34 – BRAKE LEVERS

ABOUT THIS CHAPTER

This chapter is about the levers used to operate the brakes. It covers brake levers for: flat bars on MTBs, drop-bars on road bikes, BMX/freestyle bars, and upright-bars. For most of these, several subjects are covered, including installation, inner-wire attachment, failures, and service.

GENERAL INFORMATION

TERMINOLOGY

Brake lever: The lever mechanism that that is operated to control the brake calipers at the wheels.

Brake caliper: This is the mechanism at the wheel that closes the brake pads against the braking surface when pressure is applied to the brake lever.

Lever body: The part of the brake lever that is fixed to the handlebar and does not move when the lever is operated.

Lever arm: The part of the brake lever that is moved toward the handlebar to apply the brakes.

Mounting bolt: A bolt that causes a cast clamp or strap clamp to tighten around the handlebar to secure the lever body to the handlebar.

Lever pivot: The shaft on which the lever arm pivots.

Pivot stud: An unthreaded lever pivot that slides or presses into the lever body.

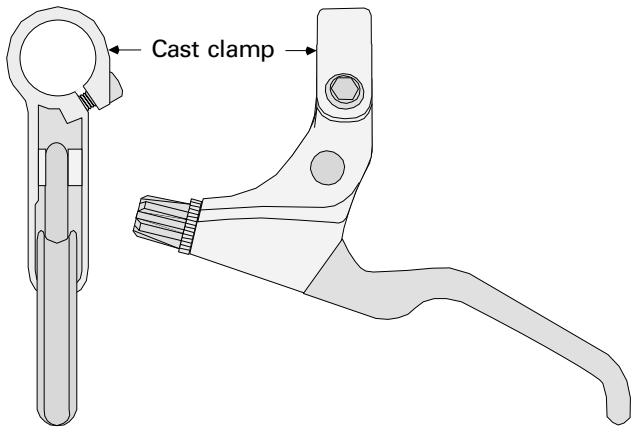
Pivot bolt: A lever pivot that threads into the lever body. It can also thread into a nut fixed to a socket in the lever body.

Pivot bushing: A plastic bushing that fits between the lever arm and the pivot stud/bolt.

Adjusting barrel: A hollow screw that changes the effective length of the brake inner wire. It is inserted into the lever body. The brake inner wire goes through the adjusting barrel. The outer end of the adjusting barrel has a socket into which the cable housing is inserted.

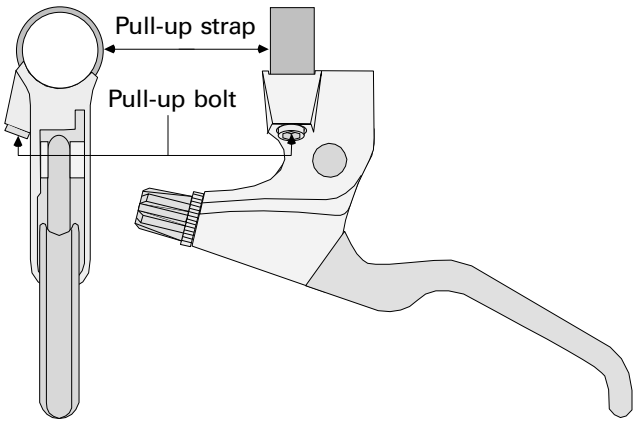
Barrel locknut: A nut threaded onto the adjusting barrel between the socket end of the adjusting barrel and the lever body. This nut is secured against the lever body to keep the position of the adjusting barrel from changing.

Cast clamp: The portion of a lever body that wraps around the handlebar. A cast clamp is usually an integrated part of the lever body, but sometimes the clamp is made in two pieces; half the clamp is cast as part of the lever body, and the other half is attached by two bolts (or a hinge and a bolt). Some brake levers are fixed to the handlebar with a cast clamp, and others are fixed to the handlebar with a pull-up strap.



