

YOUR FREE READER'S COMPANION

The Watch Repair Bench Pack

A companion to The Watch Repair Bible · by Emmett Vance

Thanks for picking up the book. This companion is the part you keep at the bench, next to your loupe and your parts tray. Print it, slip it into a sleeve so it can take a splash of solvent, and reach for it while you work: the starter kit list so you buy right the first time, the oil-by-jewel chart you check on every service, a symptom-to-cause table for when a watch comes in dead, the strip-and-rebuild running order, and the numbers you want to see on the timegrapher when you are done. Real references, straight from the book, nothing padded.

A stopped watch is almost never a broken one. Most "dead" watches are mechanically whole - just choking on dried oil and dust. Follow the power from the barrel to the balance, find where it stops, and fix that one thing. The watch will tell you what it needs if you slow down and listen instead of rummage. Keep this pack in your hand and read it before you reach for a screwdriver. - Emmett

The Starter Bench Kit

You do not need a wall of tools to service your first movement. You need a few good ones, prepared properly, and the discipline to add the rest as the hobby proves itself. The one rule that saves beginners money: spend in proportion to how much a tool touches the work. Your screwdrivers and tweezers are in your hands every minute of every job, so that is where good money pays off first. A case opener you use for two minutes can be modest. Skip the giant fifty-piece bargain kit entirely - the blades are soft, they slip, they chew screw heads and fling parts, and you replace them anyway.

Stage your buying in three waves:

Wave	Tools	Why now
Buy first (non-negotiable)	Decent screwdriver set (dressed), number 2 and number 5 tweezers, blade/tweezer dressing stone, 10x loupe or binocular visor, movement holder, casing pad, Rodico putty, pegwood, dust blower, demagnetizer	Enough to strip and rebuild your first practice movements cleanly
Buy soon	Oiler set and a small selection of oils, hand-removal tool with dial protector, hand-setting pushers, case-back opener set for your case types	Needed the moment you finish a strip and start putting one back together right
Buy when the hobby sticks	Cleaning machine or ultrasonic, mainspring winder set, timegrapher, stereo microscope, pressure tester	Real money - only worth it once you know you are staying

Screwdriver blade widths

Screwdrivers come in sets sized by blade width in millimeters, and you match the blade to the screw slot exactly. Too narrow and it digs in and slips; too wide and it scratches the plate; wrong profile and it cams out. A set of five or six, roughly 0.60 to 1.60 mm, covers most of what a beginner meets. Dress every blade flat and square on a stone before use and re-dress the moment one starts slipping - that single habit prevents most beginner screw damage.

Blade width	Common set color	Typical use
0.30 - 0.40 mm	varies	Tiny screws, some setting parts
0.50 mm	varies	Small watch screws, dial screws
0.60 mm	blue	Bridge and cock screws, general work
0.80 mm	red	Larger bridge screws, ratchet and crown wheel
1.00 mm	yellow	Barrel bridge, case screws, big movements
1.20 mm	green	Large and pocket movements, case backs
1.40 - 2.00 mm	varies	Case work, large screws

Keep tweezers in the same spirit: a number 2 for everyday handling, a fine number 5 for the hairspring

and jewels, and keep them de-magnetized and their tips trued so they close with no gap.

The Oil-by-Jewel Chart

This is the reference you come back to on every single service. A watch needs oil in maybe a dozen specific spots, each with a specific lubricant, and the goal is always the same: the right oil, in the smallest amount that fills the working gap, in exactly the right place and nowhere else. Too much oil does not lubricate better - it creeps out along the pivot, collects dust into grinding paste, spreads onto the balance and hairspring where it kills amplitude, and starves the spot you meant to oil. A correct pivot oiling is a tiny bright dome that fills the jewel hole and just touches the pivot shoulder. If oil has spread onto the plate around the jewel, you used too much. Oil under magnification, always.

You only need a few types to start: one light oil, one heavier oil, a keyless grease, a mainspring grease, braking grease if you do automatics, and an escapement lubricant. The oils below are commonly Moebius grades.

