, overhaul.
Cones and/or cups galled.	Disassemble, inspect, replace parts.
Seal mechanism drag.	Check that seal mechanisms are not incorrectly positioned and/or lubricate seals.
Wrong size balls.	Disassemble, measure balls.
SYMPTOM: *Play cannot be eliminated without severely over-tightening the adjustment.*	
Cups and/or cones galled.	Disassemble, inspect and replace.
Loose cups in pedal body.	Disassemble, inspect and repair with appropriate Loctite.
SYMPTOM: *Properly adjusted bearings feel sluggish but not rough when rotating the axle.*	
Seal mechanism drag.	Grease seal mechanisms.
Dry grease.	Disassemble, inspect, overhaul.
Plastic dustcap rubbing.	Align dustcap.
SYMPTOM: *When adjusting or inspecting the pedal, an erratic looseness or tightness is detected that comes and goes and changes location.*	
Too many balls in the cup(s), or a ball has dropped into the pedal-body core.	Disassemble and check ball quantity and for out-of-place ball(s).
SYMPTOM: *When rotating the axle, a pattern is detected of a consistent tight spot and a consistent loose spot.*	
Bent axle.	Inspect for bent axle and replace.
Low-precision parts.	None.
SYMPTOM: *When inspecting the cone, a wear pattern is detected that is high on the cone profile on one-half of the cone and is low on the cone profile 180° away.*	
Bent or broken axle.	Inspect and replace.
SYMPTOM: *When riding the bike, a clicking sound is heard from a pedal, but the axle feels normal when inspected.*	
Loose parts in the pedal body	Tighten cage bolts or other pedal-body hardware.
Loose or worn shoe cleat	Inspect and secure or replace cleat.
SYMPTOM: *When inspecting the cone, the wear pattern is very high or very low on the cone profile. Wear life has probably been very short.*	
Wrong size balls.	Measure balls.