11 – HEADSETS

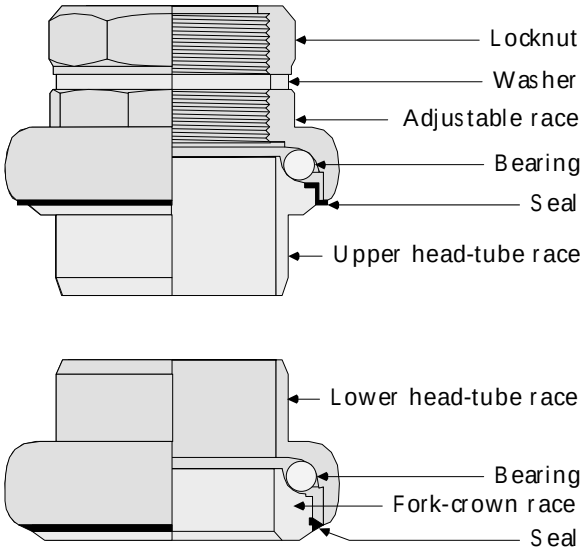
ABOUT THIS CHAPTER

Sections

The first section of this chapter is designed as general information for all types of headsets. The second section of this chapter is about threaded headsets. Threaded headsets press into the head tube, press onto the fork, and thread onto the fork. The third section of this chapter is about threadless headsets. The threadless system uses no fork threads. The fourth section of this chapter is about headsets that use roller bearings instead of ball bearings. The fifth section is about the Mavic headset and similar designs without a locknut. The final section is a table of headset-stack heights to enable selection of an appropriate replacement headset.

GENERAL INFORMATION

TERMINOLOGY



11.1 *Parts in a headset.*

Headset: The bearing assembly that allows the fork to rotate in the frame's head tube.

Head tube: The semi-vertical tube at the front of the frame that the fork rotates inside of.

Fork: The portion of the frame that attaches directly to the front wheel and allows the front wheel to rotate side-to-side relative to the rest of the frame.

Fork column: The tube at the top of the fork that rotates inside the head tube. The fork column may also be called *steering column*, *steering tube*, *steerer tube*, or *fork steerer*.

Fork-column base: The largest-diameter portion of the fork column, at the absolute bottom of the fork column. The fork-crown race presses onto the fork-column base.

Fork crown: The large joining piece between the base of the fork column and the top of the fork blades.

Crown-race seat: The top surface of the fork crown on to which the fork-crown race sits.

Race: The cone or cup surface on which bearings roll. A misuse of this term is to use it to describe a set of ball bearings held together in a holder, which is more properly called a *retainer*.

Pressed race: A race that is pressed onto the fork column or into the head tube.

Upper head-tube race: The pressed race that installs in the upper end of the head tube. It may be a cone or a cup.

Lower head-tube race: The pressed race that installs in the lower end of the head tube. It may be a cone or a cup, but is virtually always a cup.

Cone: A surface that bearings roll on that is positioned inside the circle of balls. A cone may thread onto the fork column, or it may be pressed into the top end of the head tube or the bottom of the fork column.

Cup: A surface that bearings roll on that is positioned outside the circle of balls. A cup is pressed into either end of the head tube, or may thread onto the fork column.

Adjustable cup or cone: A bearing cup that threads onto the fork column would be an adjustable cup. A cone could serve this function also, so a more generic term might be *adjustable race*, which would include an adjustable cup or an adjustable cone. On a threadless headset the adjustable cone does not thread onto the fork column, but slips effortlessly on.

Adjustable race: A bearing cup or cone that threads onto the fork column would be an adjustable race. On a threadless headset the adjustable race does not thread onto the fork column, but slips effortlessly on.

Fork-crown race: The bearing race that is pressed onto the base of the fork column. It may be a cone or a cup, but is virtually always a cone. Sometimes called a crown race.

Locknut: A nut that threads onto a fork column against an adjustable race to lock the position of the adjustable race to the fork column.

Lockring: Similar to a locknut, but instead of having the flats that are fit by regular wrenches, a lockring is round and has notches that are engaged by a curved tool with hooks.

Retainer: A clip that holds a group of balls that fit in-between a cup and a cone. A retainer is sometimes falsely called a *race*.

Cable hanger: A bracket used by some brake systems that is installed under the headset locknut to serve as a stop for the brake-cable housing.

Reflector bracket: A bracket that mounts under the headset locknut for mounting of a front reflector.

PREREQUISITES

Stem removal

Stem removal is optional for headset adjustment, but required for headset overhaul or replacement. Although other writers have indicated that having the stem in place affects the headset adjustment, scientific testing has shown that this is not the case; however, having the stem in place *does* make the adjustment more awkward. See the chapter **HANDLEBARS, STEMS, AND HANDLEBAR EXTENSIONS** (page 28-5).

Brake removal/disconnection

Depending on the type and design of the brake, it will be necessary to remove the brake calipers from the fork, or remove the brake cable from the caliper, in order to overhaul the headset. If the cable does not go through a cable hanger that is part of the headset, or cannot be released from the bracket without disconnecting the cable from the brake, then caliper removal is probably the best choice. When the cable cannot be released from the headset or the fork (suspension forks) without disconnecting the cable, leave the calipers in place and just disconnect the cable. See **CABLE-OPERATED BRAKE CALIPERS** (page 36-1).

INDICATIONS

There are several reasons a headset may need to be adjusted, and several reasons it may need to be overhauled. Adjustment should generally be done on the basis of need (looseness or tight rotation). Overhaul should be done as part of a regular maintenance cycle, the duration of which will change depending on the type of riding conditions, the amount of riding, and the type of equipment.

Maintenance cycles

If starting out with a headset known to be in good condition with good quality grease, it should last 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 being used again. For example, if ridden 200 miles in the rain in the fall then put the bike away four months for the winter, it would probably be a good idea to overhaul the headset before putting the bike away for the winter. With a new bike, there is no way to have an idea how well the bearings were prepped, greased, and adjusted. In particular, it is common that new bikes come with ball retainers in the headset. In the case of headsets, ball retainers lead to premature failure and should always be replaced with loose balls as soon as possible. Ideally, overhaul a new bike within the first 100 miles of use (not usually practical). With a new bike poor factory greasing is common, and the initial break-in period puts a lot of microscopic metal fragments into the grease, two additional good reasons to overhaul the headset almost immediately.

Some other factors affecting the maintenance cycle are whether there is grease injection and whether there are seal mechanisms. *Grease-injection systems do not eliminate the need for overhaul.* They only increase the acceptable time between overhauls; furthermore, they are only as good as the customer is consistent and thorough about pumping in new grease. Seal mechanisms (conventional headsets with rubber seals between the cones and cups) *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 headset 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 for overhaul

One of the most common conditions that leads the cycling enthusiast to believe that their headset should be overhauled is when the races are "brinelled." Brinelled races are races that are dented. A headset with brinelled races does not turn smoothly side-to-side, but moves in distinct increments — almost like an indexed shift lever. When this symptom exists it is *possible* that overhaul will eliminate it, but in most cases the headset will need to be replaced.

The only symptom indicating a need for a headset overhaul is that when performing an adjustment the looseness (free play) in the bearings cannot be eliminated without the bearing becoming excessively tight (it does not turn smoothly). The lack of smoothness could be caused by dry grease, contaminated grease, or worn parts.

Symptoms indicating need for adjustment

The primary symptom experienced indicating that a headset needs adjustment is looseness in the bearings. This can be detected by grasping the end of the fork and jerking it in and out while feeling for a knocking sensation. One method for detecting a loose adjustment that is recommended against is to lock up the front brake and feel for a knocking sensation while rocking the bike forward and back. This method can lead to the impression that the headset is loose when it is not, because a loose brake pivot will feel just like a loose headset. Inspect for loose bearings and a loose locknut after 300–500 miles of use. The only way to check for a loose locknut is to put a tool on the locknut and see if it is secure. Whenever the locknut is loose, simply securing the locknut is not adequate because the adjustment may have been lost while the locknut was loose.

Other reasons to adjust the headset are that it feels tight or feels brinelled (moves in increments). A tight headset shows up when lifting the front of the bike by the top tube and the wheel does not flop to one side under its own weight. The brinelled symptom, if caught early enough, can be eliminated through adjustment, but when it is not known whether there are loose bearings instead of retainers, it is best to overhaul the headset.

TOOL CHOICES

The design or brand of headset will determine the tools needed. Table 11-1 (page 11-4 through 11-5) covers all tools for the job. The preferred choices are in **bold**. A tool is preferred because of a balance among: ease of use, quality, versatility, and economy. When more than one tool for one function is **bold**, it means that several tools are required for different configurations of parts.

TIME AND DIFFICULTY

Overhauling the headset including stem and brake caliper/cable removal, stem and brake reinstallation, and headset adjustment is a 25-35 minute job of moderate difficulty. Adjusting the headset alone is a 8-12 minute job of moderate difficulty.

COMPLICATIONS

Headset will not stay tight

There are numerous reasons that headsets loosen up. The reasons include:

- Poorly pressed races seating fully after adjustment.
- Inadequate torque on locknuts/lockrings.
- Chrome plating peeling off race surfaces of inexpensive new headsets.
- Riding on extremely rough terrain (or abusive jumping), when the headset is designed more for light weight than for durability.
- Use of keyed washers between adjustable race and locknut/lockring.

Loose head-tube race

Loose races in the head tube can be due to poor initial tolerance or due to damage to the head tube. If the head tube has been damaged, there will often be a visible flare at the bottom in front or back (see figure 8.29, page 8-16). Loose races due to poor tolerances can be solved by finding a better fitting headset (if available), or by the use of Loctite RC680.

Loose crown race

Loose fork-crown races are usually due to poor manufacturing tolerances in the race or on the fork-column base. The solutions include finding a headset with a more suitable fork-crown-race I.D., using Loctite RC680, or expanding the fork-column base with a Stein KT knurling tool.

Removal tool will not engage head-tube race

The designs of certain head tubes and certain head-tube-race-removal tools are not compatible. When this is the case, the removal tool passes right back through the head-tube race when removal is attempted. The solution is to put the tool in place and install an internal snap ring through the race being removed so that

HEADSET TOOLS (table 11-1)

Tool	Fits and considerations
LOCKNUT WRENCHES/SPANNERS	
Diamond C79	Old fashioned monkey wrench fits all flatted locknuts better than pre-fit headset wrenches below
Park HW-2	Precise fitting 12" long 32 & 36mm locknut tool, fits 8-flat nuts
Stein HW-32/8	Precise fitting 12" long 32mm locknut tool, fits 8-flat nuts
Stein HW-36/6	Precise fitting 12" long 36mm locknut tool, fits 6-flat nuts
Stein HW-36/8	Precise fitting 12" long 36mm locknut tool, fits 8-flat nuts
Stein HW-40/8	Precise fitting 12" long 40mm locknut tool, fits 8-flat nuts
VAR 988	Fits 8-flat 36 & 40mm locknuts
VAR 65/2	Fits 8-flat 32 & 35mm locknuts
ADJUSTABLE-RACE SPANNERS/PLIERS	
Park HW-1	Anatomically shaped 32 & 36mm adjustable-race tool
Park HCW7	Fits 30 & 32mm adjustable races
Park HCW8	Fits 33 & 34mm adjustable races
Park HCW9	Fits 31 & 40mm adjustable races
Park HCW10	Fits 35 & 36mm adjustable races
Park HCW6	Fits 32mm adjustable races, with 15mm pedal wrench
Park HCW12	Fits 32mm adjustable races, with single-peg bottom-bracket-lockring wrench
Campagnolo 712	Fits 32mm adjustable races, with multiple-peg bottom-bracket-lockring wrench for Campy bottom brackets
Campagnolo 712/1	Fits 32mm adjustable race wrench with bottom-bracket adjustable-cup pin wrench for Campy bottom brackets
Campagnolo 7130033	Fits 36 & 40mm adjustable races
Hozan C431	Fits 36 & 40mm adjustable races, heavy duty and comfortable
Lifu 0600	Fits 30 & 32mm adjustable races
Lifu 0601	Fits 33 & 34mm adjustable races
Lifu 0606	Fits 36 & 40mm adjustable races, with useful offset to 36mm end
Tange 3640	Fits 36 & 40mm adjustable races
VAR 78	Adjustable-race pliers that grasp the race body instead of wrench flats
LOCKRING WRENCHES/PLIERS	
Park HCW12	Single-peg style wrench fits all headset lockrings
Hozan C205	Single-peg style wrench fits all headset lockrings, also fits bottom-bracket lockrings
Hozan C203	Lockring pliers fit all lockrings with even number of notches
HEAD-TUBE-RACE REMOVERS	
Park RT1	Fits all headset sizes
Stein FS	Fork stabilizing tool used to keep fork from turning while adjusting headset
Campagnolo 723	Fits 1" headsets
Campagnolo 1170006	Fits 1–1/8" & 1–1/4" headsets
Wheels Mfg. HR1	Fits 1" headsets
Wheels Mfg. HR2	Fits 1–1/8" headsets
Hozan C436	Fits 1–1/8" & 1–1/4" headsets, excellent quality

HEADSET TOOLS (table 11-1 continued)

