

CYCLE DIRT TEST

YAMAHA YZ250E

● FIVE YEARS AGO BUYING A MOTOCROSS bike was a lot like trying a blind date: you encountered a lot of pretty faces, most of which were attached to overweight chassis. New motocross models boasted changes that were only paint deep, and often new color schemes and tanks separated yearly models.

Today things are different. Yamaha's YZ250E has a tank and colors identical to last year's model—but everything else has been changed. Changes in basics and details are everywhere: engine, frame, swing arm, fork, air cleaner, expansion chamber, tires, levers and chain tensioners are all new. The YZ250E bears so little resemblance to other members of the Yamaha motocross family, that were the bike not a yellow monoshocker, it would be difficult to identify it as a Yamaha 250.

Yamaha has designed a completely new engine for the E-type. Although similar in appearance to the works bikes of the Yamaha motocross team, the new production bike has aluminum, not magnesium, cases. The engine is very narrow and the lower end looks more like a 125 than a 250. Earlier Yamaha 250 motocrossers had five-speed transmissions, but the YZ-E has a six-speed gearbox. The transmission gears are physically smaller than those found in old five-speed Yamahas, and the more compact gearbox cluster fits inside the new narrow cases. The clutch has an addition as well. The YZ-E has a 12-plate clutch, up one on the D-model.

The complete E-engine is 15 pounds lighter than its predecessor. That's remarkable. All the little things have been done to save weight. The ignition cover, together with the case saver, is plastic.

Yamaha's new YZ250E may handle like a 125, but it has real 250 muscle. And these qualities make the E-type Yamaha's best motocrosser yet.







YAMAHA YZ250E

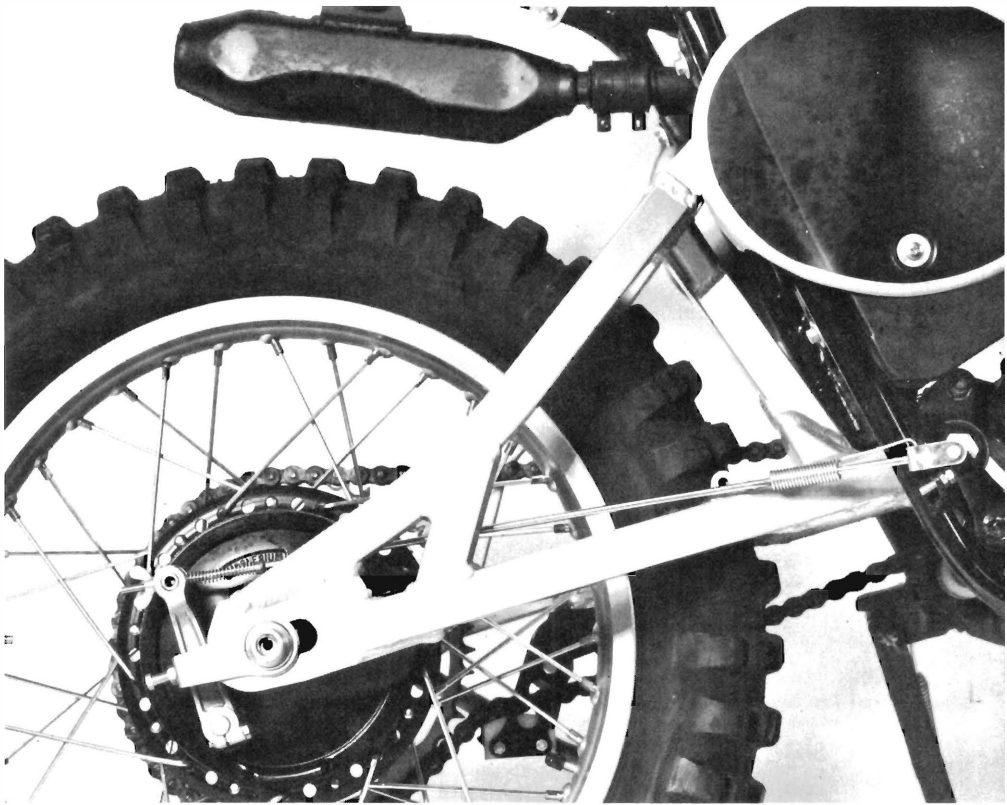
The clutch cover is magnesium. Although an all-magnesium engine would have been lighter—and outrageously expensive—Yamaha saved pounds by making the aluminum-cased engine just as compact as possible. Not only is the gearbox a tight and tidy fit, but the overall width and weight of the crankshaft has been reduced. Even the CDI rotor is four millimeters narrower than the D-rotor.

