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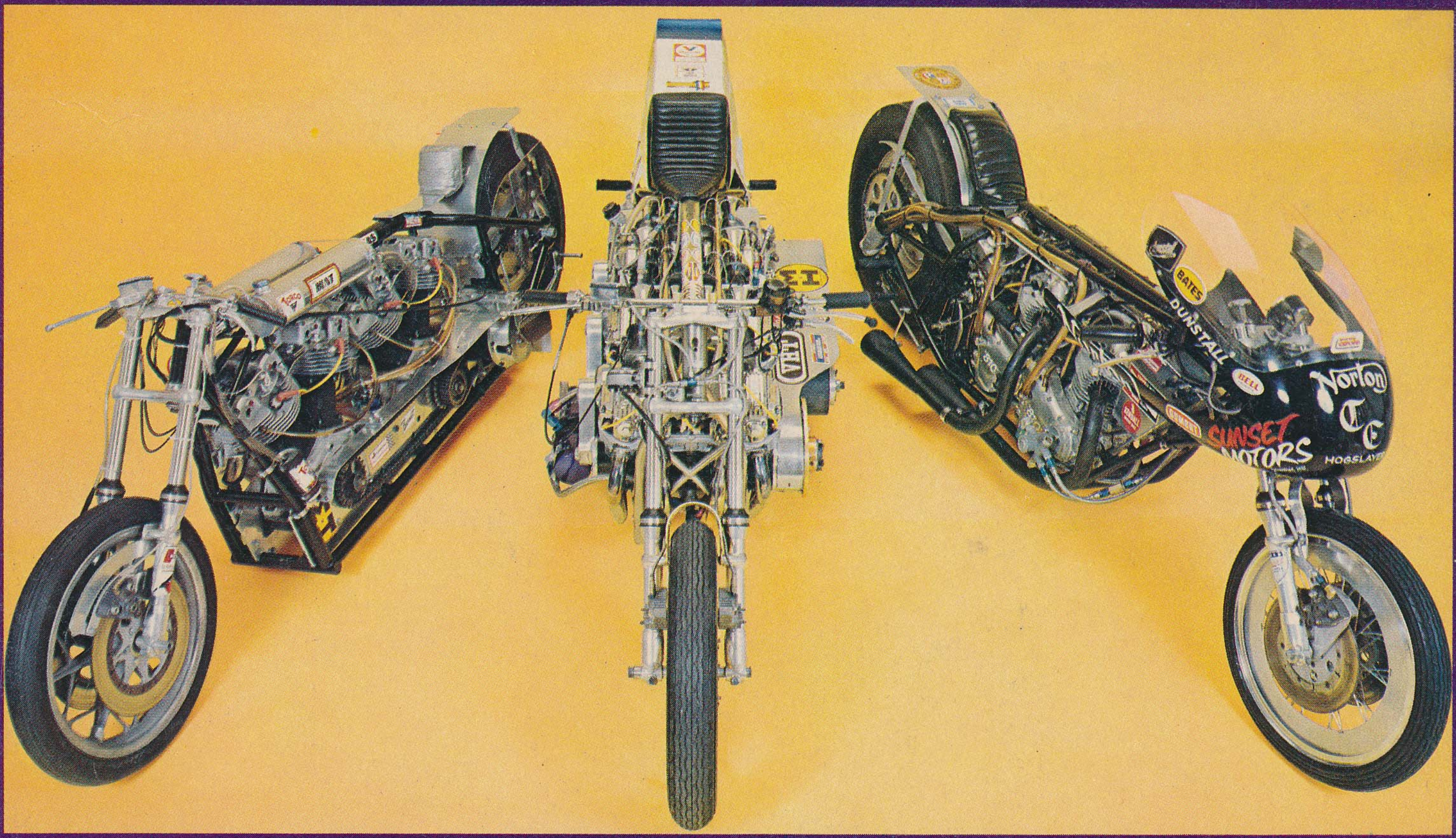
JOE SMITH'S HARLEY-DAVIDSON (8.02 - 183 mph)
T.C. CHRISTENSON'S NORTON (7.93 - 177 mph)



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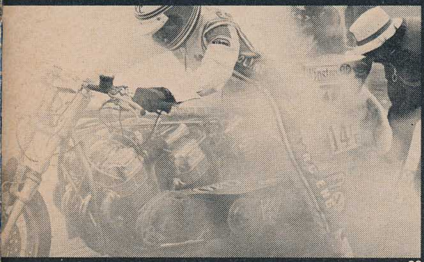