34.1 *An MTB lever with a cast clamp.*

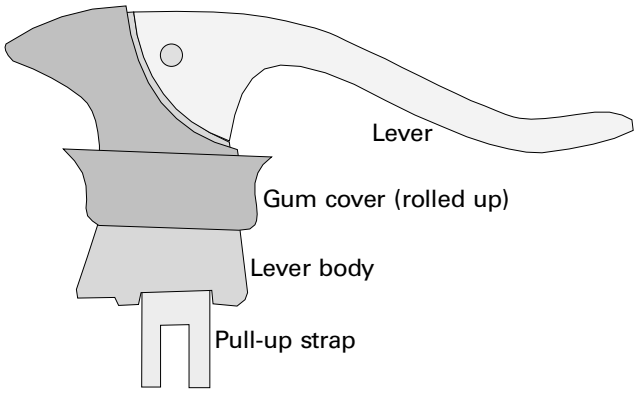
Pull-up strap: A flexible steel strap that holds the lever body to the handlebar. Some brake levers are fixed to the handlebar with a pull-up strap, while others are fixed to the handlebar with a cast clamp. See figures 34.2 and 34.3 (next page).



34.2 *An MTB lever with a pull-up strap.*

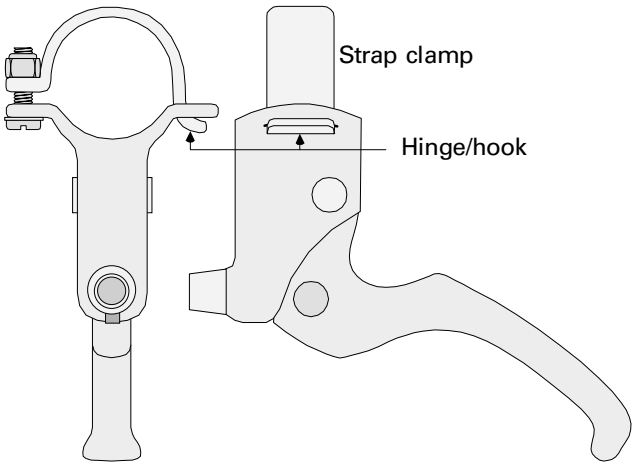
Pull-up bolt: A bolt that holds the lever body to the pull-up strap. As the bolt is tightened, it secures the body to the handlebar .

Pull-up nut: The nut that the pull-up bolt threads into.



34.3 A typical brake lever for drop bars on a road bike.

Strap clamp: This is like a cast clamp with a hinge or hook on one end, but the separate part that wraps around the side of the handlebar opposite the lever body is a semi-flexible plate of metal, rather than a rigid casting. The strap clamp is found most often on BMX/freestyle bikes, and on bikes with upright bars such as are found on classic 3-speeds.



34.4 An inexpensive BMX/freestyle lever. More expensive BMX/freestyle levers are similar in design to MTB levers.

Cable anchor: The part of the lever arm to which the brake inner-wire attaches. It might be a simple socket in the body of the lever arm, or it may be a pivoting mechanism (with a socket for the inner-wire head) attached to the lever arm.

Inner wire: The wire that attaches to the lever arm, passes through the lever body and adjusting barrel, through the cable housing, and attaches to the brake.

Cable housing: The outer sheath of the cable system. It stops against the adjusting barrel or a non-adjustable fitting on the lever body.

Ferrule: Any of a wide variety of shapes of fittings that adapt the end of the cable housing to fit to the socket in the lever body or adjusting barrel.

PREREQUISITES

To install a brake lever, it is necessary to know how to adjust the brake. In many cases it is also necessary to know how to install handlebar coverings, such as tape or grips.

INDICATIONS

Symptoms indicating a brake lever should be replaced

Brake levers need to be replaced for four reasons: bends in the lever at any point, cracks in any part of the lever, stripped threads for the mounting bolt in the cast body, or excessive play in the lever pivot that cannot be adjusted out or repaired by replacing pivot bushings.

Symptoms indicating brake levers need service

Brake levers need service for many reasons:

- Pull-up mechanisms fail and need to be replaced.
- Levers operate roughly because of dirt in the pivots.
- Levers operate roughly because of lack of lubrication in the pivots.
- Jerky brake operation or squeaks indicate that the cable anchors need lubrication.
- Bent adjusting barrels should be replaced.
- Slop in the lever pivots indicates that the pivots need adjustment or that the bushings need to be replaced.
- In some types of levers, sticky lever action might indicate that a bent pivot stud might need replacement.

Symptoms indicating a brake lever needs to be repositioned

The position of the brake levers is critical to the safe operation of the brakes. The brake levers need to be readily accessible from any normal riding position, and they should be positioned so that the rider can operate the levers with a minimum of hand and wrist contortion.

