2 – TAPPING BOTTOM-BRACKET-SHELL THREADS

ABOUT THIS CHAPTER

This section is about using bottom-bracket taps to improve the thread condition in a bottom-bracket shell.

GENERAL INFORMATION

TERMINOLOGY

Bottom-bracket shell: The part of the frame that houses the bearings that the crank arms rotate around.

Bottom-bracket tap: A tool used to chase the existing threads in a bottom-bracket shell.

Chasing: Using a tap to improve the condition of existing threads.

Tapping: In the broad sense, tapping is creating new threads. With regard to bottom brackets, the term "tapping" is used to signify the improvement of the condition of existing threads (chasing).

Pilot: A part of a bottom-bracket tap that is used to align the left and right taps to each other so that they will cut on a common axis. A pilot consists of a pilot shaft and a pilot hole.

PREREQUISITES

Usually the need for tapping the bottom-bracket shell is discovered in the course of doing another job, such as installing or overhauling a bottom bracket. In this case the condition of a bare bottom-bracket shell already exists, and the only prerequisite required for the job is an understanding of bottom-bracket thread types and directions. The additional prerequisites listed are only applicable in the case that it is your intent to tap the bottom-bracket threads before you have removed the bottom bracket.

Understanding bottom-bracket-thread types

There are several types of bottom-bracket threads. Bottom-bracket taps are not used to change from one thread type to another but to improve the condition of existing threads. For this reason it is vital to be sure of the existing thread type in the bottom-bracket shell. The following bottom-bracket-tapping procedure will provide an opportunity to identify the threads. For reference information on bottom-bracket thread types, see the **ADJUSTABLE-CUP BOTTOM BRACKETS** chapter (page 9-5).

Crank-arm removal and installation

In order to tap the bottom-bracket shell it will be necessary to remove the bottom bracket, which starts with crank-arm removal. At the completion of the job it will be necessary to reinstall the crank arms.

Bottom-bracket overhaul

In order to access the threads it will be necessary to remove the bottom bracket. At the completion of the job it will be necessary to install and adjust the bottom bracket. These procedures are covered in the chapter **ADJUSTABLE-CUP BOTTOM BRACKETS**.

INDICATIONS

Symptoms indicating need for tapping bottom-bracket-shell threads

The usual reason for tapping bottom-bracket threads is the resistance encountered when removing or installing the bottom-bracket cups or cartridge bottom-bracket mounting rings. This resistance can be caused by several things. New bikes often have poorly cut bottom-bracket-shell threads, or good threads that are fouled with paint. Used bikes often have rust in the threads. Another possible cause of the resistance could be that a cup or mounting ring has been cross-threaded.

This resistance to unthreading is aggravating to the mechanic during the removal of parts; however, during installation of parts, this extra resistance will not just be aggravating, it can cause three problems.

The first problem that this extra resistance can cause is that it can make it difficult to tell whether the thread is starting correctly, possibly leading to cross-threading and further thread damage.

The second problem that this extra resistance can cause is when attempting to adjust an adjustable-cup bottom bracket, difficulty in rotating the adjustable cup can make it almost impossible to find a good starting point for the adjustment, leading to a prolonged and more difficult adjustment procedure.

The third problem that might be encountered when this type of resistance is being experienced is that poor thread condition can lead to failure of the threads on aluminum and plastic cups, or aluminum and plastic mounting rings. This failure may occur during installation or removal. If the factory installed an aluminum or plastic part into a poorly threaded shell, then the failure may occur while the parts are being removed. Nothing can be done to prevent this, but tapping should be done to prevent future failures.

Preparation for shell facing

The only other reason to tap the bottom-bracket-shell threads is that it is a necessary first step to facing the bottom-bracket shell; the reasons for facing a bottom-bracket shell are given later in this chapter.

TOOL CHOICES

The thread type of the bottom-bracket shell determines what tool you will need. The following list covers all tools for the job. The preferred choices are in **bold**. A tool is preferred because of ease of use, quality, versatility, and/or economy. See table 2-1.