Tool	Fits and considerations
CROWN-RACE REMOVERS	
Stein CRR1	Universal, works on most suspension forks and fork-crown shapes
Campagnolo 729	Fits 1" headsets with larger diameter crown races on limited fork-crown shapes
Campagnolo 7170003	Fits some 1–1/8" headsets on limited fork-crown shapes
Campagnolo 7170002	Fits some 1–1/4" headsets on limited fork-crown shapes
Shimano TL-HP20	Fits 1" headsets with smaller diameter crown races on limited fork-crown shapes
Hozan C437	Fits some large diameter races on 1" headsets, plus 1–1/8" & 1–1/4" headsets on limited fork-crown shapes
VAR 983	Fits some large diameter races on 1" headsets, plus 1–1/8" & 1–1/4" headsets on limited fork-crown shapes
HEAD-TUBE-RACE PRESSES	
Hozan C438	Fits all sizes of headsets, uses stepped inserts
United Bicycle Tool TRC & TRC4	Dedicated 1–1/8 " & 1–1/4" inserts for Hozan C438 that provide better support and accommodate longer head tubes
VAR 34	Fits all sizes of headsets, uses stepped inserts
Park HHP1	Fits all sizes of headsets, uses stepped inserts (does not maintain headset race alignment adequately), also fits one-piece bottom-bracket cups
CROWN-RACE INSTALLERS	
VAR 146/2	Fits 1" forks, heavy slide hammer
VAR 973	Fits 1–1/8" forks, heavy slide hammer
VAR 972	Fits 1–1/4" forks, heavy slide hammer
Hozan C435	Fits all sizes of forks when used in conjunction with United Bicycle Tool HP50, HP51, and HP52, heavy slide hammer
Campagnolo 722	Fits 1" forks, light-weight slide hammer (but can be hammered)
United Bicycle CRS	Fits 1" forks, light-weight slide hammer, compatible w/ all fork columns
United Bicycle CRS2	Fits 1–1/8" forks, light-weight slide hammer, compatible with all fork columns
United Bicycle CRS3	Fits 1–1/4" forks, light-weight slide hammer, compatible with all fork columns
Shimano TL-HP50	Adapter for other slide hammers that clears any interference with bottom of fork column on 1" forks
Shimano TL-HP51	Adapter for other slide hammers that clears any interference with bottom of fork column on 1–1/8" forks
Shimano TL-HP52	Adapter for other slide hammers that clears any interference with bottom of fork column on 1–1/4" forks
United Bicycle Tool HP50	Adapter for other slide hammers that clears any interference with bottom of fork column on 1" forks
United Bicycle Tool HP51	Adapter for other slide hammers that clears any interference with bottom of fork column on 1–1/8" forks
United Bicycle Tool HP52	Adapter for other slide hammers that clears any interference with bottom of fork column on 1–1/4" forks
THREADLESS-HEADSET TOOLS	
Park TNS-1	Installs star nut for threadless headset in 1" & 1–1/8" fork columns
Park TNS-2	Installs star nut for threadless headset in 1–1/4" fork columns

it expands and ends up trapped between the race and the end of the removal tool. The tool drives against the snap ring, which has a smaller I.D. than the race, so that the tool cannot pass through.

The correct sizes of internal snap rings to use are as follows: 1–1/16" for 1" headsets, 1–1/8" for 1–1/8" headsets, and 1–1/4" for 1–1/4" headsets.

These may be a little sloppy after being installed past the race, but they are the largest sizes that will pass through the respective race sizes, and will work despite the sloppiness.

The snap ring solution may not work if the head-tube race is unusually tight in the head tube.

Fork will not pull through head-tube races, or crown race will not clear top of fork column

The fork may stick when pulling it through the head-tube races, or the fork-crown race may stick before it comes off the end of the fork column. Both of these symptoms occur when the fork column (below the threads) is bulged as a result of an over-tightened stem-binder bolt.

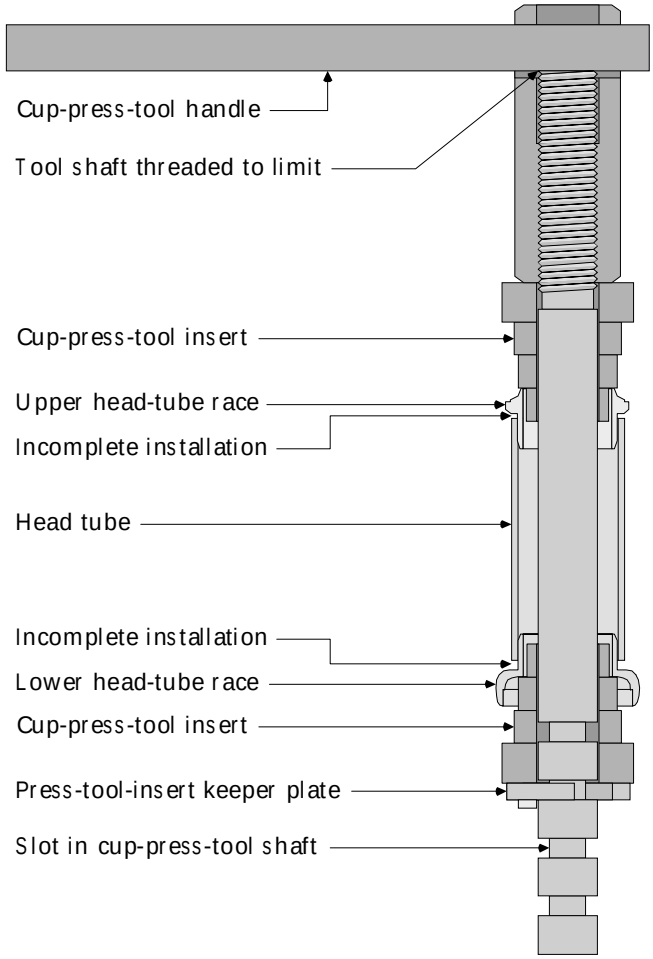
If this problem does occur, there is no alternative except to use whatever force is necessary to get the fork clear of the race, and then dispose of the fork.

Head-tube race will not seat fully

There are several reasons that a head-tube race might not seat fully when being pressed in. If using an inferior pressing tool, the races may cock to the side and jam.

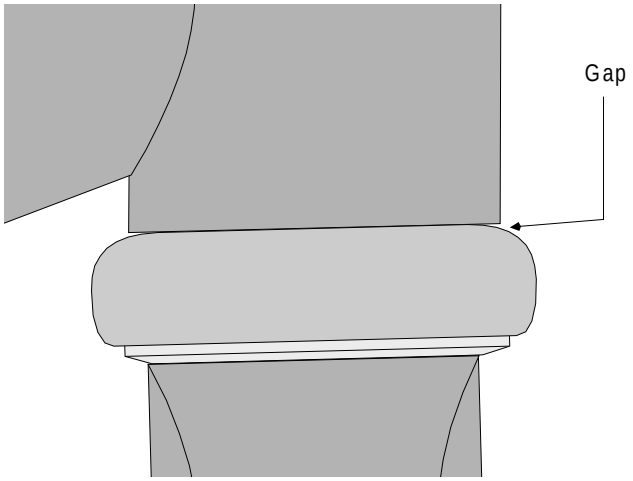
If installing aluminum body races into a steel head tube, a sharp edge on the inner perimeter of the head-tube face may create shavings or burrs that get trapped between the head-tube face and the race. Remove the race, then clean off any burrs or shavings off the race with a file. File or deburr the inner perimeter of the head-tube face with a round file or deburring tool.

Some head-tube-race pressing tools have multiple slots for the keeper plate of the tool to engage with, and a limited range of thread for the handle. Sometimes it is necessary to thread the tool shaft out of the tool head more and move the keeper plate up one slot on the tool shaft to ensure a complete pressing.



11.2 *If the keeper plate is engaged in the wrong slot, then the tool shaft may thread to its limit before pressing is complete.*

A beveled or sloped head-tube face or beveled race body may make a gap appear between the outer perimeter of the head-tube face and the race when, in fact, there is full contact at the inner.



11.3 *The curve of the cup may make it appear as though the race is not fully seated, when it is.*

Slide hammer jams before pressing crown race fully

The recommended VAR slide hammers are sometimes a very tight fit on the fork column, usually due to a buildup of paint or chrome on the fork column. An expansion reamer can be used to easily modify the tool to solve this problem (see chapter 7, page 7-3).

The Hozan C435 I.D. is a very close fit to the fork-column base. If the fork-column base is taller than the fork-crown race being installed, then the tool will jam on the fork-column base before pressing the fork-crown race fully. Use a different brand tool or use Shimano or United Bicycle Tool (HP50, HP51, and HP52) adapters with the Hozan tool.

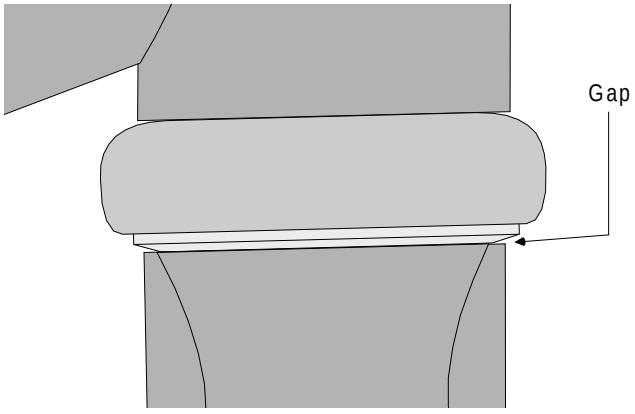
Some forks, particularly some suspension forks, have a taper just above the fork-column base that many slide hammers will not clear. Use United Bicycle Tool slide hammers CRS, CRS2, and CRS3 to solve this problem, or use Shimano or United Bicycle Tool (HP50, HP51, and HP52) adapters with the Hozan, VAR, or Campagnolo tool (see table 11-1, page 11-5).

Some carbon-fiber and aluminum forks have an extra-fat fork column. Hozan, VAR, and Campagnolo tools all jam in the first few inches before pressing ever begins. United Bicycle Tool slide hammers CRS, CRS2, and CRS3 solve this problem (see table 11-1, page 11-5).

Fork-crown race will not seat fully

See the above problem regarding slide hammer jamming before race installs fully. If none of these are the cause of the problem, it may be one of the following items.

A bevel or slope to the crown-race seat or the race body may make a gap appear between the outer perimeter of the crown-race seat and the race when, in fact, there is full contact at the inner perimeter.



11.4 *A bevel at the edge of the crown-race seat may make it appear as though the race is not seated fully when the race is seated fully.*

If the race is undersized to the fork-column base, or gets cocked during installation, burrs may peel off the surface of the fork-column base. In this case, remove the race, clean off the burrs, check the fit, and if fit is good attempt another installation (watching alignment carefully).

Fork-crown race cracks when being installed

Certain small-profile steel races are very intolerant of fit errors. Check fit carefully, especially when the fork-crown race is very small. Larger races will simply jam before installing completely, instead of cracking, when fit tolerances are poor.

Head-tube races make creaking noises

Aluminum head-tube races may creak in an aluminum head tube even when properly fit. Use Loctite 242 on mating surfaces to solve this problem.

HEADSET FIT

Headset parts press into the head tube, press onto the fork, and thread onto the fork. There are several different fit standards listed in table 11-2 (page 11-8). When replacing the headset, match the thread standard and the press fit dimensions (head-tube-race O.D. and fork-crown-race I.D.). If the bike has JIS standard press fit dimensions, or a mix of JIS and "Campy" standards, use reaming tools to convert the frame and fork to the "Campy" standard (30.0mm head tube and 26.5mm fork-crown base), which is the one that most replacement headsets are available in. Headsets are broken down into three groups: 1", 1–1/8", and 1–1/4" sizes. These numbers refer to the outside diameter of the fork threads. In some cases, a quicker way to identify what size headset is in the bike is by checking the stem's O.D. Some types of headsets are unique to one manufacturer. Old inexpensive English Raleighs (1" × 26tpi), Murrays, and Huffys have unique headsets, as well as some Austrian bikes and other bikes from European countries that would not be considered part of the cycling industry mainstream anymore.

Another important aspect of fit is the "stack height" of the headset, which relates to the difference in the length of the fork column and the head tube. In this area there are no standards, and the worksheets provided give a formula for calculating the maximum acceptable stack height for a replacement headset. Tables at the end of the chapter (page 11-24 through 11-28) help find a headset that is of a suitable stack height to fit the bike.

HEADSET-FIT FACTORS (table 11-2)

Headset type	1" "Campy"	1" JIS (Asian)	1" American	1" French (actual thread O.D.–25.0mm)	1–1/8" OS	1–1/4" OS
Typical occurrences	Most bicycles from Italy and US factories[1], not US brand imports, most quality replacement headsets	Most Asian bicycles[2] that are not oversize (OS)	Quality BMX[1] and old Schwinns	Older French bicycles, discontinued in early 1980s	Most mountain bikes with oversize headsets, some tandems	Fisher MTBs[3], limited other MTBs, some tandems
Stem O.D.	22.15–22.25mm	22.15–22.25mm	21.05–21.15mm	21.95–22.05mm	25.35–25.45mm	28.50–28.60mm
Pitch	24tpi	24tpi	24tpi	1mm	26tpi	26tpi
Fork thread O.D.	25.1–25.3mm	25.1–25.3mm	25.1–25.3mm	24.7–24.9mm	28.3–28.5mm	31.5–31.7mm
Nominal thread description	1" × 24tpi *or* 25.4mm × 24tpi[4]	1" × 24tpi	1" × 24tpi	25mm × 1mm	1–1/8" × 26tpi	1–1/4" × 26tpi
Head-tube-race O.D.	30.15–30.30mm	29.95–30.10mm	32.65–32.80mm	29.95–30.10mm	34.00–34.10mm	37.00–37.10mm
Head tube I.D.	29.95–30.05mm	29.75–29.85mm	32.45–32.55mm	29.75–29.85mm	33.75–33.85mm	36.75–36.85mm
Fork-crown-race I.D.	26.30–26.40mm	26.90–27.00mm	26.30–26.40mm	Variable[5]	29.90–30.00mm	32.90–33.00mm
Fork-column-base O.D.	26.45–26.55mm	27.05–27.15mm	26.45–26.55mm	Variable[5]	30.05–30.15mm	33.05–33.15mm

[1] Lower quality adult bikes and BMX bikes sold in department stores often have headset dimensions that are unique to the specific manufacturer of the bike. This is most notably true with Huffy and Murray brand bikes.