Location	Lubricant type	Notes
Balance jewels (cap + hole)	Light oil	Tiny drop between cap and hole jewel; the fastest, most delicate spot; practice this most
Escape wheel pivots	Light oil	Small drop; fast pivot
Escape teeth / pallet stones	Escapement lubricant (trace)	Apply to a few escape teeth, let it distribute; never a puddle
Fourth and third wheel pivots	Light oil	Standard train pivots
Center wheel pivot	Medium/heavy oil	Slower, more loaded
Barrel arbor pivots	Medium/heavy oil	Loaded; keep modest
Mainspring / barrel wall	Mainspring grease (manual) or braking grease (auto)	Thin film, not a bath
Keyless works (setting lever, yoke, clutch, stem)	Grease	Sliding contacts
Cannon pinion (friction point)	Light grease or oil	Where it grips the center arbor
Motion works teeth	Trace light oil or grease	Very little
Pallet fork pivots	Light oil (tiny) or dry	Some run these very light; opinions vary

Runs dry - never oil these

The fastest way to ruin a good cleaning is to oil where oil does not belong. Keep these bone dry:

Do NOT oil	Because
Wheel teeth (the train)	Teeth run dry; oil there just collects dust. Only the pivots get oil

Hairspring and balance wheel	Oil here kills amplitude
Pallet fork body	Runs dry; a puddle on the pallet stones is a classic amplitude killer
Any pivot before its jewel is perfectly clean	Oil on dirt is grinding paste

When in doubt, err toward less. A slightly under-oiled watch runs and you can add; an over-oiled watch spreads oil everywhere and fails, and the only fix is to clean it all again.

The Fault-Finding Table

When a watch comes in dead or erratic, do not start taking things apart. Every time you open a watch you risk a new problem and you lose evidence. Observe first, then follow the power - the energy flows barrel to train to escapement to balance, and a fault breaks that chain somewhere. Find WHERE the power stops and you have found the neighborhood of the fault. And before you conclude anything about bad timekeeping, demagnetize: a magnetized hairspring is the number-one cause of a watch suddenly running minutes fast, and the fix takes five seconds and costs nothing.

Symptom	Likely cause	Where to look first
Winds forever, never gets tight, no resistance	Broken mainspring, unhooked outer end, or stripped keyless part	Open the barrel
Winds but slips or grinds	Keyless works fault - worn clutch, click not holding, ratchet issue	Check the keyless works
Crown will not turn at all	Something seized - jammed train, foreign object, rust, broken part wedged in the gears	Open and inspect
Balance dead still, will not start even with a nudge	Power not reaching the balance, or escapement/balance fault	Free-spin test the train; inspect escapement and balance
Balance swings but weak / low amplitude	Dried oil and dirty pivots (most common), tired mainspring, escapement drag, over-oiling on the balance	Demagnetize first, then plan a full clean and oil
Swings fine but keeps bad time, wildly fast, fuzzy trace	Magnetism	Demagnetize - before anything else
Consistently fast or slow, clean trace	Just needs regulation	Regulator on the timegrapher
Runs then stops at the same hand position	Mechanical obstruction - hands touching, a bent hand, a bent tooth coming around once per turn	Check hands, dial clearance, that tooth
Runs then stops randomly	Dirt or debris moving around, a bent pivot, escapement fault, low amplitude stalling	Clean, inspect pivots and escapement
Runs on the bench but stops on the wrist	Low amplitude / marginal power that cannot handle real positions	Find the power loss - service

Three habits behind the whole table: observe before you disassemble, follow the power, and change one thing at a time so you always know which change mattered.

The Service Running Order

A movement comes apart in a logical order and goes back together by reversing your own footprints. The two escapement parts - balance first, then pallet - come off first and go back on last, because they are the most delicate and the watch is safest to handle without them. Photograph the movement from the top before you remove a single part, and again before each major step. When you are two weeks away from reassembly, those photos tell you exactly how this watch went together.

Rule zero, no exceptions: let the mainspring down before you take anything apart. Hold the winding tension, release the click with pegwood, and feed the power out slowly through your fingers until the crown offers no resistance. Disassemble a wound watch and the spring lets go all at once - spinning the train, snapping pivots, flinging parts.