TIME AND DIFFICULTY

Tapping a bottom bracket in a bare frame is a 10 minute job of moderate difficulty.

COMPLICATIONS

Titanium

Titanium has completely different metallurgical characteristics than steel or aluminum. It is necessary for a tap to be designed in a dramatically different way to be suitable for tapping titanium. Once a tap has been designed to be suitable for titanium, it will no longer be suitable for other materials. Special taps for titanium are available, but the cost is prohibitive. Since titanium is not generally painted and does not rust, difficulty in threading parts in would most likely be due to poor manufacture and should be warrantable.

Aluminum

Aluminum is a perfectly suitable material for tapping, but presents some special concerns to the mechanic. First, *the type of cutting oil used is critical*. There are cutting oils made specifically for use on aluminum. Any cutting oil suitable for use on aluminum will say so on the container. Do not interpret words like "all-purpose" and "multi-purpose" to mean: includes aluminum. Second, *it is critical that the taps be sharp*. Aluminum has a higher tendency than steel to gall (tear). Dull taps increase the likelihood of galling, to a degree that the threads in the bottom-bracket shell may be destroyed.

Threads destroyed beyond repair

The most likely complication when tapping a bottom-bracket shell is that threads may be damaged beyond repair. Since the next solution after thread chasing is a drastic one, always attempt the repair by chasing first and test for success by torquing the bottom-bracket cups or retaining rings into the shell to the recommended torque and see if further stripping occurs. If the recommended torque cannot be achieved, the threads have stripped completely.

BOTTOM-BRACKET-TAPPING TOOLS (table 2-1)

Tool	Fits and considerations
Campagnolo 721	Piloted handles w/ 1.37" × 24tpi BSC/ISO taps , very expensive
Campagnolo 721/5-I	Italian 36mm × 24tpi tap only for 721, two needed
Campagnolo 721/5-F	French 35mm × 1mm tap only for 721, two needed
Cyclo 1042	1.37" × 24tpi double ended un-piloted chaser only
Hozan C402E	1.37" × 24 tpi un-piloted tap set
Hozan C402FS	Un-piloted tap set fits French and Swiss
Park BTS-1	Piloted tap handles w/ 1.37" × 24tpi BSC/ISO taps, includes facer also
Park 693	36mm × 24tpi Italian tap for BTS-1, two needed
Park 694	35mm × 1mm French tap for BTS-1, two needed
VAR 380/2/C	Piloted tap handle set w/ 1.37" × 24tpi BSC/ISO taps
VAR 42IR	36mm × 24tpi Italian tap for 380/2/C, two needed
VAR 42FR	35mm × 1mm French tap for 380/2/C, two needed

Unusual thread types

Only one brand of bottom-bracket tap (VAR) makes taps available for every conventional thread type. If you do not buy this brand you will not be able to tap all bikes. You should not buy this brand just to be able to tap all thread types, because several thread types are very rare and it could be financially unrewarding to buy the tools to tap these threads. About 95% of bikes have BSC or ISO thread type, which are interchangeable. Most of the remaining 5% are Italian thread. This is as far as it may be practical to be equipped with taps. Other thread types are French, Swiss, and English Whitworth (1–3/8" × 26tpi). These are all no longer manufactured, already rare, and getting rarer fast.

Obstructions

It is possible that there will be obstructions inside a bottom-bracket shell that will interfere with the insertion of the taps. The most likely obstruction is a bolt or fastener (rivet) that holds a cable guide to the bottom of the bottom-bracket shell. If it is a bolt, remove it. If the obstruction is some sort of pressed-in device or rivet, then it is possible that the pressed-in device or rivet will be destroyed if removed. If this happens it may be necessary to do some creative mechanics to re-secure the cable guide.

Another possible obstruction is frame tubes protruding into the shell. This type of obstruction occurs most commonly with lugged frame construction. Use a round file or a small grinding stone on a rotary tool or die grinder to remove this type of obstruction.