[2] Occasional Asian bicycles used mixed standards for the head-tube-race O.D. (Campy standard) and fork crown race I.D. (JIS standard).

[3] Fisher MTBs ceased utilizing the 1–1/4" oversize headset in approximately 1994.

[4] BSC and ISO thread description is 1" × 24tpi. Italian thread description of 25.4mm × 24tpi is fully interchangeable, but not *exactly* the same, resulting in a slightly tight feel in the threads when mixing types.

[5] Peugeot uses a unique fork-crown-race I.D. of 26.5mm. Some French bikes adhere to the Campy standard and some to the JIS standard.

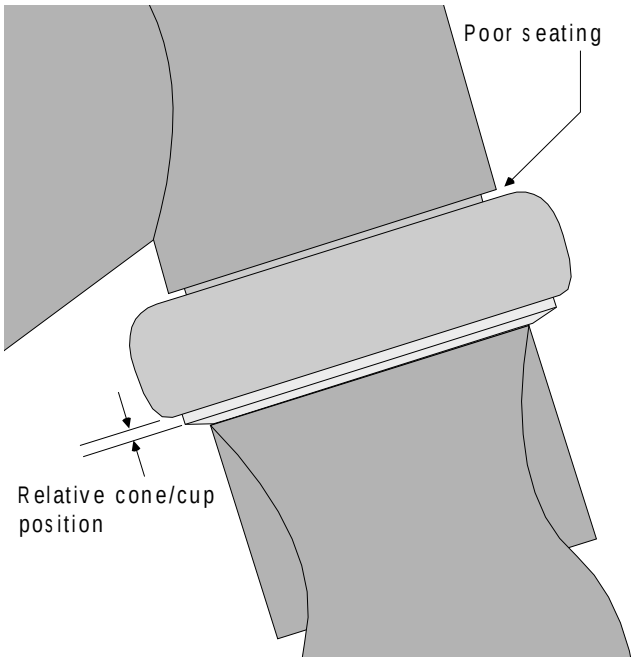
THREADED-HEADSET OVERHAUL AND ADJUSTMENT PROCEDURE

NOTE: If simply adjusting the headset, proceed directly to step 65.

REMOVAL

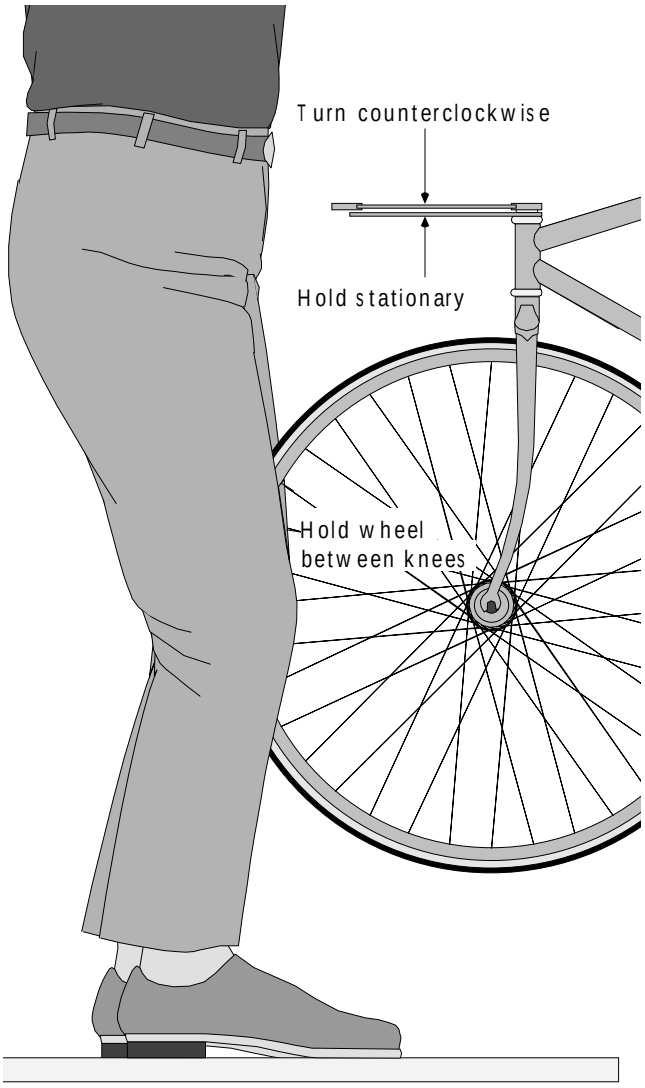
Remove brake calipers from the fork, or remove cable from brake calipers, whichever seems easier to do (keep in mind putting everything back together). If the cable goes through a cable hanger in the headset, or on a fork that has no slot to enable the cable to be released, it will be necessary to remove the cable from the brake.

1. **[ ] Remove brake calipers from fork, or remove cable from brake calipers.**
2. **[ ] Mark stem height with felt marker or piece of tape.**
3. **[ ] Loosen stem bolt (the one that goes down shaft of stem) about four full turns.**
4. **[ ] If stem-bolt head has come up out of stem, tap it down forcefully with plastic hammer or ball peen hammer and block of wood to protect bolt head.**
5. **[ ] Pull stem out of fork, and use something to tie bars to top tube, so that weight of bars does not hang against brake and derailleur cables and so that cables are not kinked.**



11.5 *Look for poorly seated race and depth of cone insertion before disassembly.*

6. **[ ] Inspect for poorly seated cups and for relative depth of cones in cups.**

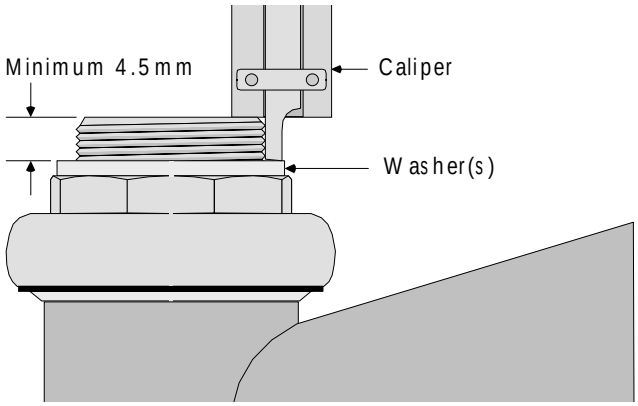


11.6 *Removing the locknut.*

7. **[ ] Use headset wrench to hold adjustable race stationary while using large adjustable wrench to turn locknut (counterclockwise) to break it loose and remove it. If possible hold wheel between legs while doing this to may make it easier to control.**
8. **[ ] Remove front wheel.**

In the next step, measure the amount of fork thread exposed above the remaining headset pieces. This number is useful for many things. If this number increases when the headset is assembled, it indicates that pieces were left out or the use of ball bearings that are too small. If this number becomes smaller, it indicates use of balls that are too large or that the ball bearings are out of place. If this number is less than 4.5mm to start with, it indicates that the locknut has

poor engagement and washers or spacers should be removed from the headset until the exposed thread measures 4.5mm or more.



11.7 *Measure the exposed thread available for the locknut.*

9. [ ] Use depth gauge on end of caliper to measure exposed thread above washers/brackets and record number here: _____mm.

Underneath the locknut there may be one or several washers and brackets (for reflectors or for the brake cable). Sometimes a washer will be difficult to lift off. Usually this means that it has rotated and jammed its key into the threads. In this case, grasp the washer with large pliers (Hozan C203 if you have one) and rotate it back until its key lines up with the slot in the threads. It should lift off easily then.

The sequence of washers and brackets is important. Sometimes there is a special washer that must go against the adjustable race, and often this special washer must face a certain way. If there is a cable hanger bracket, changing its position in the sequence could change the brake adjustment (which could be dangerous if not detected). In some cases, there might be a second locknut or lockring between the top nut and the adjustable race. If there is a lockring, a lockring wrench is needed to break it loose. To keep track of the sequence and orientation of the washers, brackets, and any additional lockring either write descriptive notes, draw an exploded diagram, or bundle them together with something like a plastic bag tie until ready to reinstall them.

10. [ ] Lift any washers and brackets off fork and note their order and orientations.

11. [ ] Remove lockring (if any).

12. [ ] Remove additional washers (if any).

Be prepared for loose ball bearings to drop out in this next step. They should not be reused, and the correct quantity is something that will be determined by trial and error, so don't be too concerned about keeping track of every last ball. Keep track of at least one for size reference.

13. [ ] Pull down on fork while turning adjustable race (counterclockwise) until fork comes out bottom of head tube. Adjustable race will remain perched on top of head tube.

In the next steps, look for seal mechanisms (see figure 11.1, page 11-1) and remove them. They will be plastic or rubber rings between the pairs of races at the top and bottom of the head tube. The seal mechanisms can be different at the top and bottom, and which way each one faces is critical as well. If seal mechanisms are switched, or the way they face is reversed, then adjusting the headset will become impossible.

14. [ ] Lift adjustable race off top of head tube and look for seal mechanism and remove it (if any). Bundle it with adjustable race now so it does not get confused with lower seal mechanism. Note its orientation here: _____

15. [ ] Remove balls (usually in a retainer) from top part of headset and measure them with Park SBC-1 or caliper. Note upper ball-bearing size here: _____

16. [ ] Look on fork-crown race, or up inside the race pressed into lower end of head tube for seal mechanism and remove it. Note its orientation here: _____

17. [ ] Remove balls (usually in a retainer) from bottom part of headset and measure them with Park SBC-1 or caliper. Note lower ball-bearing size here: _____

CLEANING THE PARTS

18. [ ] Clean head-tube races with solvent.

19. [ ] Clean adjustable race with solvent.

20. [ ] Clean fork threads with solvent.

21. [ ] Clean balls bearings with solvent only if re-using them. (Re-using bearings *not* recommended.)

INSPECTION

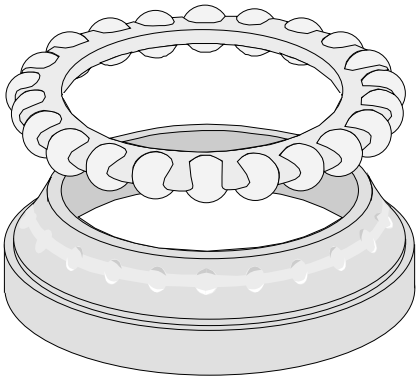
When headsets wear out, the surfaces on which the balls roll develop dents (smooth craters in the metal) called brinelling. Once this occurs, a proper adjustment cannot be made. In some cases there will be galling (rough craters in the metal where the balls roll). The design of the headset is such that the lower pair of races tends to wear out first. Although it is sometimes possible to get individual replacement parts; more often than not, only complete headsets are available. It is not

advisable to mix parts from different headsets in one stack. In any case, if any parts are heavily worn, it is a good idea to replace them all. The dents or pits may show up clearly to the naked eye, but the ultimate test to determine whether there are pits is to trace the wear path the bearings have left on the cup or the cone with the tip of a ball point pen. If the tip of the pen catches anywhere, it is a pit or dent.

Severely over-tightened headsets or badly abused headsets may fail by the lower cup cracking. The cracks will show up on the top of the lower cup, usually in a radial pattern. Another problem found with headsets is that the pressed parts may be loose. This can be due to poor original tolerances, or by an enlargement of the head tube as a result of abusive riding.

Thread damage may also occur on the fork. This will primarily be where a lock washer has been forced to rotate. Occasionally the threads may be stripped at the engagement with the locknut or the adjustable race.

Do not inspect the ball bearings for wear. Significant wear on bearings is not necessarily detectable with the naked eye or by feel. It is recommended to always replace the bearings if going to the trouble to overhaul the headset.



11.8 *Dents in these races are called brinelling and are cause to replace the headset. Note that the positions of the dents correspond to the spacing between the ball bearings created by the retainer.*

22. [ ] Inspect cup races and cone races for dents from brinelling or galling (pits).

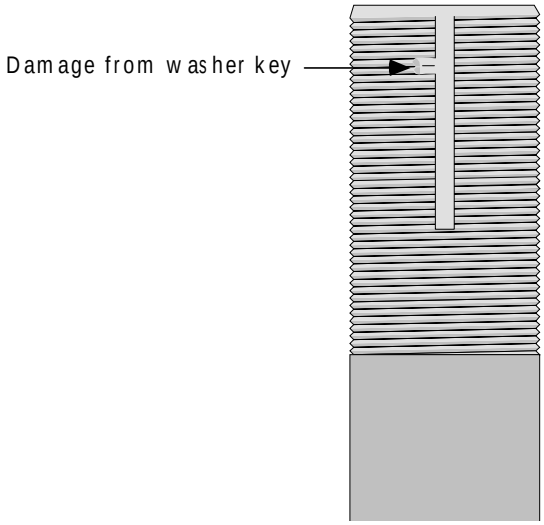
23. [ ] Inspect lower cup for cracking.

24. [ ] Inspect pressed races in head tube and on fork crown for looseness by trying to jiggle or twist them. They should be immobile.

25. [ ] Inspect for damaged fork-column threads or bent fork column (evidence is a bow along the length of the column, any bulges in the column, and any groove worn into the column, particularly about 1–2" above base).

Headsets often have keyed washers between the locknut or lockring and the adjustable race. The key on the washer is not only unnecessary and likely to damage fork threads, it may even interfere with securing the position of the adjustable race. This type of interference happens when the adjustable race is held stationary and the locknut is torqued down to the adjustable race. The keyed washer tends to rotate and jam its key into the fork threads. When this happens the washer is no longer capable of transferring force down to the adjustable race since it is stuck against the fork threads. The end result is a locknut that is tight but an adjustable race that is not.

