

# Cycle

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**Impression:  
Norton-Triumph's  
High-Power  
Mystery Wankel!**

**Comparison:  
10 Two-Stroke Silencers  
Face The Dyno**

**Basics: Filters**

## **THE YAMAHA DT400B: DUAL-PURPOSE WONDER**



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• The release of Yamaha's first enduro bike in 1967, the 250cc DT-1, signaled the beginning of a new era in motorcycling. The motorcycle, a completely street legal two-stroke single enduro bike from Japan, was all new and the design execution was amazingly accurate for this new marketplace. Earlier efforts, by Yamaha and other manufacturers, at building formidable combination street/trail machines were token efforts; the motorcycles were laden with heavy stamped steel frames, absolutely horrid suspension, pre-rotted rubber and barely serviceable engines. The DT-1 was the first honest Japanese effort at making a motorcycle equally dexterous in both riding worlds—dirt and street.

The buying public responded to the DT-1 by making it, overnight, the most in-demand motorcycle in this country. Other manufacturers responded one-by-one by duplicating the DT-1 concept with 250cc two-stroke single enduro bikes of their own. Even mighty Honda stereotyped the DT-1 six years later with their first-ever two-stroke trail bike, the MT 250. For the first time in memory some European concerns emulated the Japanese (Yamaha's) enduro bike concept in an effort to regain lost sales. The DT-1 pioneering success made Yamaha *the* force to reckon with in on/off road development.

The success of the DT-1 also shaped the future of Yamaha. While they have become the byword in road racing, their major sales and product successes have been in the enduro and motocross market. In most instances manufacturers expand successful models by making them bigger and faster. But Yamaha did just the opposite; they made their enduro bikes smaller—from 175cc down to a 60cc. Not until 1970 did Yamaha make an enduro model larger than the original 250cc DT-1.

Yamaha believed there wasn't sufficient demand for enduro models above 250cc. Riders wanted more horsepower but not necessarily bigger engines. The 250 class enduro bike was (and still is) the most popular. Riders who once rode little trail bikes move up to 250s, and it's most popular with courageous first-time buyers.

The DT400B has all the credentials necessary to make it ideal for the grass-roots neophyte as well as the expert enduro rider. The kick-crank actuated compression release takes the bite out of starting; the CDI ignition should never need timing or adjustment; the MX-copy chassis removes the evil from the handling; the gutty, flat power curve of the bigger engine requires no special skills to

# YAMAHA DT400B

COLOR PHOTOGRAPHY: LARRY WILLETT



use to its fullest; and better balancing has produced an exceptionally smooth running big-bore enduro bike. *Cycle* called last year's DT360A "the best all-round big-bore dirt bike in town," and the new DT400B is markedly better.

Until the advent of the DT-1, Yamaha and other manufacturers (Japanese and European) stuck with two basic induction systems for the two-stroke single—rotary valve and basic three-port Schnurle loop. The rotary-valve system with a crankshaft-mounted timing disc and outboard carburetor promised the most power output. Opening and closing of the intake port could be controlled separately (unlike piston port) while the rear boost port of a rotary valve cylinder cleaned out the combustion chamber. But excess engine width of a rotary-valve single didn't appeal to Yamaha's design department. A narrow frontal profile was prime criteria

After selling over half a million enduro models Yamaha has produced the best dual purpose bike from the Orient. The DT400B engine is to trail riding what a locomotive is to train travel. If you ride it once you'll never settle for a smaller enduro bike.

in the original DT-1's concept.

In 1966 Yamaha decided to build a piston-port single for their new enduro line. This decision committed them to improve or perfect the Schnurle loop system which would compete, performance wise, with stronger rotary valve designs. Earlier experiments with the original near-tragic 350cc twin street bikes proved that grinding two slots up the sides of the cylinder sleeve and adding matching holes in the pistons dramatically increased performance. These *fifth* ports (adding to the intake and two standard transfers) boosted

some of the fuel charge flow to the rear of the cylinder to better cleanse the combustion charge by pressuring exhaust waste out the front.

The DT-1 came standard with *real* fifth ports. There were four transfer tunnels in the aluminum cylinder casting and a like number of window openings in the steel sleeve. The performance delivered by the original DT-1 engine was far ahead of its time. Despite its road equipment, the bike would go places only European enduro bikes could previously handle. With knobbies mounted and gearing lowered

the DT-1 brought home many thousands of trophies for enduro riders in every part of the country. The new era began.

