CBX Technical: Advanced

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To submit an article please contact John Seltzer via email jhseltzer@attbi.com or phone 360-647-7702 Pacific time 6:00 pm to 8:00 pm weekdays. Anytime Saturday and Sunday. Current article format/content, but be creative. 250-500 word count in MS Word or email format. Jpeg pictures please. Submit text files and picture files separately (do not embed pictures in article). Regular mail/photos acceptable. **Next Xpress submissions due by 12/15/2003.**

Building Your Own Cylinder Leakdown Tester

Updated article from Jan-Feb-Mar 1995 issue

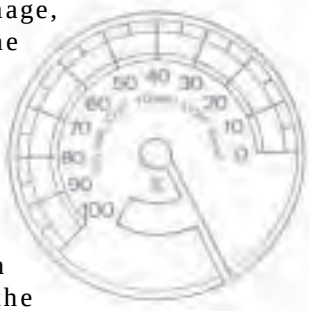
As part of your routine maintenance chores, you probably already include an occasional cylinder compression check. It's a good way to periodically monitor the general condition of your engine. However it is just that – general. A compression check can miss some serious engine problems. Many an engine that has passed a compression test will subsequently "peg" an exhaust gas analyzer's meter, indicating significant running problems. Consequently, seasoned techs know better than to trust a compression test by itself. Here's a better way.

A Better Way

Everyone remembers how to do a compression test: Screw in the tester, flip the kill switch to "off", hold the throttle wide open, and press the starter button. The cylinder takes in air and compresses it, and the tester traps it. The maximum is reached when the gauge holds as much pressure as the engine can produce. Not too difficult. The weakness of this test however is that throttle position, engine temperature, ambient air temperature, and a *host* of other factors can make the results vary considerably. What's worse, a compression test checks too many engine components at the same time. A poor reading can indicate so many things, it's hard to tell which engine part is at fault without doing a lot of other tests. A leakdown test avoids this difficulty. Air is pumped *into* the cylinder from an outside source, and the gauge reads the percentage that *escapes*. This not only eliminates all of the aforementioned variables, but as a bonus, it is a simple matter to pinpoint the source of the leakage by wiggling and rotating engine parts while the test is underway.

"That'll be $1,500, and Oh, Uhh, it Still Smokes..."

But how does it work? Okay. Let's say your brother-in-law rebuilt your engine. You've suspected that the guy is mechanically-challenged, and sure enough, the finished product smokes like a chimney. But he's your kin, so... Finally, you have a shop look at it. Good results from a compression test combined with the smoking leads them to a diagnosis of trashed valve guides. Seems reasonable and you approve the work. But, afterward the engine *still* smokes. Now you really have a problem, not to mention the shop, and your brother-in-law. Enter Mr. Goodwrench, who produces a leakdown tester, and performs the following test. On each cylinder in turn, he finds TDCC, sets up the tester, and reads the percentage of leakage. They're all good and low. Hmm. Undaunted, our hero retests each cylinder, but this time he lowers the pressure setting on the instrument, and, rotating the crankshaft a smidge each time to slide the piston down the bore a little, picks up the problem, plain as day. On the #6 cylinder, the gauge now reads 60% leakdown when the piston is partway down the bore, indicating cylinder damage, which the teardown verifies. Seems your brother-in-law didn't get one of those pesky wristpin circlips all the way into its groove. It subsequently popped out, and the wristpin tore a handsome trench into the cylinder wall. Why didn't the shop find it when the head was pulled for the valve job?



About this article, "The inspiration for this article came out of an incident at the motorcycle shop where I wrenched at the time. The machine was actually a ZX11, one that had just had a big bore kit put in it by another tech. The machine was repeatedly fouling just one spark plug. I got the idea of lowering the tool's pressure and rotating the crankshaft from some things about leakdown testing that the late Smokey Yunick had said many years ago. It worked. After replacing the trenched cylinder sleeve, I pulled the oil pan and retrieved the piston circlip. Made me a hero."