One way to identify whether brake levers need to be repositioned is to ride the bike and operate the levers from all normal hand positions on the handlebar. If some hand positions provide dramatically easier

access to the levers than others, then the levers should be repositioned. If the wrist must be cocked too close to its limit of range of motion to operate the brake lever, then a better position should be found.

You should also review the positioning guidelines offered in this chapter.

Symptoms indicating a brake lever needs to be secured

The issues of lever security are different for brake levers on road bikes with drop bars and for brake levers on off-road bikes. On drop-bar road bikes, the lever bodies are often used like handlebar extensions and twisted with great force, but on all other types of bikes the lever bodies are never grasped. For this reason, brake levers on drop bars should be virtually rigid on the handlebar. Any time the lever rotates easily around a drop handlebar, the lever should be secured to the limit of the equipment. For all other brake-lever types, there is a desireable degree of freedom to rotate; freedom to rotate prevents damage to the brake levers when they experience impact. More details on lever security are provided in the instructions for lever installation.

Handlebar and stem replacement

To replace a stem, at least one brake lever must be removed, and then properly installed on the bars. To replace the handlebars, both levers must be removed, and then properly installed on the bars.

General brake service

Any time a mechanic services the brakes in any way, the brake levers should be given a thorough inspection. If the levers are damaged they should be replaced. If misaligned they should be aligned. The levers should be torqued to the recommended torque and checked for security. If operating roughly, the levers should be cleaned or lubricated.

TOOL CHOICES

The only special tool recommended for brake lever service is a Park SD-1. This is a T-handled screwdriver with a hollow-ground tip. This tool is essential for the proper installation of slotted-head pull-up bolts.

TIME AND DIFFICULTY

Installing or servicing a brake lever is a relatively easy job of that should only take 1–2 minutes. The real work is the work comes as a result of installing a lever: adjusting the brakes or covering the bars.

COMPLICATIONS

Fit of brake levers to different-size bars

For most types of brake levers, fit to the handlebar is simple. For example, if installing a brake lever on an MTB handlebar, use an MTB brake lever; fit is assured. Brake levers that fit on road-bike handlebars are more complicated. There are three basic sizes of drop bars, and different pull-up straps available to fit the different sizes of bars. For more information on the sizes of straps and handlebars, see table 34-1 (page 34-6).

Interference with shift-control mechanisms

Brake levers and shift-control mechanisms are often mounted close together on MTB handlebars. The manufacturers of each cannot anticipate all the designs that might exist or be created. Consequently, there is sometimes interference between the brake lever and the shift-control mechanism even if both are mounted correctly. Sometimes a minor change in the position of the shift-control mechanism is all that is needed. Do not compromise the brake lever position. On rare occasions, it might be necessary to change either the brake lever or the shift-control mechanism to eliminate this interference.

Compatibility with brake calipers

Brake levers may be incompatible with some brake calipers. The distance from the center of the lever pivot to the center of the cable anchor determines the amount of inner wire that will be moved per degree of lever arm motion. If a replacement brake lever has a significantly larger dimension between the lever pivot and cable anchor, then the lever will move the pads much more quickly to the braking surface. This will result in greater maximum power, but less ability to modulate the brake. If a replacement brake lever has a significantly smaller dimension between the lever pivot and cable anchor, then the lever will move the pads much less quickly to the braking surface. This will result in less maximum power, but greater ability to modulate the brake.

Failure of pull-up-strap system

Pull-up-strap systems are prone to several types of failure that prevent the lever from securing fully.

Some types of pull-up nuts are not fixed to the pull-up strap. When the system has too much slack, the pull-up nut can disengage, resulting in a failure of the lever to secure, and damage to the pull-up strap. The strap is damaged because the nut usually remains engaged to one end of the strap; when the nut is pulled up, only one end of the strap is pulled, which destroys its symmetry.

A pull-up strap can crack or break where it joins the pull-up nut. This damage cannot be seen except when the brake lever is off the bar and disassembled.

The threads on the pull-up nut or pull-up bolt often strip. This damage is hidden inside the lever.

Levers will not secure

Levers may fail to secure for a variety of reasons due to fit problems or parts failure. In some cases, the lever will fail to secure adequately even when everything is the correct size and nothing has failed. This can be caused by two things. Plastic lever bodies do not offer enough friction against the bar to prevent slippage. Chrome-plated-steel bars are more slippery than aluminum bars and can keep levers from properly securing. The combination of a plastic lever body and a chrome-plated-steel handlebar is certain to be a problem. Without changing the equipment, there is no solution. The mechanic must make sure that everything is in working order and the maximum allowable torque is used.