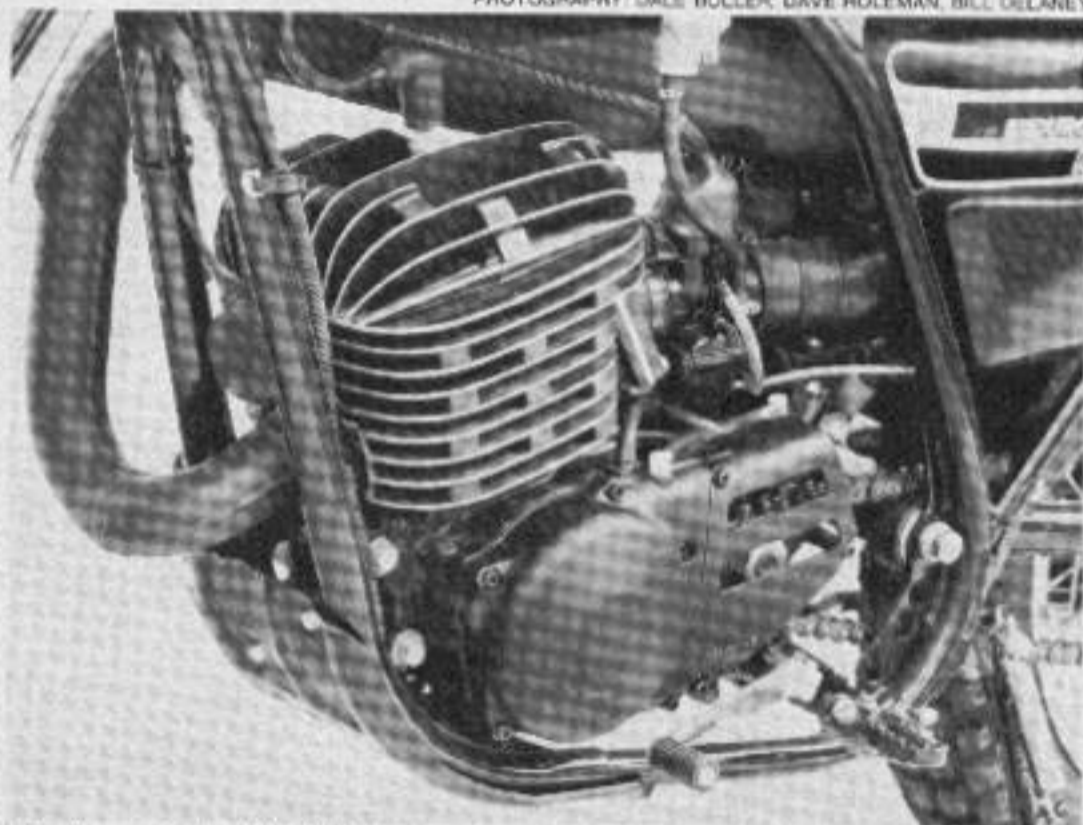
The reed-valve induction now stands as Yamaha's backbone of two-stroke dominance. The reed-valve principle isn't new but Yamaha was the first manufacturer to perfect a petal acceptable for mass production. The stainless steel reed petal is simply a flapper valve located between the carburetor and intake tract. The reed petals rest flush against vulcanized (over aluminum) rubber to seal the crankcase area from the carburetor venturi. When the piston rises a vacuum is formed in the crankcase, the reed flaps are pulled open, and the fuel/air mixture is sucked into the big end. When the pressure cycle builds, the flaps close to seal the intake tract off. Holes in the back side of the piston match with an inverted T-shaped intake slot. The holes, when passing over the arms of the T-slot, prolong the intake cycle on the up-stroke of the piston. On the down-stroke, big-end pressure forces fuel up the leg of the T-slot which acts as an additional rear boost port as used in rotary-valve engines. The Yamaha reed-valve system while being functionally simple is mechanically complex.

The reed-valve system acts as an intake timing device to better control fuel flow into the engine. The enormous amount of porting inside the cylinder lets the Yamaha engine develop more combustion efficiency from less contaminated (from exhaust leftover) fuel charge. The result is an engine that pulls like the proverbial tractor. Without question, the DT400B is the best enduro engine regardless of displacement from the Orient.