Difficult tapping

Difficult tapping may be caused by dull taps, excessive material needing to be removed, poor technique, or brass contamination in the threads. Brass has special properties that cause it to create a lot of resistance when being tapped. If brass is present on the bottom-bracket threads it means that the manufacturer was sloppy during the brazing process.

The most important things to be conscious of when tapping is difficult are *100% assurance of thread compatibility and good technique*. If tapping becomes difficult, then pull the taps out immediately and check for obstructions and brass in the threads. If these are not a problem, assume the taps are dull and do not continue without sharp taps.

CARE OF BOTTOM-BRACKET TAPS

Bottom-bracket taps are very expensive and easily damaged. Proper cutting technique is important to ensure good life, but that is not all. When storing taps, make sure they are clean and coated with oil. The cutting edges are easily chipped by light impact with other metal objects, so handle and store them in a way so this will not happen. On hooks on a pegboard is a good way to store taps.

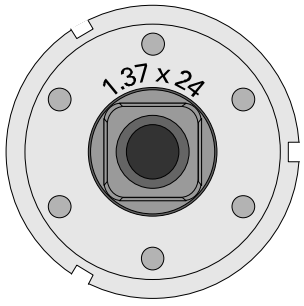
Clean taps with a brush and solvent. Blowing them clean with compressed air is not damaging to the taps, but it is dangerous. Coat the taps with a light oil after cleaning and drying to prevent rust.

Using taps on chrome-plated bottom-bracket shells will also dull them quickly. It can be done but it is not advised.

Using taps to cut new threads in an unthreaded shell, or to extend the length of existing threads will also dull them quickly. These procedures can be done, but they are not what the taps are designed for and are strongly recommended against.

BOTTOM-BRACKET-TAPPING PROCEDURE

1. **[ ] See TAPER-FIT CRANKARMS chapter for removal of crankarms and ADJUSTABLE-CUP BOTTOM BRACKETS chapter for removal of bottom brackets, and remove crank arms and bottom bracket if necessary.**
2. **[ ] Inspect any cups or mounting rings that were removed for thread identification and note thread description here: _____, unless markings are inadequate.**



2.1 *Inspect cup faces for any markings that might indicate the thread type. The 1.37 × 24 marks on this cup indicate it is a BSC thread.*

3. **[ ] Only if cup markings were inadequate measure cup O.D. and pitch, then use table 9-2 (page 9-5) to determine nominal thread description and note here: _____.**

2 – TAPPING BOTTOM-BRACKET-SHELL THREADS

Bottom-bracket-shell threads are identified by taking measurements in the bottom-bracket shell; however it is only necessary to do this if steps #1, #2, and #3 do not yield positive results. Usually all that is needed is inside diameter and pitch. In the case that the pitch is 1mm and you are prepared to tap French or Swiss bottom brackets, then you must be able to identify whether the threads in the right side of the shell or left-hand or right-hand. The technique for this is described in the **BASIC MECHANICAL SKILLS** chapter in the section called **THREADS** (page 1-4).

4. [ ] If no cups were removed from bottom bracket, measure shell I.D. and pitch inside shell, then use table 9-2 (page 9-5) to determine nominal thread description and note here:_____.

The next step is to check whether the correct thread type is on the tap handles. With Campagnolo and Park taps this is a simple matter of looking at the base of the tap (Campagnolo) or in the flutes between the lands (Park) for the thread description of the tap (see figure 2.2). Certain VAR taps may have either of two complications. VAR taps frequently have the thread description on the end of the tap where the description becomes hidden when the tap is installed. If this is the case, buy an engraving tool and write the thread description in the flutes between the lands. The other complication is that VAR is inclined to describe BSC or ISO thread types in an unconventional fashion with the diameter shown in millimeters instead of inches. If a VAR tap is marked 34.85 × 24, it is suitable for a BSC (1.37 × 24) or ISO (1.375 × 24) threaded bottom bracket.