"By the way, many people have asked me, 'What is the restrictor for?' The leakdown tester's restrictor dampens the gauge, so that when connecting and disconnecting the tool from the compressor, the needle doesn't slam forcefully full scale."

I put over 60,000 miles on his own 81 model CBX before financial and health issues forced its sale, but remembers it and his past involvement with the ICOA fondly. "While on vacation in Wyoming, a friend and I stopped in a tiny cafÈ to get out of the wind. A fella sitting at the counter came over and bought us all lunch, saying he was a member of the ICOA. His hospitality made a lasting impression on me."

I am looking forward to renewing friendships and making new friends in the Association.

Mike Nixon

Mike & Kimberly Nixon

I am pleased to advise the membership that Mike Nixon is back with ICOA. This is one of the most exciting ICOA news items I ever been associated with in 23 years with the club.

These articles helped all us maintain our bikes in the early CBX days, ride them to far off rallies with certainty we would get there and back, plus they served as the "Bible" we all used to solve CBX Technical issues when they happened.

Mike is a Registered Honda Technician with over 30 years' experience in the motorcycle service industry and was one of the first ICOA Technical Editors for ICOA. Over 15 years he contributed 30 plus Advanced Technical Articles most of which are featured in our Tech Tips which can be purchased via the Goodies area.

He also has worked in the Motorcycle Division at American Honda, and has a long history with Motorcycle Mechanics Institute, where he was for several years an instructor, and was for years the Institute's Curriculum Designer

Mike has joined John Seltzer's Advanced Technical Team and over time will provide us with some new articles and insights into the wonderful technical world of the CBX.

Mike will be also re-introducing some of these original wonderful articles over the next couple of years after he gets a chance to review and update them; which is the case with the Leakdown article in this Xpress.

Mike Brown Barone

Because two of the six pistons were at TDC. Why didn't the compression test pick it up? Because despite the trench, there was still plenty of cylinder area (the pin is nearly an inch below the deck) in which to build adequate pressure during a compression test. This actually happened, and it illustrates both the weakness of a compression test and the comparative strength of a leakdown test.

Whoosh!

Leakdown testers are *way* cool. Not only does the amount of air escaping from the cylinder register on the gauge, it can also be *heard*, enabling the source of the leak to be pinpointed prior to the teardown. For example, high readings accompanied by hissing in the carburetor indicate burnt, tight, or carboned-up intake valves. The same thing in a muffler points toward—you guessed it — exhaust valves. A breeze coming out of the dipstick hole indicates worn or heat-softened rings. And, air escaping from an adjacent spark plug hole pinpoints a blown head gasket.

Not for Everyone

There's a catch, of course. You need an *air compressor* to use a cylinder leakdown tester. And, you need to now how to accurately find TDCC (top dead center on the compression stroke) for each cylinder that is tested. Can you do it? Sure. If you can adjust your valves, you can use a leakdown tester.

Rolling Your Own

Inexpensive, ready-made leakdown testers are easy to find today — you don't have to mortgage your house to a *Snap-On* dealer. So, if you are concerned about the condition of your engine but aren't into making things, or don't have the time, you can buy a leakdown tester for about $75 at many auto parts stores and the like. If on the other hand you have an air compressor, that sort of implies that you're a certified tinker. You're probably also into making things, and for you, throwing this thing together is no big deal. For you then, here's the rundown:

Pressure regulator

This is designed to be screwed onto an automotive paint spray gun. Grainger's is probably the cheapest, followed by Sears and Ace Hardware. The gauge that is often attached is, unfortunately, the wrong kind for our purposes. Also, make sure the regulator comes with the block-off plugs for the two passages you won't be using.

Pressure gauge

Get a quality, back-mount, 0-100 psi gauge. As of this writing Grainger has the best deal. For the professional touch, carefully pry off the bezel and cover the faceplate with a copy of the label shown here. If you don't re-label the gauge, no big deal. Just read it backwards; i.e. "10" means 90% leakdown.