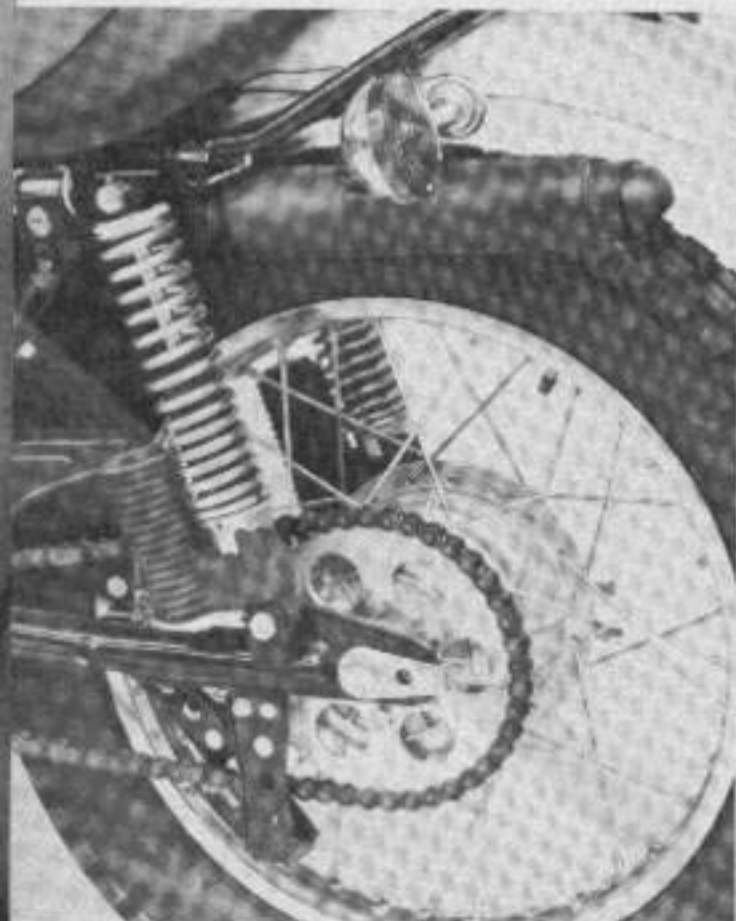
The Yamaha 400 enduro has the best Japanese engine for reasons beyond just power. It produces more torque than either the 400 Suzuki Apache or Honda XL 350 four-stroke—almost four foot-pounds more. The Yamaha also pulled Webeo's dynamometer at a lower engine speed than either the Apache or XL 350. Starting off at 2000 rpm the DT400B runs smoothly but with a deliberate power rise up to 5500 rpm, then drops off slowly to 6500 rpm. It won't pull effectively past that.

The ability of the engine to pull effortlessly at extra-low crankshaft speeds is the result of Yamaha's mechanical wizardry. Perfecting of the reed valve system is aided by care to other performance related areas. The top piston ring appears to be a conventional Dykes type, but it is actually an L-shaped Keystone loop. The Keystone ring is tapered towards the center seven degrees on its bottom side. This taper matches the machined offset in the piston ring groove. The outwardly tapered ledge of the groove allows the ring to be pushed away from the piston as combustion pressure drives down on the L-pocket. As a result the ring snugs tighter against the sleeve on the power stroke; this gives less blow-by and produces slightly greater efficiency.