In redesigning the engine, Yamaha's technicians moved the countershaft sprocket 15mm closer to the swing-arm pivot. The ideal place for the countershaft sprocket, so far as chain routing is concerned, would be on the swing-arm pivot. In that case the chain would need no tensioning device because the sprockets would remain at a constant distance from one another, no matter what the position of the rear wheel would be. For practical manufacturing reasons, the countershaft sprocket cannot be on the same shaft as the swing-arm pivot. The next best thing is to locate the countershaft sprocket as close as possible to the swing-arm pivot.

Throughout the last season Yamaha's motocrossers suffered some chain-related problems, and the YZ-E may have benefited directly from Yamaha's racing experience. At least during our testing—which covered both sun-baked and rain-soaked surfaces—we never were confronted with a chain problem.

The transmission shifts as easily as any 250 we have ever ridden. Older Yamaha motocrossers were not so blessed. Several changes account for this new-found ease in shifting. The engaging dogs of gears two through six have an undercut taper of three degrees, far more than the 1.5 degrees that Yamaha had used before. With more undercut, the dogs pull the gears into engagement and hold them there with greater certitude. Further, the YZ-E's clutch drum rides on ball bearings, not bushings used in earlier YZs. The ball-bearing setup produces less clutch drag when shifting and consequently shifts go through easier. And finally the factory took a tip from owners: Yamaha has fitted the YZ250E with a shift lever 10mm longer than the YZ-D. In the past Yamaha riders got their 250s to shift better by replacing the stubby shift lever with a longer TT500 lever. The added leverage did wonders for shifting, then and now.

Yamaha has in the past used almost exclusively a simple combustion chamber configuration, with a centered spark plug and concentric squish band. But in the new YZ250 they've moved the plug toward the rear cylinder wall, five millimeters from the bore axis, and introduced a polysphere chamber. There's a small-radius pocket for the spark plug and a large one, cut on a different center, leading out into the squish band itself. We refer to this last area as a "squish" band for lack of a



New aluminum box-section swing arm and chrome-moly frame have put an end to the infamous monoswap.



33mm of the piston skirt has been V-grooved for additional lubrication.



Yamaha's die-cast aluminum head has a new polyspheric combustion chamber dome and virtually no squish effect.

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better term; we're not sure the cylinder head on our test bike was approached closely enough by the piston to generate any squish effect. There was an 0.65mm recess in the head, a 1.0mm gasket thickness, and the piston halted another millimeter below the top of the cylinder at TDC—adding up to a total piston crown/squish area clearance of 2.65mm; normal, here, is more like 1.0mm.

The new YZ250's cylinder has porting that is wildly radical, more like that for a road racing engine than one intended for motocross. The porting is, in fact, geometrically very similar to that in the latest Yamaha TZ250 road racing engine. In the TZ250 the exhaust port height is 51 per cent of stroke and the exhaust width is 71.3 per cent of the bore diameter; the figures for the YZ250 are 51.6 and 71.4 per cent—which means that the 8000-rpm motocross engine is slightly more extreme in this respect than the 10,500-rpm road racing twin. The YZ's transfer port heights are a little less than the TZ's (23.5 per cent versus 25 per cent) but then the motocross cylinder has one more transfer port. Perhaps Yamaha's engineers have come to believe that all two-stroke racing engines should be geometrically the same, and that output characteristics for specific conditions can be generated with exhaust and intake system design.