ABOUT THE REST OF THIS CHAPTER

The rest of this chapter is divided into five sections. The first section is ***MTB-BRAKE LEVERS***. It is followed, in order, by ***DROP-BAR BRAKE LEVERS***, ***BMX/FREESTYLE-BRAKE LEVERS***, ***UPRIGHT-BAR BRAKE LEVERS***, and finally ***BRAKE-LEVER TROUBLESHOOTING***.

Detailed information about removal, installation, inspection, and installation is provided about MTB brake levers and brake levers for drop-bars on road bikes. For BMX/freestyle levers and levers for upright-bars, only significant differences from the other types of levers are covered. The **BRAKE-CABLE SYSTEMS** chapter covers setup of the cable system. Individual chapters about different types of brake calipers cover the setup of the calipers and attachment of the cable system.

MTB-BRAKE LEVERS

For purposes of installation and removal, MTB-brake levers come in several varieties. These are closed-clamp types, open-clamp types, closed-strap types, and open-strap types. The open-clamp and open-strap types can be removed and installed without sliding the lever over the end of the bar. The closed-clamp and closed-strap varieties must be slid off and on the end of the bar. Since the vast majority of MTB-brake levers are of the "closed" variety, the following procedure assumes this type.

NOTE: If working on a bike with already-installed levers, go to the section of this procedure called* INSPECTION *for used bikes, or* LUBRICATION *for new bikes.

REMOVAL

1. [ ] **Remove grip(s).**
2. [ ] **If mounted outward from brake lever, remove shift-control mechanism.**
3. [ ] **Unhook cable system from brake caliper(s).**
4. [ ] **Align slots in lever body, adjusting barrel, and barrel locknut.**
5. [ ] **Pull housing out of end of adjusting barrel and drop inner wire through slots in lever body, adjusting barrel, and barrel locknut.**
6. [ ] **Pull lever arm toward handlebar, align inner wire with slot in cable anchor, then pull inner-wire head out of cable anchor.**
7. [ ] **Loosen mounting bolt or pull-up bolt.**
8. [ ] **Slide lever off end of handlebar.**

INSPECTION

9. [ ] **Inspect lever body and lever arm for cracks.**
10. [ ] **Inspect lever arm for bends.**

Loose lever pivots detract from the rider's feeling of control. Wiggle the end of the lever arm side-to-side to check for excessive play. A couple of millimeters is normal, but more than that should be eliminated, if possible. Some MTB lever pivots are adjustable, and some are not. If the pivot bolt threads into a nut in a socket, then the lever pivot is probably not adjustable. If the nut is exposed, then the pivot is adjustable. To adjust, loosen the nut, turn the pivot bolt clockwise, then secure the nut while holding the bolt stationary. If the adjustment is made too tight, then the lever will not return when released (once the brake system is fully set up).

11. [ ] **Inspect lever pivot for looseness and adjust if possible.**

LUBRICATION

12. [ ] **Oil both sides of lever arm at lever pivot.**
13. [ ] **Oil cable-anchor pivots, or inside cable-head socket in lever arm if socket is in aluminum casting.**
14. [ ] **Grease adjusting-barrel threads if not already obviously greased.**

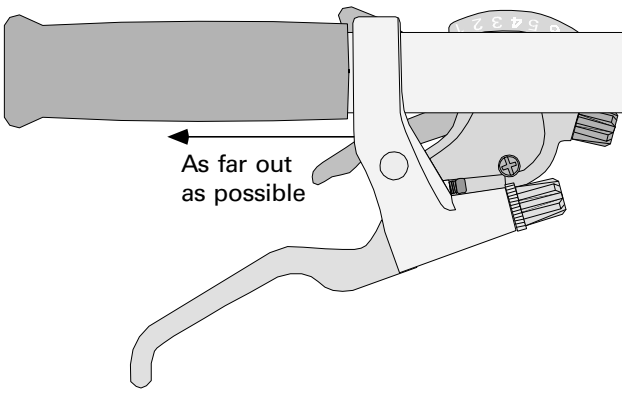
If the lever will be secured, it is critical that the mounting-bolt/pull-up-bolt threads are lubricated, because the recommended torques are based on the assumption that the threads are lubricated. If the threads are visible and clearly have lubrication on them, it is reasonable to assume that no more need be added. If the threads are not visible, or no lubrication can be seen, even if it means removing the bolt, the threads should be lubricated.