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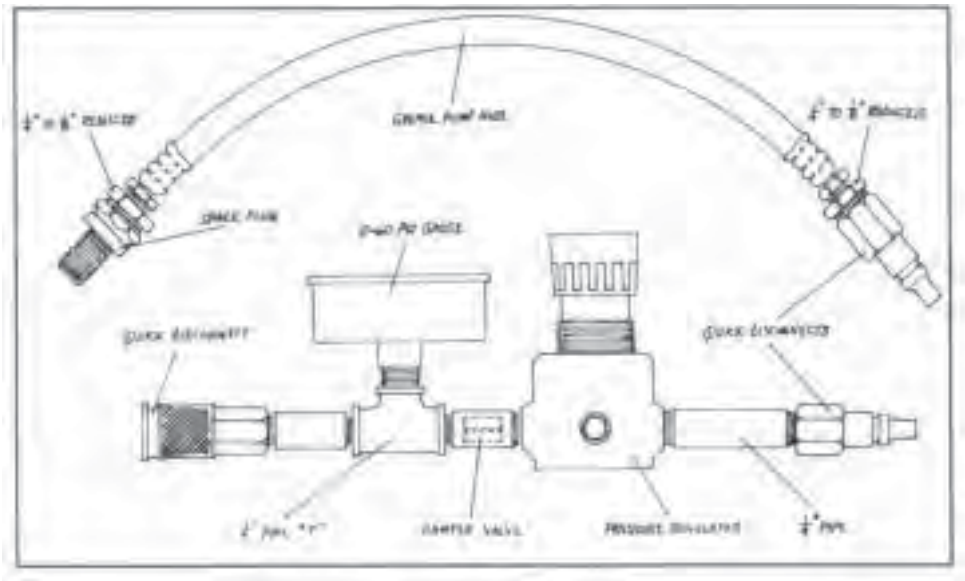

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Spark plug adapter
Make this by clamping an old spark plug in a vise (protected with wood or aluminum stock, and clamped on the hex—not the threads) and whacking off the porcelain with a well-aimed lateral hammer blow. Then grind off the rolled-over seal above the hex, grind off the ground electrode, put the plug back in the vise and drive out the remaining porcelain with a drift (if difficult, the rolled seam hasn't been sufficiently removed—on some plugs you must grind partway into the hex). Tap the hex end with a 1/4" pipe tap (NGKs are hardest to tap but seal the best afterward). Screw this onto a 1/4" to 1/2" pipe reducer, and that onto a 12" grease gun hose (about $5 at Wal Mart and just about anywhere).

Damper valve
This essential part is merely a restriction between the regulator and the gauge. The easiest way to make it is to plug the middle pipe with epoxy and afterward drill a 0.040" (#60 or 1mm drillbit) hole.

Using It
Adjust the cylinder to be tested to TDC compression. Plug your tester into an air compressor line and adjust the regulator to get "0" (or 100 psi, if you didn't customize the face). Screw the hose into the spark plug hole, and connect the tester to the compressor. If the crankshaft turns or you hear all the compressor's air rushing out of an obviously open valve, the cylinder wasn't set exactly on TDC compression. Try again. When you get it right, the piston will stay put and the tool will indicate the amount of air that is escaping from around the rings, valves and head gasket of that cylinder. All cylinders leak a little. Large ones leak more, smaller ones less. Racing cylinders lose only 1 to 2%. Production multicylinder engines in top fiddle pass 5% and less, and no more than 10% regardless of the mileage. More than 10% leakdown means there's something wrong.

Yowie!
In the event of a high reading, first take the time to double-check that you are in fact at TDC on the *compression* stroke, not on the *exhaust* stroke (where both valves will be open). If that checks out, and the leak is (as it is usually) a valve, remove the valve cover and, with a hammer and drift, carefully tap on the valve followers for that cylinder, watching the gauge as you do so. This will often loosen carbon from around the valve and the reading will drop to a reasonable level. If not, well, time to get it fixed.

Parts List
Miniature air pressure regulator
0-100 psi gauge, back-mount, metal case, removable bezel
12" grease gun hose
1/4" NPT quick disconnect fittings
1/4" plumbing pipe and "T" joint
1/4" to 1/8" NPT reducers (2)
Old spark plug
Teflon plumber's tape