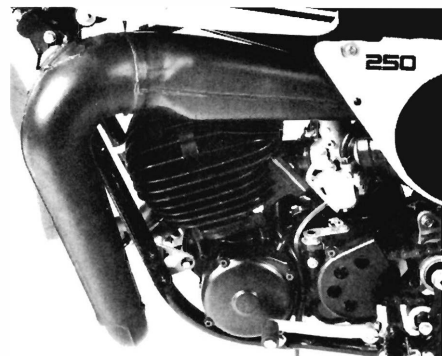
To smooth out the port tunnels the cast cylinder is dipped in a paint-like coating. Since polishing ports in production cylinders is economically unrealistic, the coating is a cheaper and more efficient way to cut down turbulence on air/fuel mixture in the ports. The dipping seems like a good idea, but our imperfectly-dipped cylinder showed bare metal spots in each port. Presumably air bubbles had been trapped in the tunnels during the coating application and left exposed metal.

Premix is fed to the reed-induction system by a 38mm Mikuni through a new six-petal reed cage. This reed departs from earlier Yamaha practice in that the assembly is significantly larger. The overall width of the six-petal cage has been increased 10mm to 66.5mm. The reeds are the same thickness at 0.25mm as last year, but of course they are wider. According to tests conducted by Yamaha, the E-type's stainless steel reeds produce the least resistance to flow.

The single-ring D-type piston has been replaced with a two-ring model, and the bottom 33mm of the skirt has been V-grooved. When the piston begins its downstroke from TDC, the thrust face of the piston is under its highest load because of combustion gas pressure and connecting rod angularity. Another high thrust load comes during the second half of the compression stroke. The grooved surface on the piston's lower skirt serves to retain oil and provide a large area of

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Magnesium and plastic has been used extensively to keep the Yamaha's weight competitive at 229 pounds.



Shift selector lever has been lengthened 10mm. The YZ-E now shifts as easily as any 250 available.



The steering has been aided by addition of 20mm more fork-bearing length and excellent IRC tires.

lavish piston-to-wall lubrication. This design should offer more protection against piston failures and seizures.

At the other end of the connecting rod, the big-end bearing has a silver-nickel cage, something that's almost standard racing practice at Yamaha. Big-end bearings don't rotate at a uniform speed. There's a cyclic speed variation produced by rod swing, and due to this effect the bearing rollers alternately push, and are pushed by, their cage. Thus, if the cage is heavy enough, it will cause the rollers to skid and that skidding quickly leads to bearing failure. So there is every reason to make the bearing cage very light, and it also must be very strong. These requirements have led to the use of alloy steel in the making of these cages, but of course naked steel cages rubbing against steel bearings would wear both rapidly. Steel bearing cages are, therefore, plated with a softer "bearing" metal. Copper plating is economical; silver-nickel is superior.

A redesigned expansion chamber com-

plements the YZ-E engine. Everything from the engine-pipe joint to the silencer has been changed. The rubber-mounted pipe uses exhaust springs with swivel hooks to secure the pipe to the exhaust. The D-model had a single 1.5mm exhaust gasket to control leakage; the YZ-E uses two 1.2mm gaskets. A good seal at the cylinder/pipe junction is important because any opening there allows the engine to draw dirt back into the engine and roach the piston and cylinder—or worse. The new arrangement is a much better seal and should extend component life.

The YZ-E air filter, though rounder than the D-model's unit, has the same surface area, but the more gradual contours, according to Yamaha, offer less resistance to air flow. The element material itself is an oiled foam that's easily serviced.

For the YZ250E, Yamaha departed from the usual use of a mild steel frame and used a Japanese chrome-moly. In the switchover, the wall thickness of the tubing has been reduced from the 1.6mm to

1.4mm; nevertheless the frame is both stronger and lighter than its mild-steel predecessor. There's a limit, of course, to how light a monoshocker can get because the system requires a massive backbone to house the unit. Nevertheless, at 229 pounds, YZ-E weighs only two pounds more than the CRZ250R and one pound more than Suzuki's RM250C.