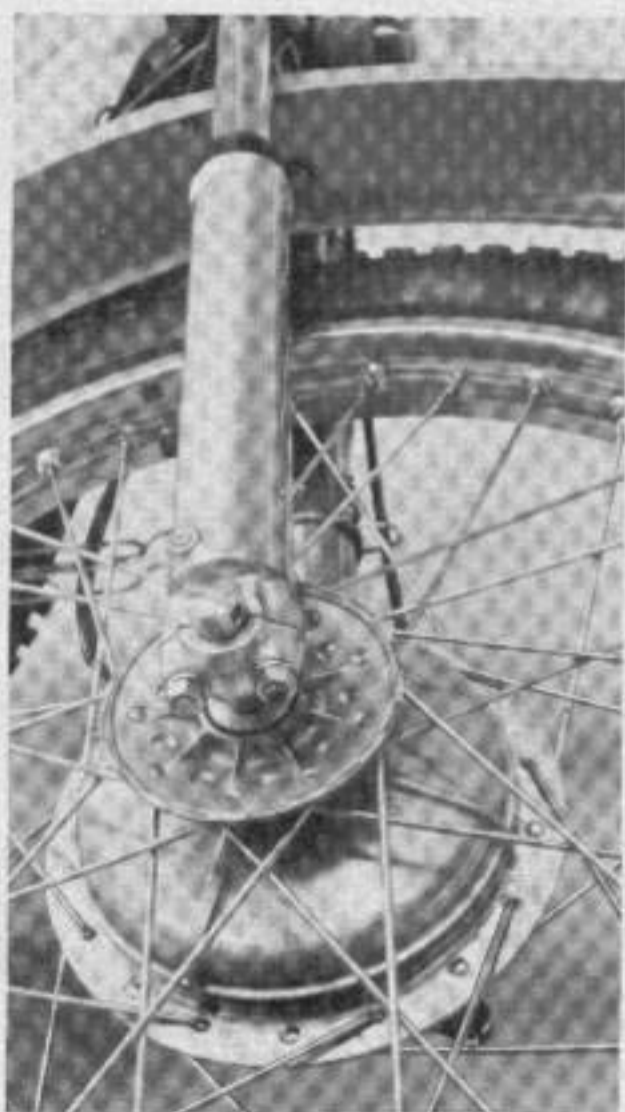
PHOTOGRAPHY: DALE BOLLER, DAVE HOLEMAN, BILL DELANEY



*The heart of the DT 400B is its engine—gobs of torque with controllable power.*



*Shock springs are far too stiff; the brakes too grabby and the turn signals too vulnerable.*



*Conical style hub has a bigger brake and is too touchy. Fork action is good, springs bad.*





The cylinderhead this year is radial designed for less weight and better cooling. The compression ratio remains the same as last year's—a mild 6.4:1. The low compression permits use of low octane fuels. The entire engine is coated in a gloss black for appearance, not cooling.

Besides the radial head, the other major change to the DT400B is the 5mm larger piston which raises the displacement from 352cc to 397cc. The DT400B boasts a monster 85mm bore and 70mm stroke. The Mikuni carburetor this year is nominally 2mm bigger at 32mm. The oil injection tube runs into the carburetor venturi rather than the cylinder's intake casting. Invisible modifications have been made to the internals of the muffler and its baffles for the larger engine. The spark arrestor has been pulled outside of the fender well further to permit clearance for a big 4.50 knobby.

The broadly spaced five-speed remains the same. Robust gears, shafts and a trio of hardchrome-tipped shift forks assure dependability and positive gear changes. The clutch is slightly different with the DT400B. Yamaha narrowed the left case cover by removing one friction plate from the old 14-plate clutch. Also, the all-metal plates were thinned slightly and new material is used.

Other than a re-designed gas tank shape and color scheme the 400 enduro appears identical to last year's 360 model. The frame is the same mild tubular steel unit

and retains the 30-degree fork angle and 5-plus inches of trail. The fork is also a pickup from last year; it retains the triple progressive springs that start out with 15 pounds-per-inch pressure, moving up to 21 ppi and coil binding at 28 ppi. The front hub is newly designed in a conical shape and the brake is slightly larger.

The back wheel assembly and swing arm remain unchanged. The big aluminum hub is quite strong. The rear sprocket is a smaller 38 tooth circle compared with the 44 cog wheel used last year. The secondary ratio was 2.933; now it's up to 2.533. Each of the aluminum bodied Thermo Flow shocks are sprung with a single progressive wound spring rather than the double paired coils previously used. The rate for the paired springs was 80 ppi for the short coils and 145 ppi for the larger. The new progressive wound spring is rated the same.

Ignition spark is again generated by the Mitsubishi CDI unit with external flywheel. Electrics are all six volt; an A.C. flywheel magneto generates the electrical power. The oiled foam air cleaner is hidden in a metal box behind the carburetor. The oil tank, battery and tool kit rest under the hinged saddle.