15. [ ] **Oil mounting-bolt/pull-up-bolt threads if not obviously lubricated already.**

INSTALLATION, ALIGNMENT AND SECURITY

There are right and left brake levers for MTBs. When the lever is on the correct side, the mounting bolt will be on the back/bottom face of the lever. If the wire head is installed in a socket that is on one face of the lever arm, this socket also will be on the back/bottom face of the lever.

16. [ ] **If shift-control mechanism is to be mounted inward of brake lever (most non-integral shift-control mechanisms except twist grips), install it on bar first, but do not secure.**
17. [ ] **Slide brake lever over end of handlebar.**
18. [ ] **Install twist-grip-type shift-control mechanism onto handlebar (if any).**
19. [ ] **Install grip fully onto bar.**
20. [ ] **Position brake lever as far outward as grip (and twist grip) will allow. (Some old-style brake levers are so long that this positioning would place the tip of the lever arm past the outward end of the grip. In this case, position the brake lever as far outward as possible without the tip of the lever extending beyond the outward end of the grip.)**

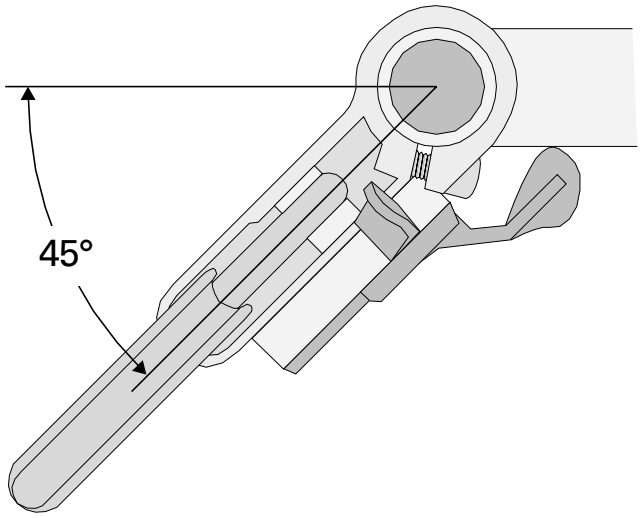


34.5 *Set the lateral position of the brake lever as close to the grip as possible.*

21. [ ] **Gently secure mounting-bolt/pull-up-bolt. (Lever should still easily rotate around bar.)**

To properly align the brake levers, the bike needs to be at the angle that it would be when sitting on level ground. This can be done several ways. If the bike is known to have a level top tube, then use a dial protractor to check that the top tube is parallel to the ground. If it is not known whether the top tube is level, or it is known that it is not, then use a tape measure to measure from the center of each axle to the ground. If the axles are equidistant from the ground, then the bike is in the "on-ground" position.

22. [ ] **Put bike at angle it would be when sitting on level ground.**
23. [ ] **Place dial protractor on lever body so that dial is visible from side of bike (if lever body has no flat surface, hold protractor so that its base is parallel to the plane in which the lever arm swings).**
24. [ ] **Adjust lever position until protractor reads 45° (±5° is acceptable range).**



34.6 *Set the rotational position of the lever so that the plane that the lever swings in is 45° down from flat.*

25. [ ] ***Lever with cast clamp:*** **Secure mounting bolt to 35–60in-lbs (12–20lbs@3").**
Lever body held on by pull-up strap: **Secure pull-up bolt to 60–70in-lbs (20–24lbs@3").**
26. [ ] **Viewing from rider's perspective, check that both levers extend in front of handlebar equally, indicating that their rotational positions match.**

INNER-WIRE ATTACHMENT

27. [ ] **Align slots in adjusting barrel and barrel locknut with slot in bottom of lever body.**
28. [ ] **Pull lever to grip and place inner-wire head in cable anchor.**
29. [ ] **Swing wire up into slots in lever body, adjusting barrel, and barrel locknut.**
30. [ ] **Turn adjusting barrel or locknut so that slot no longer lines up with slot in lever body.**

DROP-BAR BRAKE LEVERS

FIT OF LEVERS TO DROP BARS

Drop-style handlebars are made in several dimensions at the point the brake levers mount. Therefore, the pull-up straps used for mounting brake levers to drop bars also come in a variety of sizes. The nature of a pull-up strap permits it to work only within a limited range of handlebar dimensions. No pull-up strap will work across the full range of available handlebar diameters.