In the past one of the main complaints about Yamaha motocrossers was the ill-handling "monoswap." The small-tube, mild-steel swing arm became the target for accessory dealers. Suddenly the aftermarket manufacturing shops glowed at night by the light of heliarc welders. It seemed that every serious racer competing on a Yamaha had a different-than-stock swing arm because the stock arm flexed at all possible points. Even the aftermarket arms were halfway measures because the YZ-D frames weren't very rigid, and consequently some monoswapping continued. On the YZ-E a strong, lightweight box-section aluminum swing

Make and model..... Yamaha YZ250E
Price, suggested retail..... \$1568

Suspension, front..... telescopic air fork
rear..... monoshock

ENGINE

Type..... Two stroke, air cooled, single cylinder
Bore and stroke..... 70 x 64mm (2.76 x 2.52 in.)
Piston displacement..... 246cc (15.01 cu. in.)
Compression ratio..... 7.3:1
Carburetion..... 1; 38mm Mikuni
Exhaust system..... Expansion chamber with silencer
Ignition..... CDI Mitsubishi magneto
Air filtration..... Oiled foam
Oil filtration..... none required
Bhp @ rpm..... 26.47 @ 7000
Torque @ rpm..... 19.96 @ 6500

CUSTOMER SERVICE CONTACT

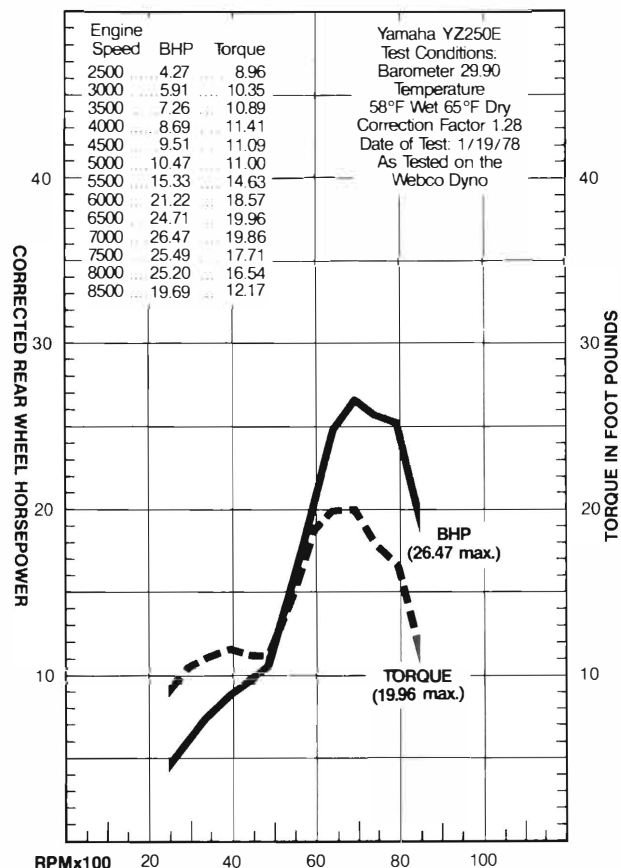
Yamaha Motor Corp., U.S.A.
6620 Orangethorpe Ave.
Buena Park, CA Calif. 90620
Attn: Customer Service

TRANSMISSION

Type..... Constant mesh, six speed
Primary drive..... Helical cut gears
Final drive..... 5/8 x 1/4 chain
Gear ratios, overall..... (1) 2.33 (2) 1.81
..... (3) 1.44 (4) 1.22 (5) 1.05 (6) 0.92
Oil capacity..... 800cc (27.05 oz.)

CHASSIS

Type..... Tubular steel, double cradle
Wheelbase..... 1454mm (57.25 in.)
Rake/Trail..... 30.5 degrees/134mm (5.28 in.)
Brake and hub, front..... Drum, conical, double shoe
rear..... Drum, conical, double shoe
Wheel, front..... DID shoulderless, 1.60 x 21
rear..... DID shoulderless, 2.15 x 18
Tire, front..... 3.00 x 21 IRC GS45F
rear..... 4.50 x 18 IRC GS56F
Seat height..... 940mm (37 in.)
Ground clearance..... 317.5mm (12.5 in.)
Fuel capacity..... 7.9 lit (2.1 gal.)
Curb weight, full tank..... 229 pounds





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arm is standard equipment, and together with the new frame, has turned mono-swap into history.