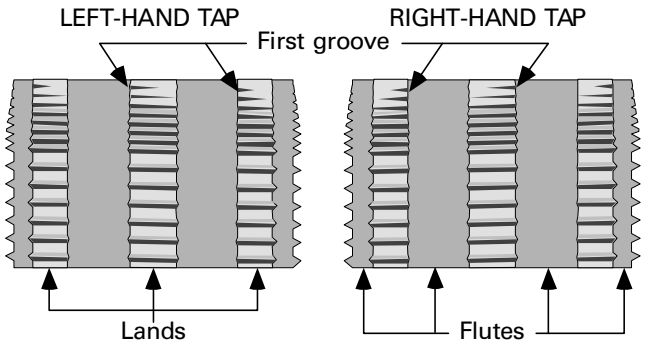
5. [ ] Verify that taps on tap handles are correct thread (replace with correct thread if not).

Campagnolo and VAR taps use a threaded retaining device to hold the tap on the handle. If the retaining device is loose it will compromise the precision of the tapping. Use a headset locking spanner to secure the taps on the Campagnolo tool and a large adjustable wrench to secure the nuts on a VAR tool.

6. [ ] Secure both tap retention nuts (skip if using Park tool).

If you are using a BSC, ISO, or Swiss tap set, the next step is to identify which tap is a left-hand thread and which is a right-hand thread. If the taps are the Campagnolo or the Park brand, there will be a RH or LH notation as part of the thread description marked on the tap. If you cannot find such a notation, or your taps are VAR (which are not marked), then use the following technique.

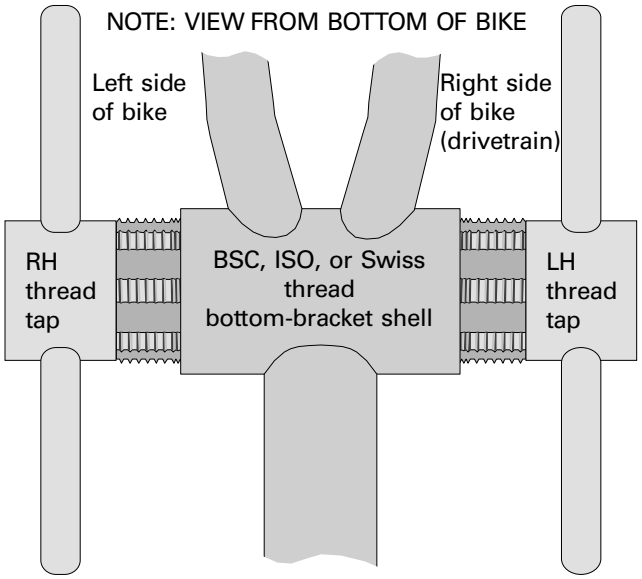
To identify whether an unmarked tap is a right-hand or left-hand thread, hold the tap so the leading end points up. Examine the top groove in any one of the lands. If the top groove is deep on the left and tapers off to the right, the tap is left-hand thread. If it is deep on the right and tapers off to the left, it is a right-hand thread. See figure 2.2.



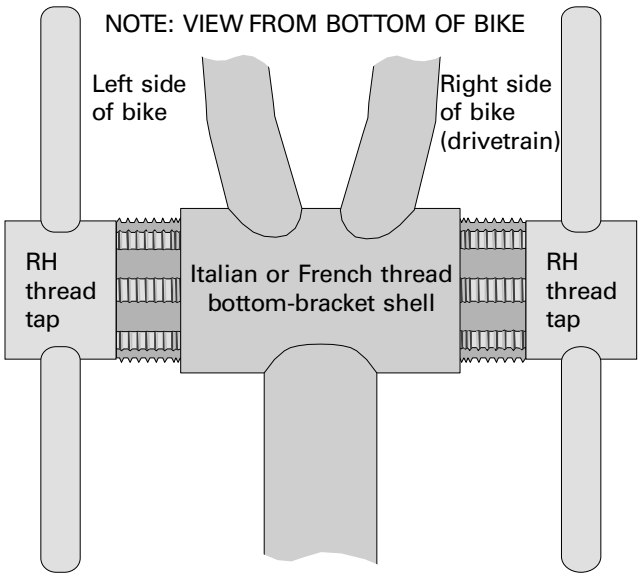
2.2 *Inspect which side of the lands the first grooves start on to determine whether the tap is left-hand or right-hand thread.*

7. [ ] Identify which tap is left-hand thread and which is right-hand thread.