This could be prevented by turning the adjustable race up in addition to turning the locknut/lock washer down, but this turns the adjustment process into a trial-and-error fiasco.



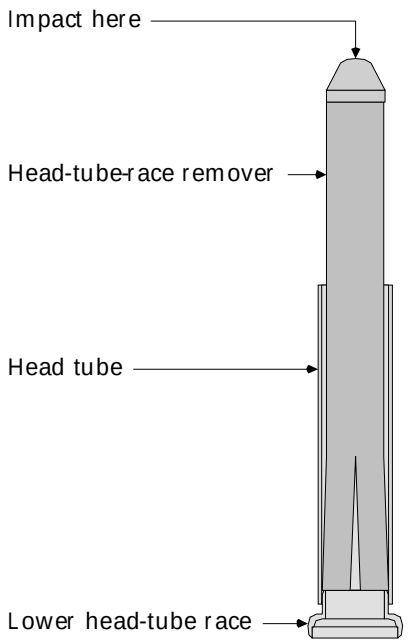
11.9 *Fork threads damaged from rotated lock washer.*

26. [ ] Inspect keys on inside of lock washers and brackets, and replace washers or brackets if keys are damaged. (It is optional and recommend to replace keyed washers or file out keys on washers.)

REPLACEMENT OR INSTALLATION

NOTE: If not replacing or installing a headset, skip ahead to step 49.

Removal of pressed races



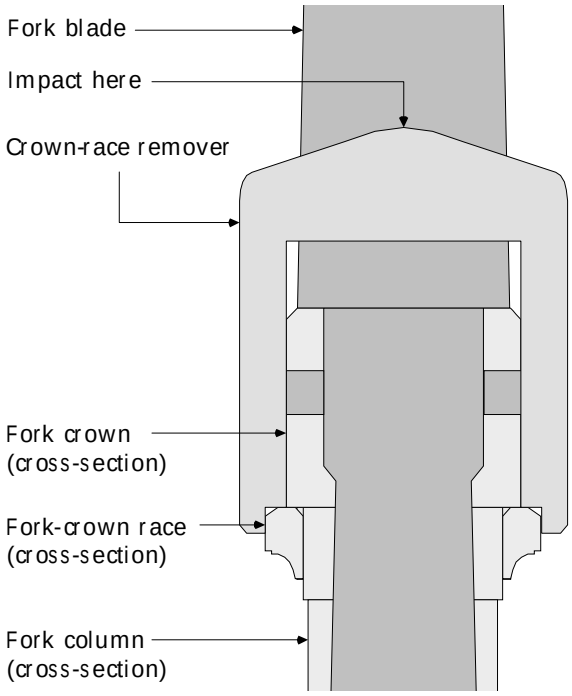
11.10 *Removing the lower head-tube race.*

27. [ ] Remove head-tube races.

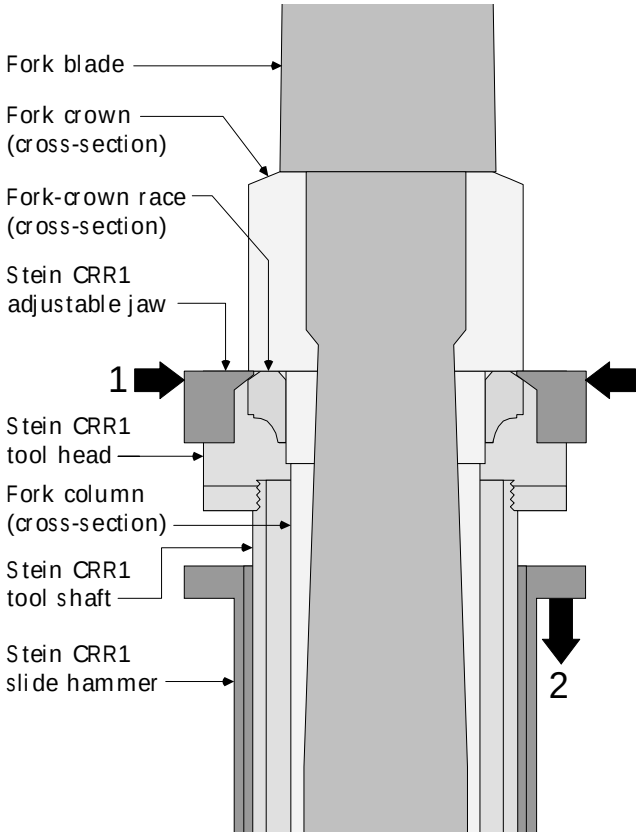
The fork-crown race can be very awkward to remove. There are several styles of tools and techniques.

The traditional tool design looks like an upside-down U or a horseshoe. The tool straddles the fork crown from below and the ends of the tool catch on any of the fork-crown race that extends beyond the profile of the fork crown (see figure 11.11). Fat fork crowns or deep-profile fork crowns both interfere with this type of tool, and it is virtually certain that this tool will be of no use on a typical suspension fork. In addition, many sizes and varieties of this tool are required to fit different sizes and brands of races.

Stein makes a completely different crown-race remover (CRR1) that has two wedge-like jaws that come together from the sides to catch under the edge of the fork-crown race. A hollow shaft that fits over the fork column is joined to these jaws. A slide hammer slides down the shaft to provide the impact that removes the race. The jaws can be pressed together in a vise to wedge the race up slightly to get better engagement of the jaws before using the slide hammer. This design is the most universal yet, with minimal chance of damaging the race or fork crown.



11.11 *A traditional crown-race remover in use. This type of tool has very limited usefulness.*



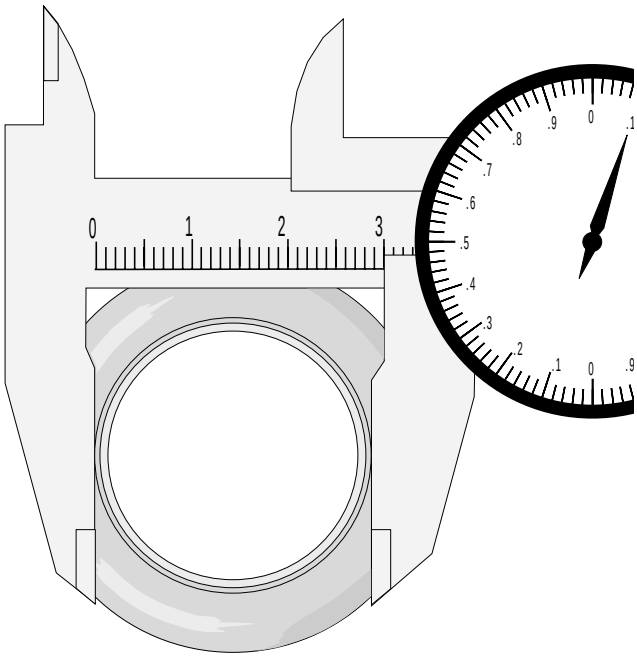
11.12 *To use the Stein CRR1 crown-race-removal tool, (1) squeeze the adjustable jaws in until they catch between the crown race and the fork crown (squeeze in vise if necessary), then (2) vigorously accelerate the Stein CRR1 slide hammer down to drive the fork-crown race off.*

Traditionally mechanics have used a punch and hammer on the bottom face of the fork-crown race to drive it off, but certain types of races are marred or damaged with this technique and it is completely inapplicable to most suspension forks. The Stein CCR1 makes this technique virtually obsolete.

28. [ ] Remove fork-crown race.

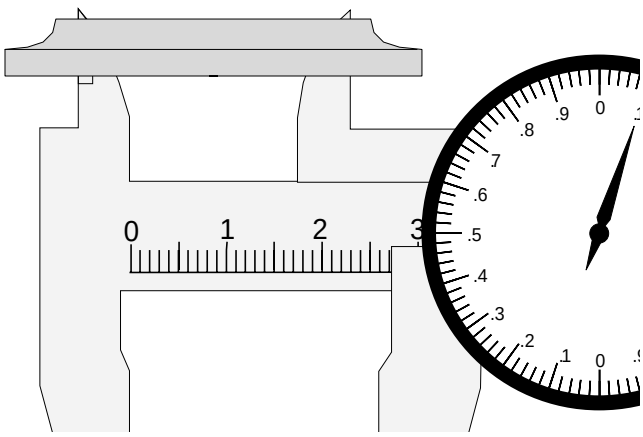
Verification of fit

When replacing parts and the old parts are at hand, measure fork-thread diameter and pitch. Measure the head-tube-race O.D. and the fork-crown-race I.D. Check **HEADSET-FIT FACTORS (**table 11-2, page 11-8) to help determine the headset type to use or order.



11.13 *Measuring the head-tube race.*

29. [ ] Record original head-tube-race O.D. here: _____mm.



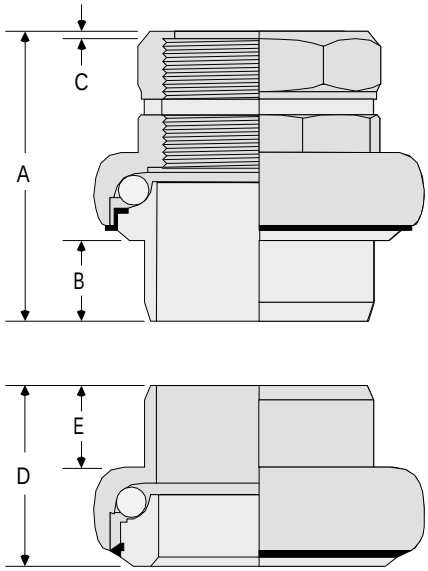
11.14 *Measuring the fork-crown race.*

30. [ ] Record original crown-race I.D. here: _____mm.

31. [ ] Record original thread description here: _____

Stack height is an important consideration, if not replacing a headset with an identical model. If the new headset has a greater stack height than the old one, then there will not be enough room to install the locknut. Shorter is acceptable because washers can be added to the new headset to make it taller. Rather than measuring the old headset, determine the maximum allowable stack height by measuring the length of the head tube and the length of the fork column and subtracting the difference. This number is the maximum stack height for the replacement headset.

To measure stack height of a headset, start by stacking up the parts of the lower half of the headset (including bearings). Measure the total height of the stack, then subtract the length of the cylinder on the pressed race that inserts inside the head tube. Assemble the complete upper stack including washers and locknut(s), measure the total height, subtract the length of the cylinder on the pressed race that inserts inside the head tube, and subtract the thickness of the lip of the locknut that sits on top of the fork column. The stack height of the headset is the upper and lower stack added together. If this number is greater than the difference between the head-tube length and the fork-column length, the headset will not fit.



11.15 *Measure A, B, C, D, and E. (A–B–C)+(D–E) = stack height.*

32. [ ] Measure total length of fork column in millimeters with metric tape measure and record here: _____

33. [ ] Measure head-tube length in millimeters with metric tape measure and record here:

_____

34. [ ] Subtract step 33 from step 32 and record difference here: _____mm. This is maximum stack height.

35. [ ] Replace headset with one of compatible thread size, press fits, and stack height.

In the next few steps, verify that the press-fit dimensions for the new headset are a good fit, or whether Loctite is needed to make the fit ideal. The process involves measuring the inside diameter of the head tube and the outside diameter of the head races to determine the diameter difference. The head-tube I.D. should be smaller than the race O.D., so that there will be interface when the race is pressed in to the head tube. When subtracting race O.D. from head-tube I.D., a negative answer indicates that there will be interference. The ideal answer range is –.2mm to –.3mm. Based on the diameter difference calculated in step #38, choose an option: install as is, augment fit with Loctite, machine the head tube to improve the fit, or get a better fitting headset.

These measurements require an accuracy of .05mm. Measurements of this accuracy not only require a high quality caliper, the method in which the caliper is used is critical. If not 100% confident in the measurements, pay close attention to what happens when attempting to install the parts. If they slip together with little or no effort, it indicates the press fit is marginally loose. Loctite will be needed. If the parts are extremely difficult to press together, the tolerance difference is too great. In this case, either a different headset is needed or some machine work is needed on the fork and/or head tube.

In steps #36 through #38, measurements are taken and a calculation is made to determine the dimensional difference between the head-tube-race O.D. and the head-tube I.D. In step #39, a course of action is chosen, based on the dimensional difference determined in step #38. Consider the following examples.

Example 1:

head-tube I.D.: 30.1mm
race O.D.: 30.0mm.
30.1 – 30.0 = .1 (>.0mm)
A different headset is needed because the positive .1mm difference indicates that there will be no interference between the race and head tube.

Example 2:

head-tube I.D.: 30.1mm
race O.D.: 30.2mm.
30.1 – 30.2 = –.1
The negative difference indicates that there will be some interference to the fit, but it is not enough, so Loctite 680 should be used to improve the fit.

Example 3:

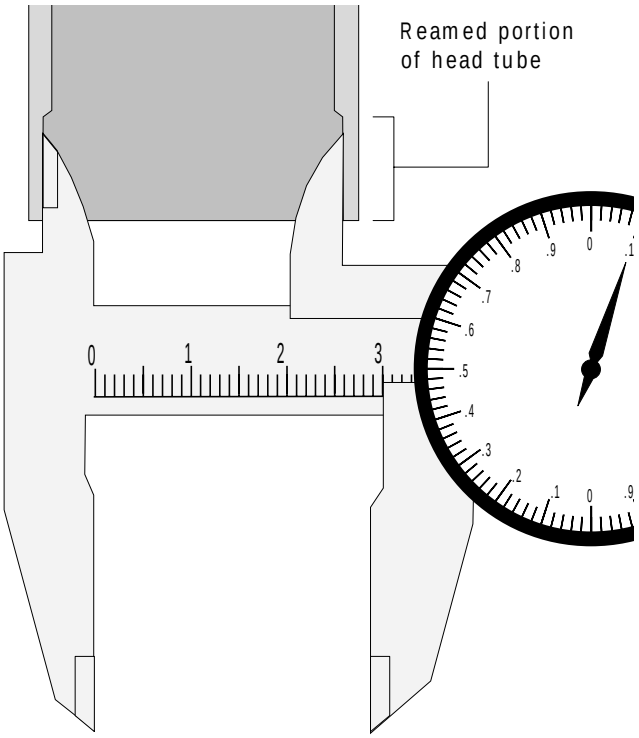
head-tube I.D.: 30.0mm
race O.D.: 30.25mm.
30.0 – 30.25 = –.25
The negative .25mm difference is inside the acceptable difference range (–.2 to –.3mm), so the part can be installed as is.