The swing arm is yet another spin-off from Yamaha's racing program. The more rigid box-section swing arm is 10mm longer than the mild-steel tube arm it replaced. The added length allows another five millimeters of rear-wheel travel. That works out to be a 0.2-inch improvement, hardly noticeable. What is apparent

is that the rear suspension can provide full travel. No longer do frame twisting and bucking force the swingarm into its own two-step. The suspension is left with only one enemy—the motocross course.

The rear travel of 11.25 inches is the longest ever from a monoshock, and its suppleness and bump control are comparable to the best dual shock set-up we have tested. The monoshock is a DeCarbon type with both spring pre-load and damping adjustability. The monoshock must be removed to re-set the spring pre-load, but the damping valve is accessible

through a small hole in the backbone near the steering head. As standard with monoshocks, the clearance volume is charged with nitrogen under extreme pressure. The damping is controlled by a small thermostatic valve that adjusts the damping orifice to compensate for the viscosity changes of the oil in a long moto. The hotter the oil gets, the smaller the valve. Damping remains fairly consistent and resists the fading that afflicted the early monoshocks.

The swing arm pivots on needle bearings which are great, provided that they're kept clean. Two of the three new roller chain guides are located at the swing-arm pivot: one above and another below. The third chain-guide is positioned well up the frame tube; it serves to protect the airbox from the chain when the suspension is completely compressed. A fourth more conventional guide employs a block-and-roller system attached to the swing arm near the rear sprocket.

Yamaha improved the fork, but not by increasing its travel—the usual way. Although the travel remains a 10.5 inches, the air-charged, oil-damped fork has been lengthened 20mm. The added length without added travel means an increase in bearing surface. The fork tubes and sliders have approximately 3/4-inch more overlap, translating into a stronger front fork which reduces flex and permits greater steering accuracy through turns.

This precision has also been height-

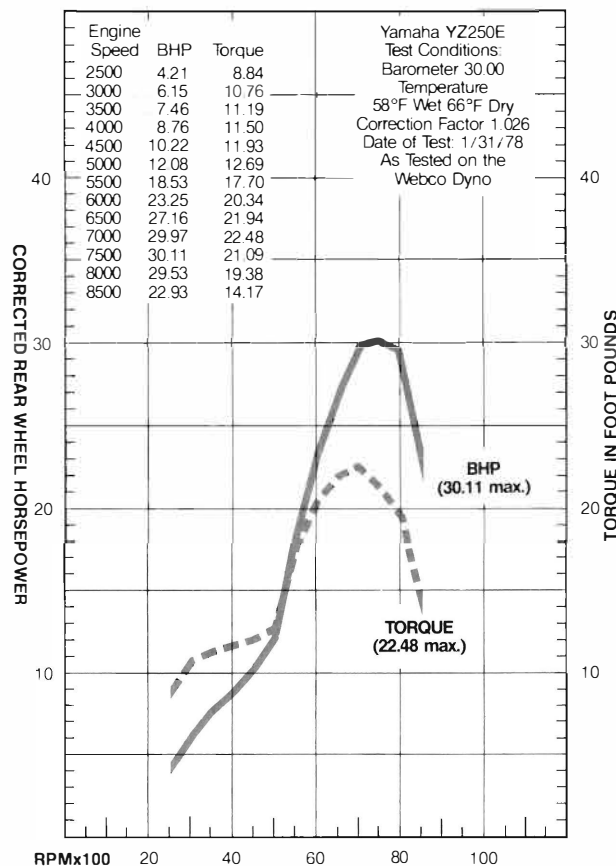
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One More Time . . .

● When we returned the YZ250E to Yamaha at the conclusion of its test, we mentioned its maximum power output—26.47hp—and noted that the YZ's best was over three horsepower down on the Honda CR250R's (29.82). Yamaha representatives expressed some concern, and asked if another unit could be dynoed. We said yes. Five days later, the second YZ arrived at Webco and produced 30.11 hp at 7500 rpm. At 5000 rpm the second engine produced almost two hp more than the first. It was also 3.5 hp stronger at 7000, and a whacking 4.8 hp stronger at 7500, where it peaked. When we returned the

second bike to our shop the engine was closely inspected. It became immediately evident that close attention had been paid to its ignition timing and jetting. On the original, for which no owner's manual existed when we tested it, ignition timing was set at 2.5 mm BTDC and there was a #380 main jet screwed into the carburetor. On the second version timing was set at 1.8mm BTDC—a significant change—and the main jet size was #370. There were no other differences between the two engines.