Step	Disassembly (top down, delicate first)	Watch for
0	Let the mainspring down	The one rule you cannot break
1	Balance and balance cock, lifted out as one unit	Never touch the hairspring; handle the cock
2	Pallet fork and its cock	Handle by the body, not the pallet stones
3	Ratchet wheel and crown wheel	Crown-wheel screw is often LEFT-hand thread - try clockwise before you strip it
4	Train bridge (and barrel bridge)	Keep each screw with its bridge
5	Train wheels - escape, fourth, third, center - then the barrel	Lay them in the tray IN ORDER
6	Flip: keyless works - setting lever, yoke, clutch, stem, click and spring	The setting-lever spring is under tension and loves to launch; cup your hand
7	Motion works - cannon pinion, minute wheel, hour wheel	Small and simple

Automatics add a step at the very start: remove the oscillating weight (rotor) and the automatic winding module first, then the movement underneath strips like a manual. The auto module goes back on last.

Reassembly reverses the list: keyless and motion works, barrel, train, bridge - then run the free-spin test (with balance and pallet still out, the train should spin free and bounce; if it does not, find the bind before you go further) - then pallet, then balance. Nudge the balance and it ticks to life.

Regulation Quick Reference

Once the watch is clean, oiled, and running, the timegrapher turns "I think it's running okay" into real numbers. Set the machine to your movement's beat rate (commonly 21,600 or 28,800 beats per hour) and its lift angle (movement-specific, often around 52 degrees) or the amplitude reading will be wrong. Then read three numbers off the trace: rate (the slope of the lines), beat error (the gap between the two lines), and amplitude (the health readout the machine computes).

Reading	Healthy target	If it is off
Rate	Near zero, a touch fast preferred: about +2 to +8 seconds/day	Move the regulator a hair toward slow if fast, toward fast if slow; re-read; converge. Never touch the hairspring
Amplitude (full wind, dial up)	About 270 to 310 degrees	Below ~200 = power loss (dirty pivots, old oil, tired mainspring, drag) - do not regulate around it, find the cause. Above ~320 = knocking, maybe a too-strong mainspring
Beat error	Under ~0.5 ms (a few tenths is excellent)	Rotate the adjustable stud carrier a hair (easy), or the hairspring collet (delicate); watch the two lines converge
Trace cleanliness	Two clean, thin, flat lines	Fuzzy, scattered, wandering dots = dirt, a bent pivot, a fault, or magnetism. Demagnetize before you conclude it is mechanical

Amplitude is a result, not a setting - it reflects clean pivots, a good mainspring, correct oiling, and a healthy escapement. If it is low, the watch is telling you something upstream is still wrong. Regulate dial-up to near zero, then check one or two vertical positions (crown down, crown up); a wild swing between positions means investigate, do not just split the difference.

Beginner Mistakes That Kill Watches

Almost every job that comes back to me went wrong in one of these predictable ways. Read the list before you start and you will dodge most of them.

- Disassembling a wound watch. Let the mainspring down first, every time, no exceptions.
- Working with a bargain fifty-piece kit. Soft blades slip and mangle screws; buy fewer, better tools and dress the blades.
- Skipping blade dressing. A rounded blade cams out of the slot and gouges the plate. Dress flat, square, and re-dress the moment it slips.
- Over-oiling. The single most common self-taught mistake - great puddles that creep, collect dust, and drown the balance. Aim for a filled hole with a slight dome, no spread.
- Oiling where oil must not go - wheel teeth, hairspring, balance wheel, pallet fork body. These run dry.
- Oiling before the jewels are perfectly clean. Oil on dirt is grinding paste.
- Handling the balance by the wheel or the hairspring. Lift it by the cock, as one unit; a kinked hairspring is a miserable repair.
- Forcing the crown-wheel screw counterclockwise. It is often left-hand threaded - try clockwise before you strip it.
- Letting the setting-lever spring launch. Cup your hand over it when you release it.
- Working without a tray and without a demagnetizer nearby. Cap jewels and springs vanish into carpet, and a magnetized hairspring sends a good watch running minutes fast while you chase a fault that a demagnetizer would cure in seconds.
- Learning on a watch you would cry over. Start on a cheap, big, robust movement (a 6497-style manual or a Seiko 7S26 / NH35 automatic) bought "for parts or repair." The early stumbles are tuition, not failure.

That is the pack. Print it, keep it at the bench, and let it walk you through the strip, the clean, the oil, and the timegrapher. When you are ready to take on your first full service, the complete step-by-step - and three worked service walk-throughs - are waiting in the book.

- Emmett Vance