Example 4:

head-tube I.D.: 29.9mm
race O.D.: 30.25mm.
29.9 – 30.25 = –.35
The negative .35mm difference is outside the acceptable difference range (–.2 to –.3mm), so the part can be installed only once the head tube is reamed to improve the fit.

36. [ ] Measure I.D. of head tube in two or more places and average result. Record here:

_____ + _____ = _____ ÷ 2 = _____mm.



11.16 *Use the caliper jaws to measure inside diameter and make sure that the tips of the jaws are not inserted beyond the reamed portion of the head tube.*

37. [ ] Measure O.D. of new races to be pressed into head tube and record here: _____mm.

38. [ ] Subtract step 37 from step 36 and record answer here: _____mm.

39. If step 38 is (check one):

[ ] >.0mm, find different headset.

[ ] .0 to –.19mm, install race w/Loctite RC680.

[ ] –.20 to –.30mm, install headset as is.

[ ] <–.30mm, ream head tube (not always possible) or get new headset.

In the next few steps, verify that the press-fit dimensions for the new headset are a good, or whether Loctite is needed to make the fit ideal. The process involves measuring the inside diameter of the fork-crown race and the outside diameter of the fork-column base to determine the diameter difference. The crown-race I.D. should be smaller than the fork-column-base O.D., so that there will be interface when the race is pressed on to the fork. When subtracting fork-column-base O.D. from race I.D., a negative answer indicates that there will be interference. The ideal answer range is –.1mm to –.2mm. Based on the diameter difference calculated in step #42, choose an option: install as is, augment fit with Loctite, machine the fork-column base to improve the fit, or get a better fitting headset.

In steps #40 through #42, measurements are taken and a calculation is made to determine the dimensional difference between the crown-race I.D. and the fork-column-base O.D. In step #43, a course of action is chosen, based on the dimensional difference determined in step #42. Consider the following examples.

Example 1:

crown-race I.D.: 27.1mm.
fork-column-base O.D.: 27.0mm
27.1 – 27.0 = .1 (>.0mm)
A different headset is needed because the .1mm difference indicates that there will be no interference between the race and fork.

Example 2:

crown-race I.D.: 27.0mm.
fork-column-base O.D.: 27.05mm
27.0 – 27.05 = –.05
The negative difference indicates that there will be some interference to the fit, but it is not enough, so Loctite 680 should be used to improve the fit.

Example 3:

crown-race I.D.: 27.0mm.
fork-column-base O.D.: 27.15mm
27.0 – 27.15 = –.15
The negative .15mm difference is inside the acceptable difference range (–.1 to –.2mm), so the part can be installed as is.

Example 4:

crown-race I.D.: 27.0mm.
fork-column-base O.D.: 27.25mm
27.0 – 27.25 = –.25
The negative .25mm difference is outside the acceptable difference range (–.1 to –.2mm), so the part can be installed only once the fork-column base is counter-reamed to improve the fit.

40. [ ] Measure I.D. of fork-crown race and record here: _____mm.

41. [ ] Measure O.D. of fork-column base and record here: _____mm.

42. [ ] Subtract step 41 from step 40 and record answer here: _____mm.

In the first option of step #43, it indicates that if the result of the calculation is greater than .0mm, a different-sized headset must be used. There is one additional option that can be very effective if the result in step #42 is between .0 and .2mm. A Stein KT knurling tool can be used to increase the effective diameter of the fork-column base by up to .2mm. Use Loctite RC680 in addition to knurling.

This knurling technique has the same effect as an old mechanic's trick called "staking." To stake a fork-column base a chisel would be used to make indentations at multiple points around the fork-column base. Both the knurling tool and the staking technique cause some metal to rise up by forcing other metal to be indented. The knurling tool does a more thorough and consistent job without any risk of mis-striking with the chisel when performing the staking technique. The knurling tool serves triple use, enlarging handlebar centers and seat posts as well.

To use the knurling tool, the tool is put in the vise jaws and the fork column is inserted inside the knurling tool. Close the vise just enough to cause the toothed wheels of the knurling tool to indent the fork-column base, then rotate the fork around several times. If the knurling pattern is not very pronounced, repeat the process with the vise closed tighter.

43. If step 42 is (check one):

[ ] >.0mm, find different headset.

[ ] .0 to –.09mm, install race w/Loctite RC680.

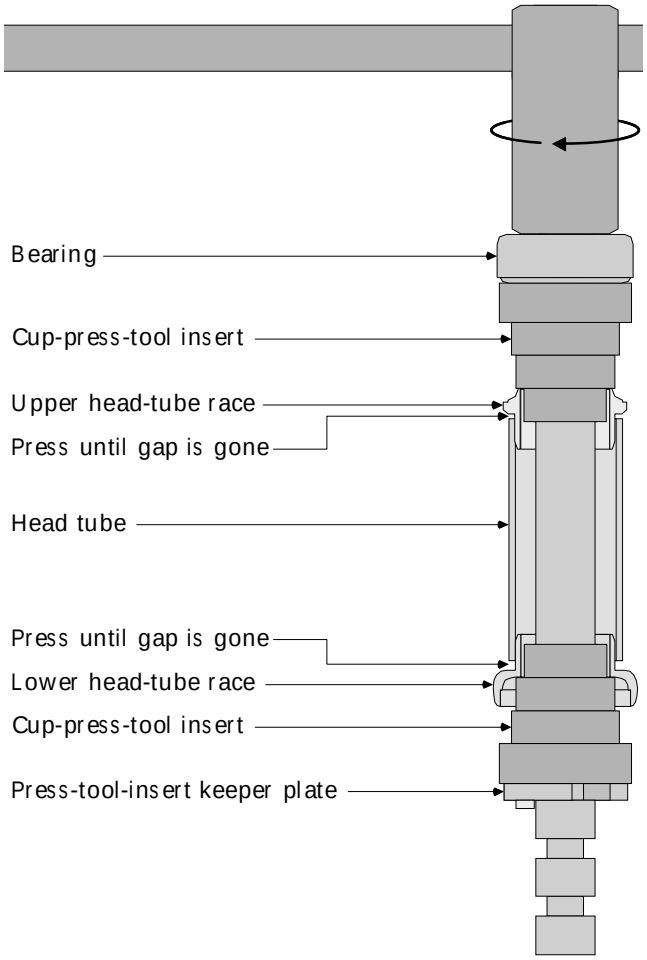
[ ] –.10 to –.20mm, install headset as is.

[ ] <–.20mm, mill fork crown (not always possible) or get better-fitting headset.

Installation of pressed races

44. [ ] Clean with alcohol or acetone all three pressed race mating surfaces: plus outside of fork-crown-race seat, and inside of head tube. Prepare same surfaces with Loctite 242 to prevent corrosion (optional) or Loctite RC680 to improve poor fit (if necessary).

When pressing in the head-tube races, they must be pressed on fully. There is no specific force required, but there will be a distinct "bottomed-out" feeling when they are in fully.

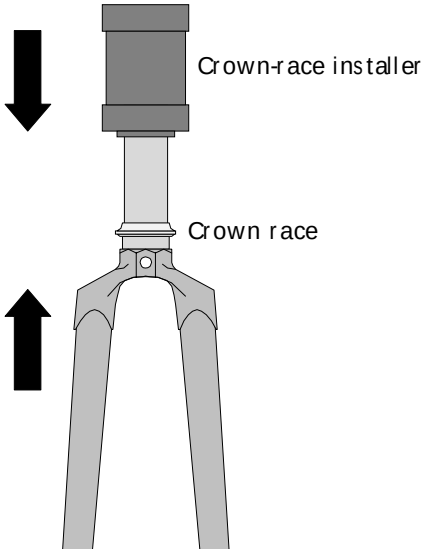


11.17 *Installing the races into the head tube with a Hozan C438.*

45. [ ] Insert larger race into bottom of head tube and smaller one into top of head tube and press in fully with press. If aluminum races appear to be developing shavings as they press in, remove shavings before completing installation.

46. [ ] Inspect head-tube races to confirm they appear pressed in fully.

To use a slide hammer to install a fork-crown race, simply place the race on the fork-column base and accelerate the slide hammer down the fork column against the race. *Do not support the fork on its dropouts while doing this!* Simply hold the fork in mid-air with one hand while accelerating the slide hammer with the other hand.



11.18 *With the crown race sitting on top of the crown-race seat, rapidly accellerate the fork and the crown-race installer towards each other.*

47. [ ] Press crown race onto fork.

48. [ ] Inspect that crown race appears fully seated.

Replacing ball bearings

The original ball bearings are usually in a retainer (a clip that holds the balls together in a set). Although there are no mechanical advantages to using retainers, there are several disadvantages. Installing loose balls is always recommended. If installing loose balls, try to find the highest quality ones available. Good balls are described as *grade 25*. Decent ball bearings might be described in the range of *grade 100* to *grade 200*. Any higher number than these is a mediocre bearing.

Balls in a retainer are more expensive to buy in a high grade, and grade information is rarely available for balls in a retainer. Retainers create a fixed relationship between the balls, which is one of the causes of brinelling, the primary cause of headset failure.

Important information if installing ball retainers

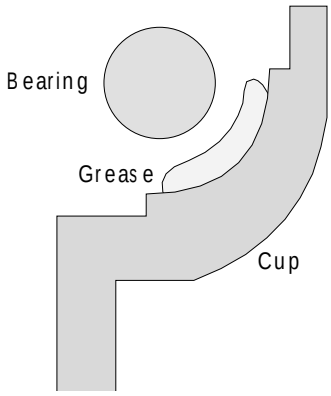
Forget any rules of thumb about which way ball retainers face in relation to the cups and cones, or relative to the ground. There is only one way to get ball retainers in correctly and that is to test-mate them both ways to the cone and both ways to the cup. In one of the four combinations, the clip that holds the balls together (instead of the balls) will be obviously con-

tacting the ball race on the cone or the cup. Install the retainers opposite this. If good measurements of the exposed thread were taken once the locknut was removed, and original retainers were in correctly, and the original or an identical headset has been installed, putting a retainer in backwards will reduce the exposed thread by more than a millimeter.

ASSEMBLY

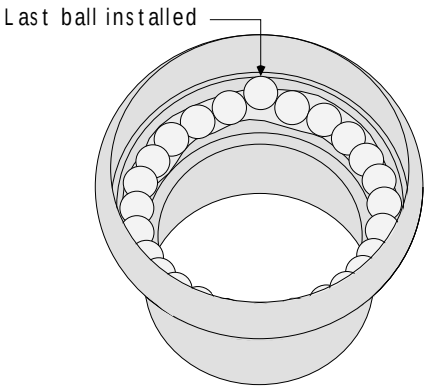
Getting a headset assembled with loose balls can be tricky. Follow these steps carefully and there will be a good chance of success.

49. [ ] Replace ball bearings (check steps 15 & 17 for sizes).



11.19 *Put a light layer of grease in each cup. The thickness of the layer of grease should be less than 1/2 the diameter of the ball bearing.*

50. [ ] *Lightly* coat cup race with grease. One millimeter thickness of grease should be more than enough. The upper cup could be an adjustable race or upper head-tube race.

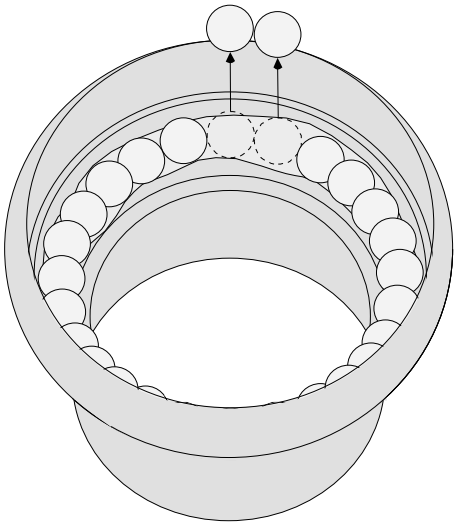


11.20 *Place the balls in the cup so that they touch each other. If a gap remains that is too small for a ball, put one more in anyway.*

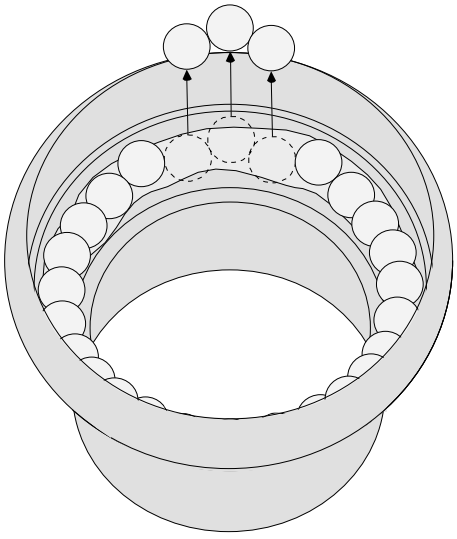
51. [ ] Fill cup with balls and make sure they are all touching each other.

52. [ ] Test mate upper cup to upper cone, separate, and inspect balls.

In the next step, some balls will be removed. The reason this is done is to prevent headset failure from brinelling. By leaving the balls room to move around relative each other it guarantees that any brinelling that occurs is in random locations. When ball retainers are used or the cup is left full, the brinelling occurs in the same places over and over again until it reaches a noticeable depth and causes headset failure.