To determine the handlebar dimension, measure the diameter of the bar at the end. Measuring in the curve where the brake lever mounts will yield inaccurate results. Use a caliper and measure to the nearest tenth of a millimeter.

The size of pull-up straps cannot be determined by measurement because of their flexible nature. Virtually all straps are marked with a size. If there is no size on a strap, then a trial and error process is necessary to determine whether the strap will fit the bar. A strap that is too small will be difficult to slide over the end of the bar, even when the pull-up bolt is fully loosened. A strap that is too large will not secure the lever when the maximum torque is put on the pull-up bolt.

PULL-UP STRAP FIT (table 34-1)

Strap size	Fits handlebar sizes
22.0mm	22.0–22.2mm
23.5mm	23.5–23.8mm
23.8mm	23.5–23.8mm
23.8–24.2mm	23.8–24.2mm
24.2mm	24.0–24.2mm

NOTE: If working on a bike with already-installed levers, go to the section of this procedure called* INSPECTION *for used bikes, or* LUBRICATION *for new bikes.

REMOVAL

1. [ ] **Remove handlebar covering.**
2. [ ] **Remove shift-control mechanism if mounted in end of handlebar.**
3. [ ] **Unhook or detach cable system from brake caliper(s).**
4. [ ] **Pull housing away from brake lever a few inches.**
5. [ ] **Push inner wire into brake-lever body to unseat inner-wire head from cable anchor.**
6. [ ] **Manipulate inner wire to move it through slot in cable anchor and remove inner wire from brake lever, or push inner wire fully through cable anchors that have no slot.**
7. [ ] **Loosen pull-up bolt until it almost disengages the pull-up nut.**
8. [ ] **Slide lever off end of handlebar.**

INSPECTION

9. [ ] **Inspect lever body and lever arm for cracks.**
10. [ ] **Inspect lever arm for bends.**

Loose lever pivots detract from the rider's feeling of control. Wiggle the end of the lever arm side-to-side to check for excessive play. A couple of millimeters is normal, but more than that should be eliminated, if possible. Most drop-bar brake levers have bushings between the lever arm and the pivot. That bushing an wear out, but replacement bushings are only sporadically available.

11. [ ] **Inspect lever pivot for looseness and replace bushings if possible.**

LUBRICATION

12. [ ] **Oil both side of lever arm at lever pivot.**
13. [ ] **Oil cable-anchor pivots.**
14. [ ] **Grease adjusting-barrel threads if not already obviously greased (if any).**

If the lever is to be secured, it is critical that the pull-up-bolt threads are lubricated, because the recommended torques are based on the assumption that the threads are lubricated. If the threads are visible and clearly have lubrication on them, it is reasonable to assume that no more need be added. If the threads are not visible, or no lubrication can be seen, even if it means removing the bolt, the threads should be lubricated.

15. [ ] **Oil pull-up-bolt threads if not obviously lubricated already.**

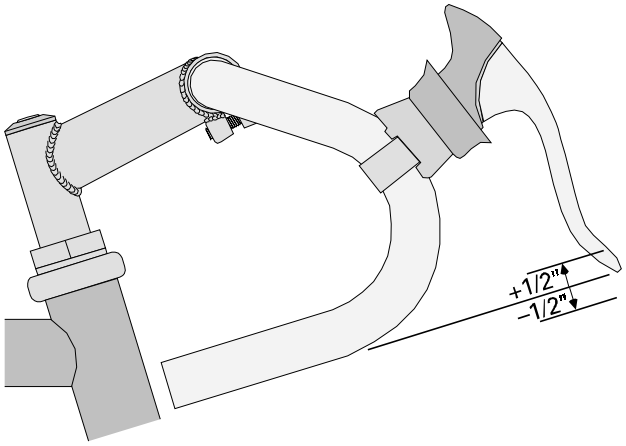
INSTALLATION, ALIGNMENT AND SECURITY

There are right and left brake levers for road bikes. If you're mounting an aero' lever, in nearly all cases the socket for the housing in the base of the lever will be on the inward face. Some inexpensive levers have auxiliary levers attached, or mounts for the future attachment of auxiliary levers. The auxiliary levers (or mounts for them) go on the inward side of the lever. Levers with integrated shifters should be the easiest to figure out. When the lever is correctly mounted, the shifter housing-stop should point inward.