If tapping an ISO, BSC, or Swiss threaded bottom bracket, it is vitally important to get the correct taps on the correct sides of the bottom-bracket shell. All others have double right-hand thread, so the taps cannot be put in wrong. With ISO, BSC, and Swiss thread types the right side of the shell is a left-hand thread. The right side of the shell is right from the rider's viewpoint while riding the bike. It is the side that the chainrings, chain, and derailleurs go on.



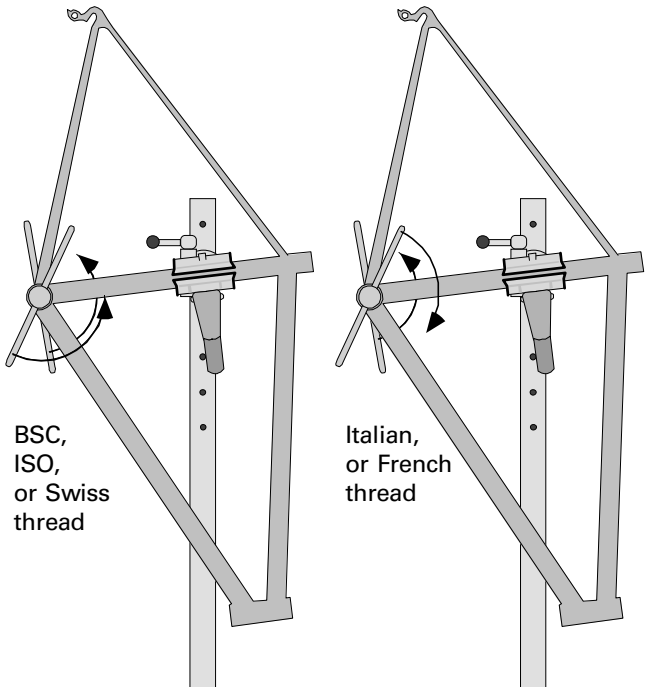
2.3 *If installing taps in a BSC, ISO, or Swiss-threaded bottom-bracket shell, the left-hand tap goes in the right (drivetrain) side of the bike, and the right-hand tap goes in the left side of the bike.*



2.4 *If installing taps in an Italian or French-threaded bottom-bracket shell, since both taps are right-hand thread, side of installation does not matter.*

8. [ ] Place left-hand threaded tap (right-handed threaded if both taps are right-hand) in right side of the bottom-bracket shell, and place the other tap into left side of shell.

The whole point to using a piloted tap set is to guarantee that threads on both sides of the shell have a common axis. For this reason in the next step the taps are started simultaneously. *Do not start one tap, and then start the other.*



2.5 *To start the taps simultaneously, turn them in the directions shown.*

9. [ ] Start both taps simultaneously so that they just engage shell threads.

One of the most important things when cutting metal is the proper use of cutting oil. If cutting steel, the type of oil is not important (high speed or low speed), but if cutting aluminum it is critical to use oil labeled specifically for use on aluminum.

In addition to using the right oil, it is important to use enough of it. Cutting oil does not simply lubricate. One of its most important functions is to absorb heat generated by the cutting of the metal. If the heat builds up, the metal being cut gets harder. Tools dull quicker, and the quality of the threads will be compromised. By using ample quantities of cutting oil and re-applying it repeatedly, heat will be kept to a minimum. There should be a substantial quantity of oil on the floor when done if enough was used. Use a drip rag if you are concerned about this mess.