11.21 *If the balls are not jumbled after test-mating the parts, remove two balls.*

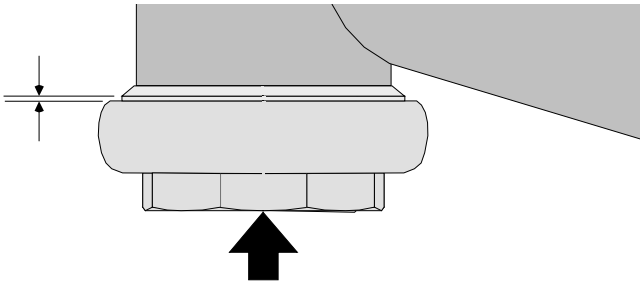


11.22 *If the balls remain jumbled after test-mating the parts, remove three balls.*

53. [ ] Remove two balls from cup if they sit level, three balls if jumbled.

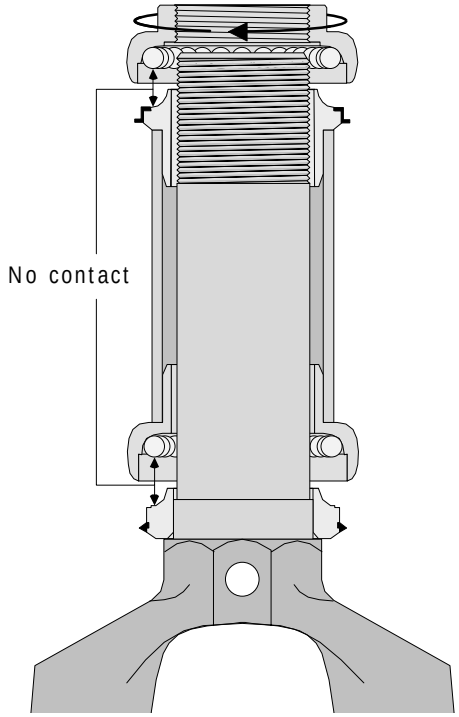
In the next step, re-mate the cup and cone back together. The function of this step is to observe the depth of the cone in the cup. This way, if the balls get

jumbled during assembly, it will show up as a cone not inserting as far into the cup; take the headset apart and reassemble it before going to the trouble of adjusting it. Also, this same observation was made before disassembly. If the relation between these parts has changed, it probably means the ball size has changed.



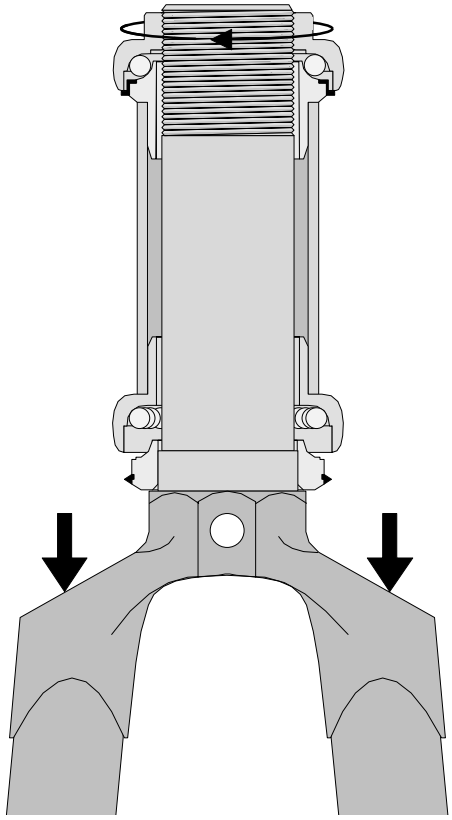
11.23 *Mate the cone and cup together again to seat the balls in place, then check the depth of the cone in the cup. When the headset is finally assembled, the cone should be in the same position relative to the cup, or ball bearings are out of place.*

54. [ ] Test-mate cone and cup again to seat balls and inspect depth of each cone in each cup.
55. [ ] Coat balls lightly with grease.
56. [ ] Insert seal (if any) into cup or onto cone.
57. [ ] Repeat steps 50–56 for lower cone and cup.
58. [ ] Grease fork threads and fork column fully.



11.24 *Engage the adjustable race to the top of the fork, while maintaining no contact between the balls and the cones.*

59. [ ] Assemble fork into head tube and adjustable race onto fork. (***Cones should not insert fully into cups at this point***.)



11.25 *With the upper race seated and with a downward pressure on the fork, turn the adjustable race clockwise to draw the fork up into place.*

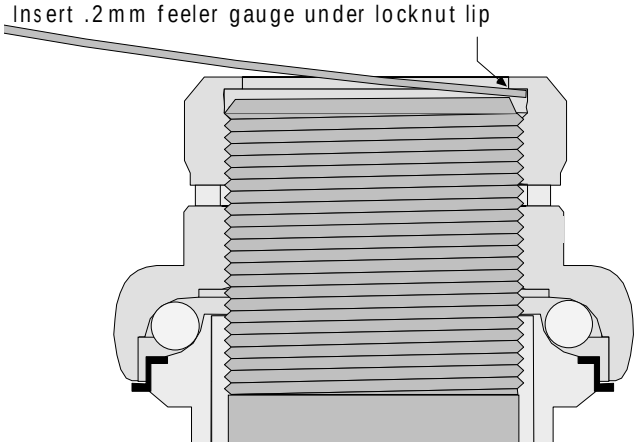
60. [ ] Drop fork down and thread race fully on to draw fork up fully.
61. [ ] Inspect if positions of cones in cups appear similar to how the cone positions appeared when checked in step 54, then check for smooth rotation of fork.
62. [ ] Install washers, lockring (if any), and brackets (if any).

If ball size has increased, a retainer has been inverted, or the balls are jumbled and out of position, it will show up as a reduced amount of thread available for the top locknut. If the ball size has been reduced, or washers or brackets have been left out, it will show up as an increased amount of thread available for the top locknut. In the next step, measure the result and compare it to the measurement taken during disassembly.

63. [ ] Measure exposed thread and verify it matches pre-disassembly dimension (step 9). If installing a new headset check that at least 4.5mm of thread is available for locknut.

If changing the number or washers, whether a bracket is used, or the entire headset, verify that there is not too much thread for the locknut. If there is,

the lip on the top of the locknut will stop against the top of the fork column before securing against the adjustable race.

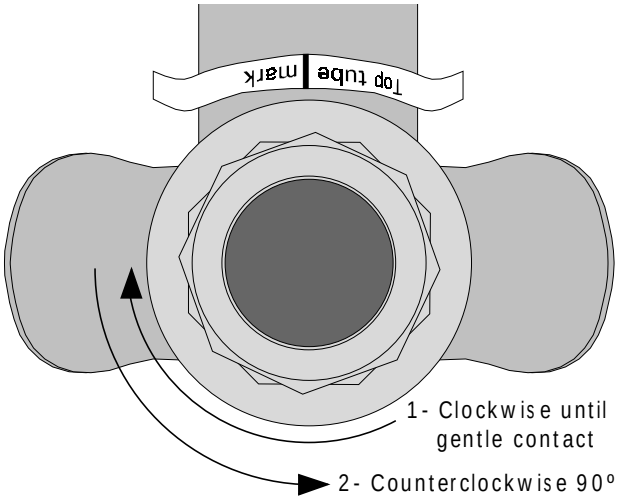


11.26 *Use a thin feeler gauge between the locknut lip and the top of the fork column to verify that the lip is not stopping against the fork column.*

64. [ ] Thread on, but do not secure, locknut. Verify lip does not bottom on top of steering tube.

ADJUSTMENT

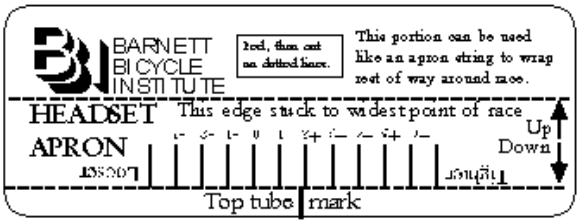
65. [ ] If headset has not just been overhauled, break loose locknut and turn adjustable race 1/4 turn (counterclockwise).
66. [ ] Gently thread race down to contact balls.
67. [ ] Install wheel if not already installed.
68. [ ] Hold fork stationary and turn race 90° counterclockwise.



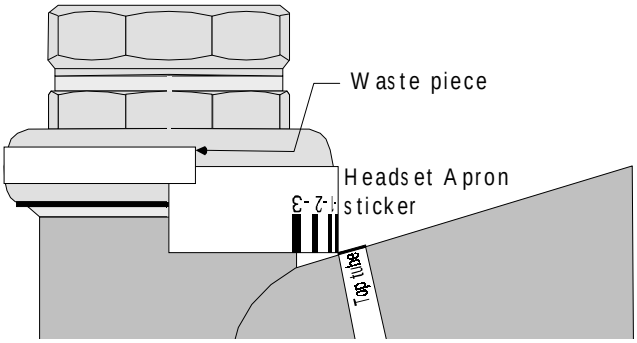
11.27 *Turn the adjustable race clockwise until it gently contacts the ball bearings, then turn it at least 90° counterclockwise. Placement of the top tube mark sticker (step #69) is also illustrated.*

The following adjustment procedure is very different from the way most mechanics adjust headsets. The procedure uses an adjustment-calibration sticker (a BBI product), but a piece of masking tape that you mark yourself can be used as an alternative to the sticker. This approach (with sticker or tape) may seem awkward at first, but students at BBI that were very experienced with headset adjustment prior to arriving at BBI, endorse this approach wholeheartedly.

69. [ ] Put sticker with top tube mark (or marked masking tape) on top tube, with mark close to adjustable race and centered on top of top tube (see figure 11.27).

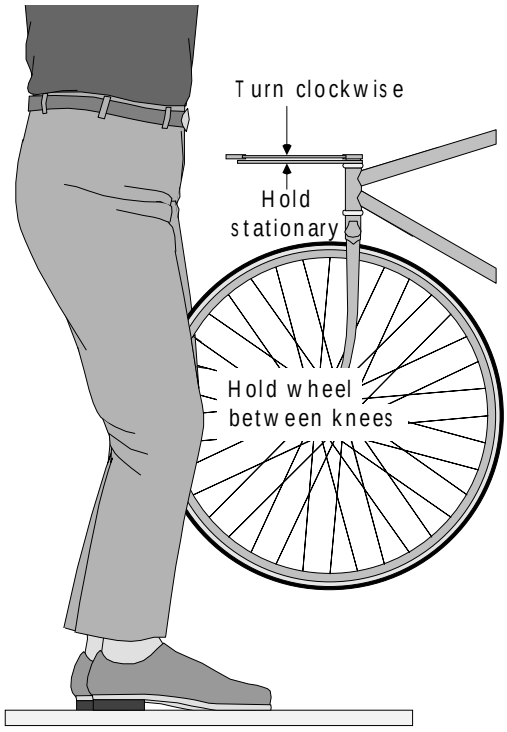


11.28 *This is the BBI Headset Apron sticker that is recommended for precise and easy headset adjustment.*



11.29 *Install the Headset Apron sticker. Note that the Headset Apron Sticker is installed with the numbers upside down and the edge as close to the Top Tube Sticker as possible.*

70. [ ] Hold fork square to frame and put BBI Headset Apron sticker on adjustable race so that it hangs down like an apron and "0" mark lines up with top tube mark. (When sticker is on correctly, calibration lines are on bottom edge and numbers are upside down at top edge of sticker.) If not using Headset Tape sticker, just put matching marks on top tube and masking tape on adjustable race.

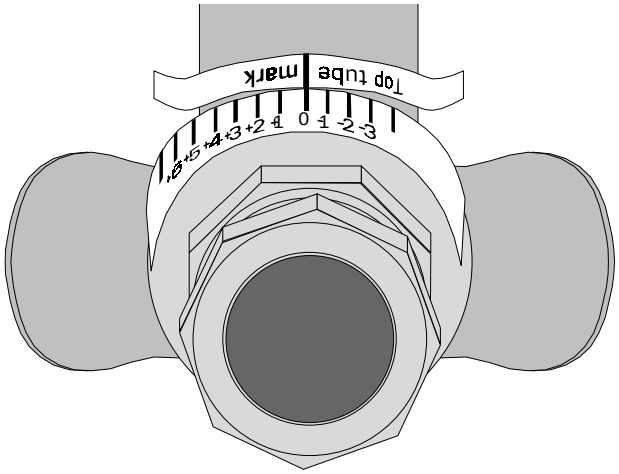


11.30 *Stabilizing the fork while securing the adjustment.*

71. [ ] Stabilize fork with wheel (or Stein FS) between knees, hold race stationary, and secure locknut to 300in-lbs (38lbs@8").

In step #72, bearing play is checked by jerking on the bottom ends of the fork blades. With non-suspension forks, this method is preferred because it provides the greatest leverage. With suspension forks, it is necessary to jerk on the fork crown or the stanchion (upper) tubes, instead. This is because play between the sliders (lower tubes) and stanchions can be misinterpreted as play in the headset adjustment.

72. [ ] Check for play by grasping both fork blades (or Stein FS clamp) in one hand and bottom of down tube in other hand, then jerking fork forward and back. Rotate fork to several positions and check further for play. If there is no play, check for smooth rotation. If not smooth, restart at step 67, but start with race turned further counterclockwise.