16. [ ] **Slide brake lever over end of handlebar.**

17. [ ] Slide lever up bar until it is obviously too high.
18. [ ] Place straight edge flat on bottom side of handlebar so that it extend forward of handlebar by several inches.

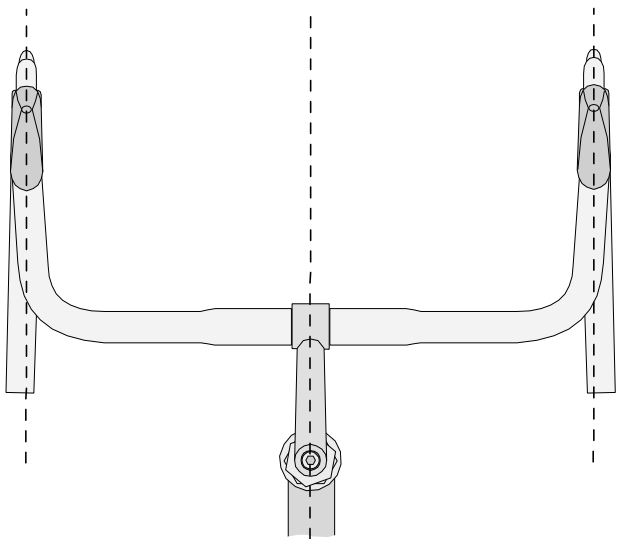
The brake-lever-height setting described in step #19 creates equal access to the lever, whether the rider is riding on the tops of the bars, or on the drops. Some riders might prefer favoring access from one riding position more than another. It is acceptable to move the tip of the lever up or down 1/2" from the position in step #19, at the customer's request, only. Deviations greater than 1/2" will make it too difficult to access the brake lever from one of the riding positions, and should not be done even at customer request.



34.7 *Acceptable brake-lever height.*

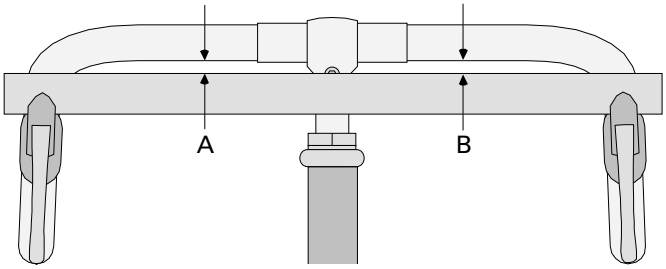
19. [ ] Slide brake lever down until tip of lever reaches straight edge (with lever arm fully released, or forward).
20. [ ] Adjust tip of lever arm up or down no more than 1/2" to suit rider preference, if any.
21. [ ] Gently secure pull-up bolt. (Lever should still easily rotate around bar.)

Lever rotation affects access to the lever as well. If the levers are rotated in, they are harder to use. If they are rotated out, they tend to get bumped and hit more. The best way to see the lever rotation is to get a viewpoint from high above the handlebars. The imaginary centerline of each brake lever should be parallel to the imaginary centerline through the stem (see figure 34.8, next column). If the wheel is in, it can be used as a reference, instead of the stem.



34.8 *Brake lever rotational alignment.*

22. [ ] Rotate brake lever so that centerline of lever body is parallel to centerline of stem.
23. [ ] *Hex- or Allen-head bolts:* Secure pull-up bolt to 70–85in-lbs (24–28lbs@3").
***Slot-head bolts:* Secure bolt to equivalent of 18–24lbs applied simumlaneously at both ends of a Park SD-1 screwdriver handle.**
24. [ ] When both levers are installed, lay straight edge across both lever bodies, and compare straight edge to flat center section of handlebar to see if brake-lever heights are equal.



34.9 *If lever heights are equal, the straight edge should end up parallel to the center section of the handlebar (A and B should be equal).*

25. [ ] When both levers are secure, press them firmly towards each other with force of approximately 75 pounds to check security.

INNER-WIRE ATTACHMENT

26. [ ] *Aero' levers only:* Compress lever arm, insert inner wire through cable anchor, then insert inner wire through lever body.
***Non-aero' levers only:* Compress lever arm, insert inner-wire head through hole in top of lever body, then hook inner wire into cable anchor.**

BMX/FREESTYLE-BRAKE LEVERS

For most purposes, BMX/freestyle-brake levers are the same as MTB-brake levers. Refer to the earlier section about MTB-brake levers for full information. The primary differences are with the rotational angle, and with the torque required for levers that use a strap clamp, instead of the cast clamp found on MTB-brake levers. For these different specifications, see the following special notes.