There are certain reactions we expect from any big-bore single. A lot of kicking pressure is one. However, Yamaha has nearly eliminated this by perfecting its decompressor which is actuated by the kickstarter. As the kickstart lever is pushed

down, a small rocker arm follows a cam-like detent on the ratchet wheel. The arm pulls on a cable which opens a minute valve. This valve assembly is screwed into the top front of the cylinder. The tiny exhaust valve has a special outlet passage that breathes into the exhaust port so that no mess spews out of the engine. The valve setup substantially reduces the compression at the kickstart lever; the 400 kickstarts like a 250.

On the DT400B the self-actuating compression release works better than any on the smaller 360s. There's seldom any kick back. Matched to the easy kicking aid is an electronic advance system in the CDI ignition. A thyristor placed in the ignition circuit holds the spark retarded until 600 to 800 rpm when it automatically advances the timing. Primary current for the ignition comes from a source coil in the flywheel generator and not the battery. If the battery fails the ignition won't quit.

While the compression release system works perfectly, the CDI ignition is far less developed. Starting the DT400B isn't as easy or quick as it should be. When cold (choke on, throttle closed) the engine will usually start in two or three kicks. Sometimes it takes ten swipes at the kick arm while opening and closing the throttle and fiddling with the choke. When hot the engine either starts first kick or a dozen stabs later. It lacks any predictability. Our lengthy experience with the

*(Continued on page 94)*



DT360A (with the same ignition system) and two DT400Bs confirms that the starting difficulties are inherent with the Mitsubishi CDI unit.

The CDI ignition performs erratically at low engine speed. When engine revs drop suddenly to idle speed it will often just quit running—out of spark. It would seem that poor low-speed spark from the primary coil and uncontrollable action of the thyristor advance/retard action combine to rob the engine of its spark at some very embarrassing times. This symptom existed with the DT360A and DT400B.

Low speed performance of the engine is phenomenal for a bike weighted down with a full load of street legal accouterments. Because the power curve has a slight peak (rather than being absolutely flat like the Suzuki 400 Apache or XL 350), full throttle acceleration is brisk and exhilarating. Low speed and mid-range power are smooth and predictable; this eases plonking through really rough sections, driving up tough hills, or slowly grinding through muck or sand. Riding over rocks and logs forces an engine to chug on the upside and then rev suddenly when decelerating off the far side of an obstacle. In such sections where this process goes on in rapid-fire succession, the Yamaha excels. The engine's ability to grunt and pull and get its power to the ground will inspire new confidence in any novice trail riders. You'll attack hills and plow through sections you just wouldn't try on other bikes except a 400 Maico Qualifier or 340 Rokon automatic—and they cost far more than the Yamaha.

The tachometer redlines at 7000 rpm but it's futile to spin the engine past 6000. It runs best between 2000 and 5000 rpm. In this speed range the engine is producing its most useable power. And it's running at its smoothest. Because the engine doesn't have to rev fast or work hard to cover the most demanding terrain it is easy to manipulate. Less time is spent worrying about whether the transmission is in the right gear or whether the engine is revving fast enough. Therefore more rider attention can be focused on the trail or road.

The secondary gearing, taller than last year's DT360A, will probably be a shade high for most trail conditions although it's perfect for a combination of street and dirt roads. The 400 is happy cruising on the pavement at the maximum speed limit; it can run up to 70 mph quickly and effortlessly. The bike is smooth enough at 55 mph to be acceptable for all street and highway chores and even an occasional jaunt on the freeway.

The gearbox is an ideal unit for on and off-road use. Low gear is down in the basement range for controllable sub-10 mph plonking (lower yet with a smaller 13 tooth countershaft sprocket). There's a noticeable jump to second gear then even spacing up to third and through

fourth. Then there is distant span to fifth gear; it's like an overdrive. The engine makes the gear ratio spacing seem unimportant because of its wide power spread.

Gearbox operation is smooth and pleasant. There aren't any glitches or gremlins causing missed shifts or false neutrals. Shifting is easiest and most precise when the clutch is used. Clutchless shifts demand that the throttle be rolled off momentarily then on again to release loading on the gear dogs. The clutches used in Yamaha enduros in recent years have been exceptionally good. They have always taken a great deal of abuse without failing or withering away from heat. This isn't the case with the DT400B. The clutch loses its adjustment when used constantly. In a couple of tough rock sections where the clutch was engaged and disengaged repeatedly, it soon lost all free play. The lever would fall back against the handlebar completely useless. It took about ten minutes cooling before the clutch regained its normal working ability. This shortcoming can be traced back to this year's change in the clutch: removing one plate and thinning the others.