11.31 *With fork square to frame, turn the race clockwise to the next "+" mark to tighten the adjustment, or counterclockwise to the next "–" mark to loosen the adjustment.*

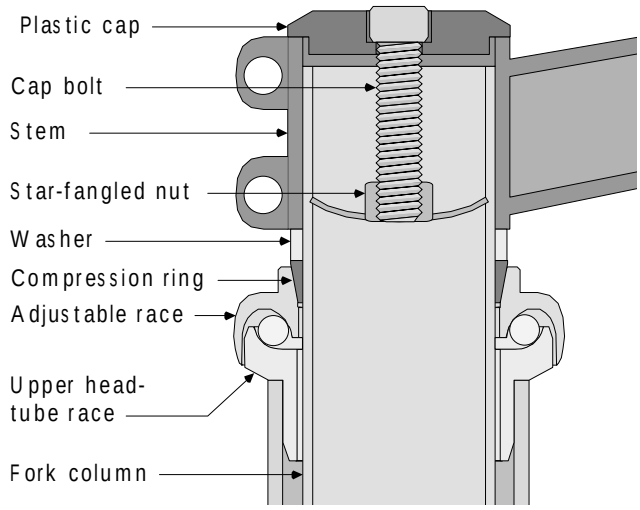
73. [ ] *If using Headset Apron Sticker*: tighten adjustment by putting the next "+" mark on sticker at top tube mark with wheel lined up with down tube. (If headset had no play, but was smooth, loosen adjustment to next "–" mark instead.)
***If not using sticker*: put new mark 2–3mm counterclockwise from last mark and adjust new mark to line up with top tube mark to tighten adjustment.**

74. [ ] Secure locknut to minimum 300in-lbs (38lbs@8").

75. [ ] Check for play and repeat adjustment as necessary, securing locknut each time before checking for play. (If headset originally had no play, repeat loosening adjustment until play is found, then return to last "no play" adjustment.)

THREADLESS-HEADSET SYSTEMS

NOTE: If replacing a conventional fork and headset with threadless fork and headset, skip to step 7.



11.32 *Cross-section of the top half of a threadless headset installed.*

REMOVAL

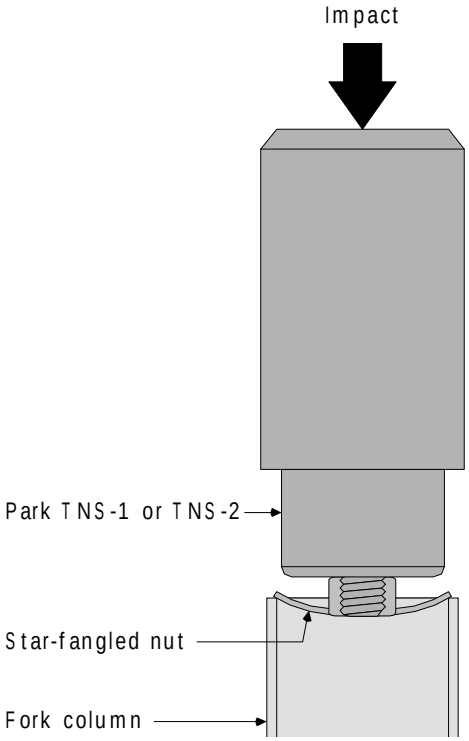
1. [ ] **Remove wheel from fork.**
2. [ ] **Remove brake calipers from fork, or remove cable from brake calipers.**
3. [ ] **Remove cap bolt and plastic cap at top of fork column just above stem.**
4. [ ] **Loosen stem-binder bolt(s) and remove stem from fork column. (Be prepared for fork to drop out.)**
5. [ ] **Slide fork out bottom. (Note adjustable race, compression ring, and spacer washers will be left balanced on top of headset.)**
6. [ ] **Do steps 14–24 from *THREADED-HEADSET OVERHAUL, AND ADJUSTMENT PROCEDURE* (page 11-10).**

NOTE: If overhauling an existing threadless headset, skip steps 7–12.

CONVERSION TO THREADLESS SYSTEM

A threadless headset installs into the head tube and onto the fork crown just like a normal headset. The difference comes with the installation of the adjustable race. In fact, it is no longer threaded but slips onto the fork column, and is trapped in place by a special stem that clamps on the outside of the fork column. So, assuming all three pressed races are installed and it is time to slip on the adjustable race, proceed with step #7.

7. [ ] **Do steps 1–31 (page 11-9), then steps 36–48 (page 11-14) from *THREADED-HEADSET OVERHAUL, AND ADJUSTMENT PROCEDURE*.**
8. [ ] **Grease stem bolt threads and threads on bolt that goes through cap that mounts on top of fork column.**
9. [ ] **Install ball retainers in cups. Slide adjustable race, split cone called "compression ring", spacer washers, and stem onto fork.**
10. [ ] **Mark fork column 3mm below top of stem and remove fork.**
11. [ ] **Cut fork column at this point with a hacksaw or tubing cutter. File off any burrs or swells.**
12. [ ] **Press star-shaped nut called "the star fangled nut" fully into fork column with Park TNS-1 or TNS-2.**



11.33 *Installing the "star-fangled nut."*

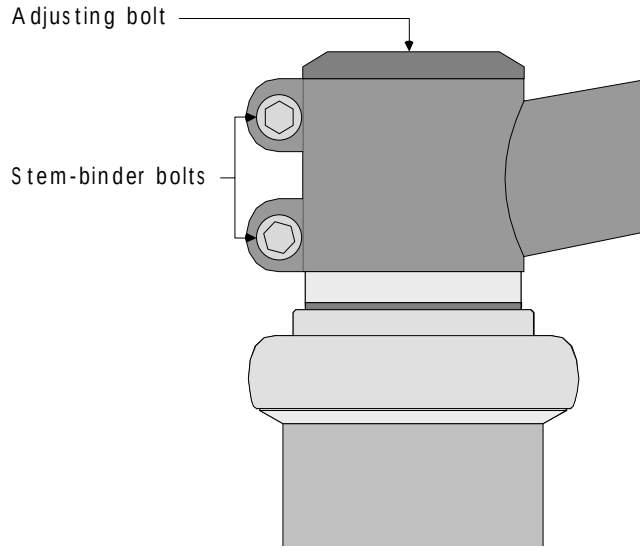
ASSEMBLY

13. [ ] **Do steps 50–57 from *THREADED-HEADSET OVERHAUL, AND ADJUSTMENT PROCEDURE* (page 11-17).**
14. [ ] **Put fork in and slide on adjustable race, compression ring, washers, and stem.**

15. [ ] **Put plastic cap with bolt on top of fork column and engage bolt in star-fangled nut threads.**

Adjustment

NOTE: If adjusting an already installed threadless headset, loosen the stem-binder bolts before starting the adjustment.

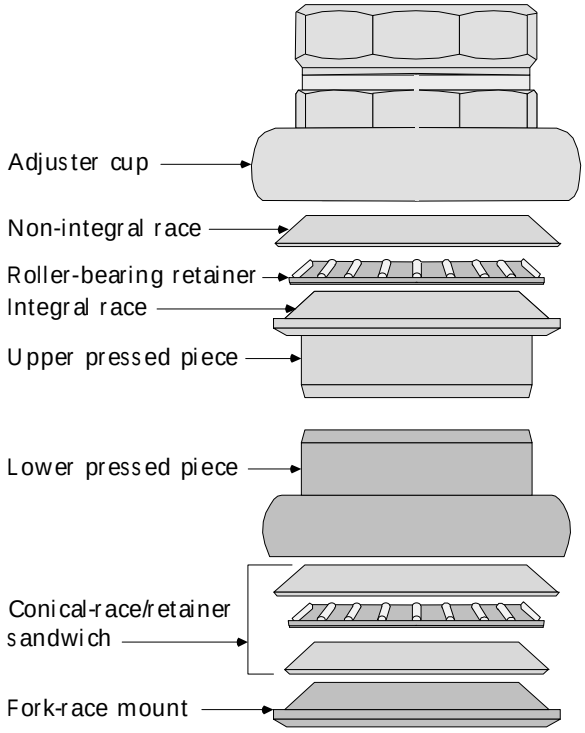


11.34 *Loosen stem bolts before starting the adjustment.*

16. [ ] **Tighten cap bolt slowly until just a trace of knocking can be felt when jerking on end of fork.**
17. [ ] **Align stem and torque bolts to 85in-lbs (24lbs@3" or 21lbs@4") if double-bolt stem, or 100in-lbs (33lbs@3" or 25lbs@4") if single-bolt stem.**
18. [ ] **Check again for knocking when jerking on fork. If knocking is not felt, adjustment is done. If knocking is felt, proceed to next step.**
19. [ ] **Loosen stem bolts until stem rotates about fork column easily.**
20. [ ] **Turn adjusting bolt in plastic cap approximately 1/6 turn (clockwise).**
21. [ ] **Align stem and torque bolts to 85in-lbs (24lbs@3" or 21lbs@4") if double-bolt stem, or 100in-lbs (33lbs@3" or 25lbs@4") if single-bolt stem.**
22. [ ] **Check again for knocking when jerking on fork. If knocking is not felt, adjustment is done. If knocking is felt, repeat steps 19–22 as many times as necessary.**

ROLLER-BEARING HEADSETS

Roller-bearing headsets use cylindrical bearings instead of ball bearings. These cylinders are held in a conical retainer, which is sandwiched between two conical races. The conical races can be machined directly into the pressed cups and cones, or they can be loose and floating.



11.35 *A roller-bearing headset.*

Assembly

1. [ ] **Do steps 1–48 from *THREADED-HEADSET OVERHAUL, AND ADJUSTMENT PROCEDURE* (page 11-9).**
2. [ ] **If conical races are not integral with pressed pieces, grease both sides of each race.**
3. [ ] **Grease bearing retainers fully.**
4. [ ] **If conical races are separate, sandwich retainers between pairs of conical races.**
5. [ ] **Install retainers/retainer sandwiches in cups.**
6. [ ] **Insert fork into head tube.**
7. [ ] **Thread on adjuster cup all the way.**

ADJUSTMENT

8. [ ] **Do steps 62–75 from *THREADED-HEADSET OVERHAUL, AND ADJUSTMENT PROCEDURE* (page 11-18).**

MAVIC HEADSETS WITHOUT LOCKNUTS

Most new Mavic headsets have a locking mechanism built into the adjustable cup, instead of a separate locknut. The adjustable cup has a tiny Allen bolt that is tightened to compress the adjustable-cup threads against the fork threads. ***Warning***— there are 32mm wrench flats on the adjustable cup that can easily be rounded off if a wrench is used to turn the cup *without* first loosening the Allen bolt. It is easy to destroy the adjustable-cup threads.

ASSEMBLY OR REPLACEMENT

1. [ ] **Do steps 1–60 from *THREADED-HEADSET OVERHAUL, AND ADJUSTMENT PROCEDURE* (page 11-9), except that no washers or locknuts are removed (unless replacing conventional headset with Mavic).**

ADJUSTMENT

2. [ ] **Loosen locking bolt with 2.5mm Allen wrench if not already loose, and turn adjustable cup 1/4 turn (counterclockwise) to prevent over-tightening.**
3. [ ] **Adjust adjustable cup (clockwise) gently down against bearings until slight resistance is felt, then back off about 1/8 turn (about 10–15mm at the cup perimeter).**
4. [ ] **Use 2.5mm Allen wrench to gently secure locking bolt in cup.**
5. [ ] **Grasp the fork and jerk it to check for play.**
6. [ ] **To eliminate play loosen locking bolt, turn adjustable cup 3–4mm (clockwise) at its perimeter, then resecure locking bolt. Check for play and repeat as necessary.**

HEADSET-STACK HEIGHT

Headset-stack height is the room that the headset takes up on the fork column. Stack height plus head-tube length should equal fork-column length.

It is acceptable to use a shorter stack height than will fit (washers must be added or fork column shortened), but a headset with too great a stack height cannot be made to fit.

The following table is divided into four sections. These are 1" threaded, 1–1/8" threaded, 1–1/4" threaded, and threadless headsets.

Each section of table 11-3 (pages 11-23 through 11-27) has headsets arranged in ascending order of stack height on the assumption that the desired stack height is known and the suitable brands/models need to be found. This assumption makes the layout of table 11-3 less suitable for situations where the headset is known and the stack height needs to be looked up.

POPULAR HEADSET FITS FOR 1" THREADED-FORK COLUMNS (table 11-3,A)

STACK HEIGHT	BRAND	MODEL	FIT STANDARDS AVAILABLE
30.0mm	Shimano	Dura-Ace (HP-7600)	Campy[1]
31.2mm	Tange-Sekei	MA-60	Campy/JIS[3]
32.5mm	Shimano	Sante	Campy[1]
33.0mm	American Classic	Trilock	Campy[1]
33.0mm	Campagnolo	Veloce	Campy[1]
33.0mm	King	Short Stack	Campy[1]
33.0mm	Ritchey	Logic Comp, Pro WCS, Logic Expert	Campy[1]
33.0mm	Shimano	Deore XT (HP-M730, HP-M732)	Campy[1]
33.0mm	Tange-Sekei	Extrude (steel)	Campy[1]
33.4mm	Tange-Sekei	Levin CDS	Campy[1], JIS[2], Campy/JIS[3]
33.5mm	Shimano	105 (HP-1050)	Campy[1]
33.5mm	Shimano	105SC (HP-1055)	Campy[1], JIS[2]
33.5mm	Shimano	600 Ultegra (HP-6400)	Campy[1]
33.5mm	Shimano	Deore (HP-MT60), Deore DX (HP-M650, HP-M651)	Campy[1], JIS[2]
33.5mm	Shimano	Deore XT (HP-M735)	Campy[1], JIS[2]
33.5mm	Shimano	Exage (HP-M350, HP-A450, HP-M450)	Campy[1]
33.5mm	Tioga	DSL	Campy[1]
33.8mm	Campagnolo	Nuovo Record (track), Gran Sport	Campy[1]
34.0mm	Odyssey	Pro	Campy[1]
34.3mm	Shimano	XTR (HP-M900, HP-M901)	Campy[1]
35.0mm	Specialized	Pro (alloy and steel)	Campy[1], JIS[2]
35.5mm	Shimano	RX100 (HP-R500)	Campy[1]
35.5mm	Suntour	Superbe Pro	Campy[1]
36.0mm	American Classic	Airlock	Campy[1]
36.0mm	Dia-Compe	Threadhead	Campy[1]
36.0mm	Tange-Sekei	Extrude (alloy)	Campy[1]
36.2mm	Suntour	Superbe Track	Campy[1]
36.3mm	Shimano	Dura-Ace (HP-7400)	Campy[1]
36.5mm	YST	HP-8311	Campy[1], JIS[2]

[1] Campy means head-tube races are 30.2mm or equivalent and fork-crown race is 26.4mm or equivalent.