NOTE: The rotational position of a BMX/freestyle lever should be so that the lever is rotated down 25–30° from horizontal.

NOTE: Many BMX/freestyle levers have a strap clamp that holds the lever to the handlebar. The torque on the bolt that tightens this type of strap should be 25–35in-lbs (8–12lbs@3").

UPRIGHT-BAR BRAKE LEVERS

Upright bars are the classic type of handlebar most often found on 3-speed bicycles. They are also called tourist bars. Upright bars might also be found on bikes with derailleurs.

The brake levers that go on these handlebars are unique, but simple. The general principles that apply to other types of brake levers apply to these as well. When installing or aligning these brake levers, use the following guidelines.

1. The rotational angle should be 15–30° out from directly below the grip.
2. If retained by a pull-up strap, the pull-up-bolt torque should be 60–70in-lbs (15–17lbs at both ends of a Park SD-1 screwdriver handle).
3. If retained by a strap clamp, torque bolt to 25–35in-lbs (8–12lbs@3").

BRAKE-LEVER TROUBLESHOOTING

Cause	Solution
SYMPTOM: *Brake lever will not secure on the handlebars at the recommended torque.*	
Pull-up strap is the wrong size.	Check strap and bar size, and look in table 34-1 (page 34-6) for fit.
Pull-up-bolt or mounting-bolt threads have seized.	If the threads are seized, the bolt will be difficult to loosen. Use penetrating oil and force the bolt loose, then replace damaged parts.
Lever body is plastic; normal security cannot be achieved.	Advise the customer of the problem and recommend replacement of the brake levers.
Handlebar is chrome- plated steel; normal security cannot be achieved with a pull-up-strap-type brake lever.	Advise the customer of the problem and recommend replacement of either the handlebars or brake levers.
SYMPTOM: *Mounting bolt or pull-up bolt will not reach recommended torque.*	
Threads of bolt or nut have stripped.	Replace the damaged part.
Threads in lever-body casting have stripped.	In some cases, a thread coil can be installed. If there is not enough material or access, replace the brake lever.
Pull-up strap has failed.	Replace the pull-up strap.
Lever body is cracked.	Inspect the lever body for cracks, and replace the brake lever if any cracks are found.
Pull-up stud is cracked.	Disassemble the lever and replace the pull-up stud.

Cause	Solution
SYMPTOM: *Brake lever will not return fully when released.*	
Cable system or caliper is causing the problem.	Detach the inner wire from the brake lever and see if the problem persists. If not, the problem is with the cable system or caliper (see appropriate troubleshooting charts for these items).
Adjustable pivot is too tight.	Loosen the pivot adjustment (if adjustable).
Lever pivot needs oil.	Oil the lever pivot.
Lever pivot needs cleaning.	Remove and clean the brake lever.
Rubber gum cover is interfering with lever.	Peel back the gum cover to check if the symptom persists. If it does, then reposition or trim the gum cover.
Pivot area of lever arm is bent.	Remove the lever arm and inspect for a bend in the pivot area. If there is one, replace the lever arm or the brake lever.
Pivot stud is bent.	Remove and inspect the pivot stud. Replace it if it is bent.
SYMPTOM: *Pull-up strap fails when pull-up bolt is correctly torqued.*	
Error in using or reading torque wrench.	Check the recommended torque value and the setting on the torque wrench, if the torque wrench is the preset type.
Pull-up bolt was previously over-torqued, or torqued repeatedly in the past.	Replace the damaged parts and use the recommended torque.
SYMPTOM: *Brake lever does not operate smoothly.*	
Lever-arm pivots need oil.	Oil on both sides of the lever-arm pivots.
Cable-anchor socket or anchor pivots need oil.	Oil the cable-anchor socket, or the cable-anchor pivots.
Cable system or caliper is the source of the problem.	Inspect cable system and caliper if oiling the brake lever does not solve the problem.
SYMPTOM: *A squeak (or similar noise) comes from the brake lever when it is operated.*	
Cable-anchor socket or anchor pivot needs oil.	Oil the cable-anchor socket.
SYMPTOM: *Lever arm is bent.*	
Impact from crash has bent lever arm.	Replace the part, or the whole brake lever.