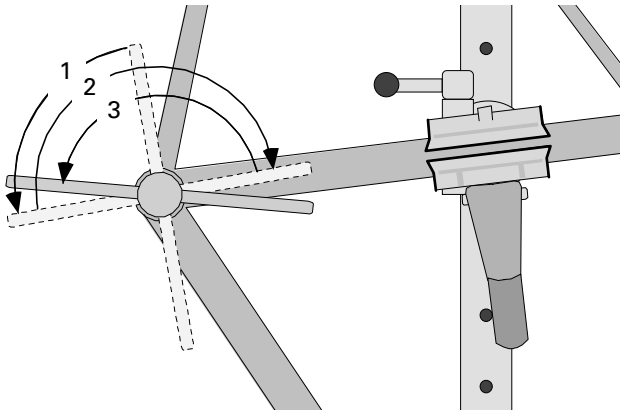
10. [ ] Add generous amounts of appropriate type of cutting oil to both taps.

Sometimes all the threads in the shell will need chasing and sometimes just some of them will. As long as there is no significant resistance to threading the tap in, then no cutting is happening and no special technique is required to advance the tap. *No significant resistance is defined as when you can thread the tap in with one finger!*

11. [ ] Thread each tap in as far as it will go without encountering significant resistance.

Once significant resistance is encountered then cutting has begun and a technique called cut-and-clear is needed to advance the tap.

To cut-and-clear with the tap, advance it approximately one quarter turn once resistance indicates the tap has begun to cut. Then back the tap out about one half turn to clear the cut fragments away from the leading edges of the cutters. Finally, advance the tap one half turn to be in position to start the cycle again.



2.6 *The cut-and-clear technique: cut (1), clear (2), then advance (3).*

12. [ ] Once resistance is encountered use cut-and-clear technique to advance each tap, repeatedly flooding each tap with cutting oil (about every 2–3 full revolutions of tap).

Depending on several circumstances, the point at which the tapping is complete varies. With all types of taps, the objective is to clean all of the threads. When the last thread has been reached, it will feel as though the tap has "hit-the-wall" (extremely high resistance to further tapping). If Park-brand taps are being used, and the bottom-bracket shell is to be faced with a Park BTS-1 facing tool, then the taps must end up fully inside the bottom-bracket shell. Due to the short length of the Park taps, this objective should always be easy to achieve. If a Campagnolo 725 bottom-bracket-facing tool is to be used, then the criteria is that a thread depth of 17mm must be achieved. Since every tap has 5–7mm of taper at the leading end, this means that 22–24mm of tap must end up inside the shell. This objective may be difficult to achieve, because the 17mm of threading is more than most bottom-bracket cups require and, consequently, more threading than exists in many bottom-bracket shells. To achieve this 17mm thread depth in some cases, new threads must be cut. You must go past the point the taps "hit-the-wall." This will require considerable effort on your part, and will be hard on the taps as well.

13. [ ] Continue cut-and-clear technique and repeated flooding with cutting oil with each tap until both taps have reached the last existing thread.

NOTE: In order to face the bottom-bracket shell with a VAR tap set modified for facing, proceed at this point to MODIFIED VAR 380/2/C FACING PROCEDURE (page 3-5).

NOTE: In order to face bottom-bracket shell with a Park BTS-1, proceed at this point to PARK BTS-1 FACING PROCEDURE (page 3-4).

14. [ ] If taps are unevenly engaged, unthread one until taps are evenly engaged.

15. [ ] Unthread both taps simultaneously until they both will pull out, then pull taps out of bottom-bracket shell together.

16. [ ] Clean bottom-bracket threads with toothbrush and solvent.

17. [ ] Clean outside of bottom-bracket shell and rest of frame as necessary.

18. [ ] Clean bottom-bracket taps.

19. [ ] Use appropriate procedures/worksheets to install bottom bracket and crank arms as necessary, unless shell facing will be done next.