[2] JIS means head-tube races are 30.0mm or equivalent and fork-crown race is 27.0mm or equivalent.

[3] Campy/JIS means head-tube races are Campy 30.2mm and fork-crown race is JIS 27.0mm.

(Continued next page)

POPULAR HEADSET FITS FOR 1" THREADED-FORK COLUMNS (table 11-3,A cont.)

STACK HEIGHT	BRAND	MODEL	FIT STANDARDS AVAILABLE
37.0mm	Onza	Mongo UFO, Mongo II	Campy[1]
37.0mm	Stronglight	X94	Campy[1]
37.0mm	Suntour	XC-Pro Grease Guard	Campy[1], JIS[2]
37.6mm	Shimano	Deore XT (HP-M740), Deore LX (HP-M563), STX (HB-MC30), DuraAce (HP-7410), 600 Ultetgra (HP-6500)	Campy[1], JIS[2]
38.0mm	Mavic	315	Campy[1]
38.0mm	Specialized	Direct Drive	Campy[1], JIS[2]
38.0mm	Tioga	Beartrap	Campy[1]
38.0mm	Tange-Sekei	Levin	Campy[1], JIS[2], Campy/JIS[3]
38.5mm	Campagnolo	C-Record (track)	Campy[1]
39.0mm	Mavic	305	Campy[1]
39.1mm	Campagnolo	Nuovo Record, Victory, Triomphe, Olympus	Campy[1]
39.5mm	Campagnolo	Xenon	Campy[1]
40.0mm	Shimano	600EX (HP-6207)	Campy[1]
40.0mm	Tange-Sekei	Comet (cartridge bearing)	Campy[1]
40.0mm	Tange-Sekei	MTB225	Campy[1], JIS[2], Campy/JIS[3]
40.2mm	Stronglight	Delta	Campy[1]
40.7mm	Campagnolo	Euclid, Centaur, Olympus (alloy)	Campy[1]
40.7mm	Stronglight	X-14MTB, X-12, A-9[3]	Campy[1], Campy/JIS[3]
41.0mm	Wilderness Trail	WTB/King	Campy[1]
41.2mm	Campagnolo	Athena, Chorus, Croce D'Aune	Campy[1]
41.5mm	Campagnolo	Record (aluminum), C-Record	Campy[1]
42.2mm	Campagnolo	Super Record (road)	Campy[1]
43.0mm	Stronglight	B-10, C-11	Campy[1]
44.0mm	Tange-Sekei	G-Master 2000	Campy[1], Campy/JIS[3]

[1] Campy means head-tube races are 30.2mm or equivalent and fork-crown race is 26.4mm or equivalent.

[2] JIS means head-tube races are 30.0mm or equivalent and fork-crown race is 27.0mm or equivalent.

[3] Campy/JIS means head-tube races are Campy 30.2mm and fork-crown race is JIS 27.0mm.

POPULAR HEADSET FITS FOR 1-1/8" OS THREADED-FORK COLUMNS (table 11-3,B)

STACK HEIGHT	BRAND	MODEL	DESCRIPTION
33.0mm	Ritchey	Logic Expert	Conventional
33.0mm	Tange	Extrude (steel)	Conventional
33.5mm	Shimano	Altus (HP-R501)	Conventional
33.5mm	Shimano	Deore DX (HP-M650, HP-M651)	Conventional
33.5mm	Shimano	Deore XT (HP-M736)	Conventional
33.5mm	Tioga	Avenger OS	Conventional
33.9mm	American Classic	Trilock	Allen bolt locking
33.9mm	King	Threaded	Sealed
34.0mm	Odyssey	Pro OS	Allen bolt locking
34.3mm	Shimano	XTR (HP-M900, HP-M901)	Conventional
35.0mm	Specialized	Pro	Conventional
35.0mm	Stronglight	X-15MTB	Roller (needle) bearings
35.0mm	YST	CS-717	Conventional
35.5mm	Shimano	Altus (HP-R501)	Conventional
35.5mm	Tange-Sekei	AP-1 OS	Conventional
36.0mm	American Classic	Airlock	Allen bolt locking
36.0mm	Dia-Compe	Threadhead	Threaded version of Aheadset
36.0mm	Tange-Sekei	Levin OS CDS	Conventional
36.5mm	Race Face	Real Seal II	Allen bolt locking
37.5mm	Tange	Extrude (alloy)	Conventional
37.5mm	YST	CS-737	Conventional
37.6mm	Shimano	Deore XT (HP-M741), Deore LX (HP-M564),	Conventional STX (HB-MC31)
38.0mm	Mavic	316	Allen bolt locking
38.5mm	Onza	Mongo II	Allen bolt locking
38.5mm	Tange	High Roller	Needle bearing
39.5mm	Campagnolo	Record OR	Conventional
40.6mm	Tange	Comet	Cartridge bearing
41.0mm	Campagnolo	Chorus, Athena	Conventional

POPULAR HEADSET FITS FOR 1-1/4" OS THREADED-FORK COLUMNS (table 11-3,C)

STACK HEIGHT	BRAND	MODEL	DESCRIPTION
33.0mm	Ritchey	Logic	Conventional
33.0mm	American Classic	Trilock	Allen bolt locking
33.5mm	Shimano	Deore DX (HP-M650, HP-M651)	Conventional
35.0mm	YST	Ultralight	Conventional
35.0mm	King	Threaded	Sealed
36.0mm	American Classic	Airlock	Allen bolt locking
36.0mm	Dia-Compe	Threadhead	Threaded version of Aheadset
37.0mm	Tange-Sekei	VP-5000	Conventional
38.0mm	Mavic	317	Allen bolt locking
38.5mm	Onza	Mongo II	Allen bolt locking
39.5mm	Campagnolo	Record OR	Conventional
39.9mm	Shimano	Deore XT (HP-M742)	Conventional
40.3mm	Shimano	Deore XT (HP-M737), XTR (HP-M902)	Conventional
41.0mm	YST	CS-707S	Conventional
41.0mm	Campagnolo	Chorus	Conventional
43.0mm	YST	CS-707A	Conventional
44.0mm	Dia-Compe	Threadhead S-Series II	Conventional

POPULAR HEADSET FITS FOR THREADLESS-FORK COLUMNS (table 11-3,D)

NOTE: The height of the stem must be added to the following stack-height figures when calculating fit.

STACK HEIGHT	BRAND	MODEL	FIT STANDARD AVAILABLE
24.0mm	Tange-Sekei	NSS-STS	1" Campy
24.0mm	Dia-Compe	AheadSet Kontak DL	1" Campy
27.0mm	Dia-Compe	AheadSet Kontak SA	1" Campy
28.0mm	Dia-Compe	AheadSet Kontak	1" Campy
28.0mm	King	NoThreadSet, Team NoThreadSet	1" Campy
28.0mm	Tange-Sekei	NSS-ALS	1" Campy
28.0mm	Tioga	Alchemy	1" Campy
29.8mm	Dia-Compe	AheadSet S-series	1" Campy
30.0mm	Dia-Compe	AheadSet S-series II	1" Campy
35.0mm	Ritchey	Fuzzy Logic, Logic	1" Campy
37.0mm	Ritchey	Logic Pro, Logic Pro WCS	1" Campy
37.0mm	American Classic	TriLock 511010, 511020	1" Campy
41.0mm	YST	G-force	1" Campy/JIS[3]
41.9mm	Kor	G-force	1" Campy/JIS[3]
25.0mm	Dia-Compe	AheadSet Kontak DL	1-1/8" OS
27.0mm	Dia-Compe	AheadSet Kontak SA	1-1/8" OS
27.6mm	Dia-Compe	AheadSet S-series	1-1/8" OS
28.0mm	Tioga	Alchemy, High Roller	1-1/8" OS
30.0mm	Dia-Compe	AheadSet Kontak S-Series II	1-1/8" OS
31.3mm	Tange-Sekei	NSS-ALM	1-1/8" OS
31.4mm	King	NoThreadSet, Team NoThreadSet	1-1/8" OS
31.5mm	Race Face	Real Seal	1-1/8" OS
33.0mm	American Classic	TriLock 511010, 511020	1-1/8" OS
33.5mm	Dia-Compe	AheadSet, Kontak	1-1/8" OS
35.0mm	Ritchey	Fuzzy Logic, Logic	1-1/8" OS
37.0mm	Ritchey	Logic Pro, Logic Pro WCS	1-1/8" OS
41.0mm	YST	G-force	1-1/8" OS
41.9mm	Kor	G-force	1-1/8" OS
26.0mm	Dia-Compe	AheadSet Kontak DL	1-1/4" OS
27.0mm	Dia-Compe	AheadSet Kontak SA	1-1/4" OS
29.7mm	Dia-Compe	AheadSet S-Series	1-1/4" OS
30.0mm	Dia-Compe	AheadSet S-Series II	1-1/4" OS
31.0mm	King	NoThreadSet, Team NoThreadSet	1-1/4" OS
32.0mm	Dia-Compe	AheadSet Kontak	1-1/4" OS

HEADSET TROUBLESHOOTING

Cause	Solution
SYMPTOM: *As the headset is turned, there is a constant pattern of the adjustment feeling tight at one point and loose at another.*	
Head tube and/or fork crown need facing and are causing the races not to be in line with each other.	Face both always.
Fork column is bent, causing the races not to be in line with each other.	Replace the fork.
Races are not fully seated, causing the races not to be in line with each other.	Inspect, then disassemble headset and repress the races (all three).
SYMPTOM: *As the headset is turned, it has one or more positions that it tends to settle at, as though it were indexed. Also, the fork tends to lock in the straight-ahead alignment and will not stay on its own if turned a degree or two to the side. The symptom is sometimes described as automatic pilot. The proper name is brinelling.*	
Dents in the races of the lower stack. (Aggravating factors are use of ball retainers and over-tight adjustments.)	Replace the lower stack or entire headset. Use loose balls, two less balls than the maximum, and do not over-tighten the adjustment.
Dents in one portion of the race more than another indicate races have been out of alignment.	Face the head tube and fork crown (shop) and replace the lower stack or complete headset.
SYMPTOM: *When adjusting the headset, it changes from having a trace of play to being obviously over-tight with only one ten-degree adjustment.*	
Wrong size balls (likely if ball size was assumed or guessed).	Disassemble and try the next likely size.
Inverted retainer(s).	Disassemble, inspect and assemble correctly.
Mismatched brands of parts within one stack.	Replace necessary parts.
Head tube and fork crown need facing, particularly if loose spot is at only one location of rotation.	Face head tube and fork crown.
Dry grease (particularly if headset is old).	Overhaul headset.
SYMPTOM: *An erratic symptom of tightness or looseness appears and disappears, particularly when the fork is rotated, or a sound of clicking, popping or snapping accompanies a change from an adjustment that is tight to one that is loose when the fork is turned, but the headset has not been adjusted. Any erratic tightness or looseness.*	
Ball(s) out of position in races.	Disassemble, inspect, reassemble.
Too many balls in a cup.	Disassemble, inspect, reassemble.
SYMPTOM: *Headset will not hold its adjustment after riding bike.*	
Inexpensive, new headset breaking in.	Readjust.
Locknut inadequately secured.	Tighten locknut.
Locknut properly tightened, not remaining secured.	Use Loctite 242 on threads.
Aluminum locknut not remaining secured.	Replace with steel locknut or use Loctite 242 on threads.
Headset pressed races not fully pressed.	Inspect, repress if necessary, and readjust.
SYMPTOM: *Headset feels very sluggish, but not rough, when it is rotated and the adjustment is correct.*	
0-ring type seal out of position.	Inspect, disassemble and reassemble with seal in place.
Seal mechanism inverted.	Disassemble, inspect and reassemble with seal correctly oriented.
Grease is dry and congealed.	Disassemble, inspect and overhaul.

(Continued next page)

HEADSET TROUBLESHOOTING (Cont.)

Cause	Solution
SYMPTOM: *Headset squeaks when rotated.*	
Grease is dry.	Overhaul headset.
SYMPTOM: *Creaking noises come from the headset area when the bike is being ridden.*	
Loose stem.	Secure stem.
Loose handlebars.	Secure handlebars.
Handlebars creaking internally at ferrule.	Ignore or replace handlebars.
Loose pressed races.	Inspect, disassemble, reinstall with Loctite 242 or install a better fitting headset.
Aluminum pressed pieces in aluminum head tube, even if press fit tolerances are correct.	Reinstall with Loctite 222.
SYMPTOM: *Looseness cannot be eliminated even by over tightening the adjustment.*	
Loose pressed pieces.	Replace with better fitting headset or reinstall with Loctite RC680.
Locknut lip stopping against steering tube instead of stopping against the screwed race.	Inspect and install stack washer under locknut.
SYMPTOM: *Headset makes a rumbling sound when riding over bumps.*	
Loose adjustment.	Check and readjust.
Loose pressed pieces.	Check and correct.
SYMPTOM: *Headset locknut will not secure.*	
Stripped fork-column threads.	Remove locknut and inspect. Replace fork if threads are stripped.
Fork column has collapsed at washer key slot.	Visually inspect inside of fork column for deformation, or test-fit stem into fork column.