Conclusions? A perfectly-prepared engine will outperform a well-prepared engine, evidently by a substantial margin.



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ened by the addition of IRC tires. Along with the swing arm, Yamaha riders used to immediately replace the sub-standard tires. The current IRCs, with the same knob pattern as Metzellers, perform well in mud or on hard pack. The large 4.50 x 18 rear tire handled the increased horsepower and violent acceleration of starts flawlessly. Trying to get a lot of horsepower to the ground through a narrow-section rear tire can result in wheelspin, tail-wag and lost time.

The Yamaha leaves the rider with an impression of awesome acceleration, in part because the engine is pipey like a 125. With the six-speed transmission you shift a lot. Riders who've grown up on 125cc buzz-boxes will feel right at home on the E-type, while some long-time 250 riders, especially those accustomed to Maico-like torque, might find the YZ-E's power characteristics unappealing. Those at home with road-racer-type power probably can deal with corner bogging.

What saves wild charges deep into turns from becoming wild exits into snow fences are the excellent brakes. The front brake is housed in a small hub that belies its stopping power. The brakes at both ends offer a good progressive feel and resist locking up prematurely. The brakes are much the same as on the D-model, but the IRC tires bite so well that the brakes feel like they were new.

One caution is necessary. The YZ-E rewards precision and punishes sloppiness. While we talk about 125-like power, don't think—even for a moment—that once in a turn you can bog the engine, flick in the clutch lever, pull the revs out of sight and drop the hammer. Most likely you'll hook up the 4.50 rear tire so hard that you'll get a giant wheelie straight off the course. At times it will be necessary to feather the clutch, and feather is the operative word. Slap it at your own peril.

Wet-weather motocrossing has its hazards, given the YZ-E's power characteristics and necessity to use the brakes heavily. When wet, the brakes' stopping power diminishes rapidly. The same turns you dove into with dry brakes and caught the speedy YZ in the nick of time suddenly become a hazard with wet brakes and it's over-the-top-bermside.

The header pipe opens into the expansion chamber between the two main downtubes of the engine cradle, from where the chamber runs up and along the left side of the bike. The large exhaust port suggested that the powerband would be quite narrow. This was not entirely true; the YZ-E has a powerband that's a bit wider than a razor's edge. It appears that Yamaha combined a road racer type cylinder with a plonker pipe. After it clears the front downtubes, the pipe begins immediately to increase in diameter. The gradual increase in taper spreads the

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wave reflections over a longer time span than a pipe with a sharply divergent front cone. The bike is not as pipey as the size of the exhaust port would indicate, but the YZ-E has nowhere the power spread of the Honda CR250R or Suzuki RM250C.

In the small accessory department, Yamaha outfitted the YZ with a new handlebar; the diameter of its crossbar has been increased two millimeters for a little more strength. The wall thickness of the plastic rear fender has been doubled at the frame attachment points. The new mounting will support a fender full of mud without collapsing on the rear tire. The Yamaha gas-tank graphic is applied after the plastic, 2.1-gallon tank is flame-prepared. While the tank is hot, the logo is bonded to the sides of the tank. The process seems to work well and after vigorous use in mud the Yamaha sticker refused to part company with the tank.

Overall, the Yamaha YZ250E is almost eight pounds lighter than the D-type, and this newest Yamaha outperforms any previous Yamaha. The engine is narrow and with a remarkably improved suspension and competitive horsepower, the super-slender YZ-E must rank as one of the two top 250s sold to the motocross public.

If you are a successful 125cc racer, ready to move to the 250 class, the YZ-E will have a familiar feel because in many ways it's like a 125—only much quicker. It demands precise riding, forgives minor errors, tolerates some blunders, suffers no great fools, and in all cases goes fast. ©

Yamaha's new YZ250E may handle like a 125, but it has real 250 muscle. And these qualities make the E-type Yamaha's best motocrosser yet.