The engine package is so useable that it overshadows many of the bike's faults. For most riders the comfort level of the DT400B is good. During long spells in the saddle, especially crossing rough terrain, a rider clad in cloth trousers will find himself driven forward on the seat and onto the gas tank. The rider must continually push himself back on the seat. Dressed in leathers, the rider gets virtually stuck in position thanks to a very high friction coefficient between the vinyl seat cover and cowhide.

The newly shaped gas tank has the same deficiency as previous year's Yamaha enduros—too little capacity. The average mileage for the DT400B is 30-plus mpg (under ideal conditions) and less than 25 mpg in the dirt. With a capacity of only 2.4 gallons the minimum range is down at a very short 60 miles—not enough for street or dirt. It's a shame that Yamaha went to all the trouble of redesigning a new gas tank and still made it too small.

The electrics are dependable enough but incredibly complex for a trail bike. Plan on carrying the owners manual. Or better yet, xerox the wiring diagram in the service manual. The headlight works only with the engine running while the other lights are battery operated. The turn signals are again mounted on solid steel stems securely bolted to frame bracket and handlebars. The first time we flopped the bike (inevitable with any dirt bike) the rear turn signals snapped off. Shortly thereafter the handlebar lamps put divots in our kneecaps. Rubber mounts ala the Can-Ams could eliminate these problems.

Both front and rear wheels are beefy and should never fail, but the spokes require constant attention. After every ride the spoke nipples needed up to two turns each. They never seemed to bed in. The



brakes are too powerful. In the dirt they lock up the wheels at the slightest touch of the levers and adjustment fades away rapidly when they are used repeatedly.

Soft springing and light damping make the front forks nice and cushy. However the springs collapse after just a few hundred miles and require pre-loading or replacement. This year's shock springs are far too stiff for even the heaviest rider. Different springs, probably 70 to 80 ppi, would work better. The chassis works very well for street and dirt (except for the soft forks and rigid shocks). It's one of the best enduro chassis designs from Japan.

The combination of the gutsy big-bore engine and stable chassis allows the DT400B to get the power on the ground better than any other Japanese enduro bike we have ridden. With its compromise trials universal tires and tall gearing the Yamaha 400 enduro will go places in the dirt where other dual purpose bikes can't go with full knobbies. For extensive dirt riding knobbies will improve the go-anywhere capabilities of the DT400B.

As a dual-purpose machine the DT400B is a vastly better bike than the DT360A. This results almost solely from the fantastic, almost mistake-proof engine which crosses both dirt and street riding lines evenly. In the dirt it's far better than any other enduro bike from Japan. It's not as powerful and stable as the Maico 400cc Qualifier or 250cc Can-Am TNT, but it is \$200 cheaper than either. On the asphalt it's more serviceable than any other dual-purpose bike regardless of origin.

With prices soaring in everyone's camp we expect that the tall \$1371 price tag on the DT400B will be competitive by publication time. We are however disappointed that Yamaha hasn't corrected problem areas found in the DT360A after kicking up the price \$342. The ignition-related starting and stalling problems can be corrected with a conventional points system. Trimming the clutch 21mm (.827") to gain 17mm (.67") narrower case cover won't be worth the price to an enduro rider when it fades away from a little abuse. The additional cost of making the magneto and clutch covers magnesium alloy rather than aluminum to save a few ounces is useless on a 294 pound motorcycle. Investing in a quick change rear wheel with Honda XL type axle adjusters to replace the present hodgepodge set-up would be far more valuable. Redesigning the heavy tail light and replacing the rear steel fender with a more durable plastic one could keep it from cracking off.

Trying to make a motorcycle that appeals to both riding worlds is a compromise project from the outset. Yamaha's DT400B doesn't excel as either a street scrambler or pure enduro mount. It does do both very well and if properly prepared could excel as a mid-size asphalt scratcher or enduro competitor. For the price, the DT400B remains the best all-around big-bore dirt bike in town. ●