Cycle

February 1976 Volume XXVII No. 2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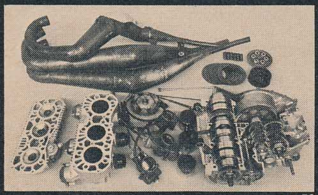
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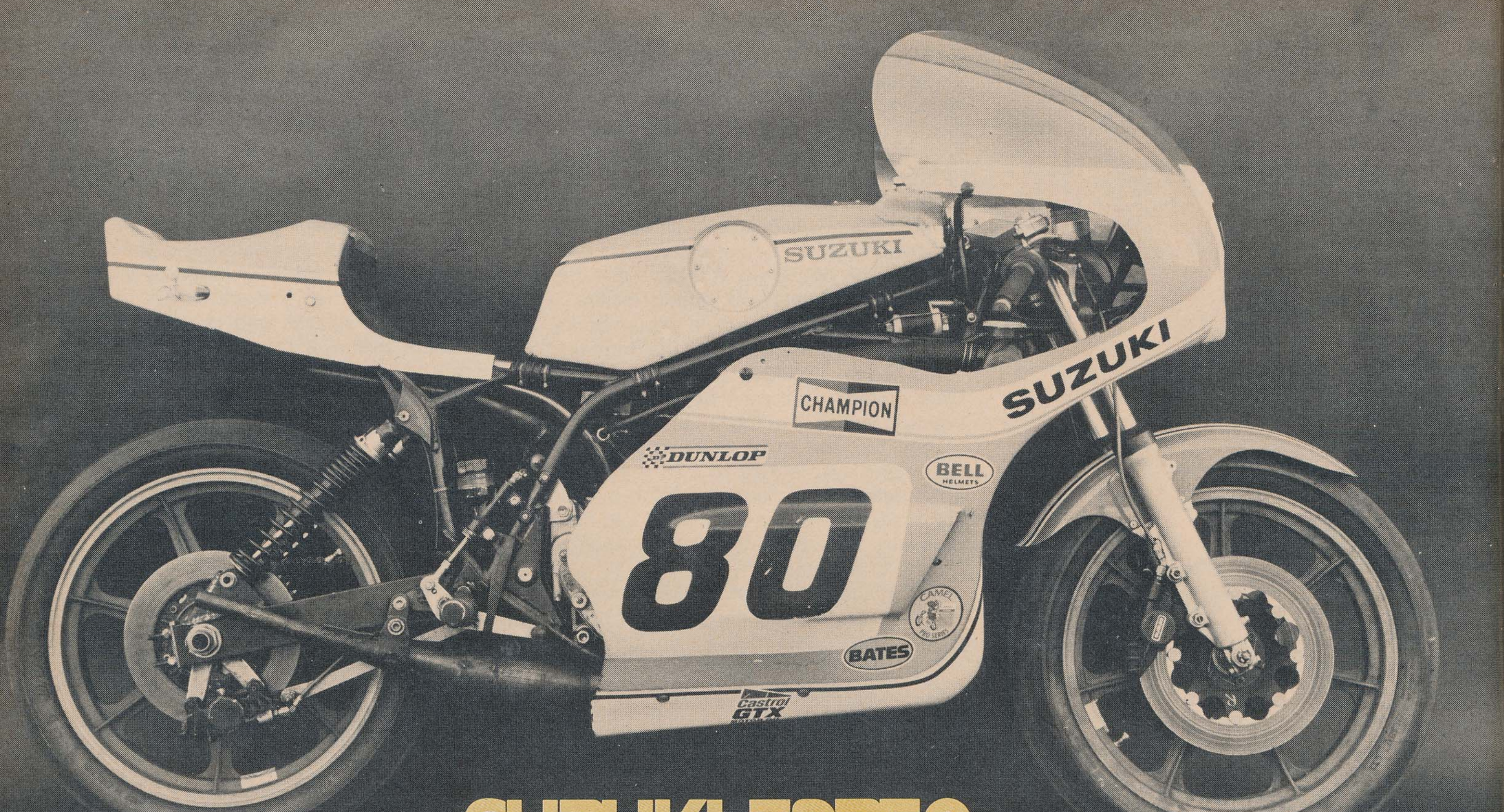
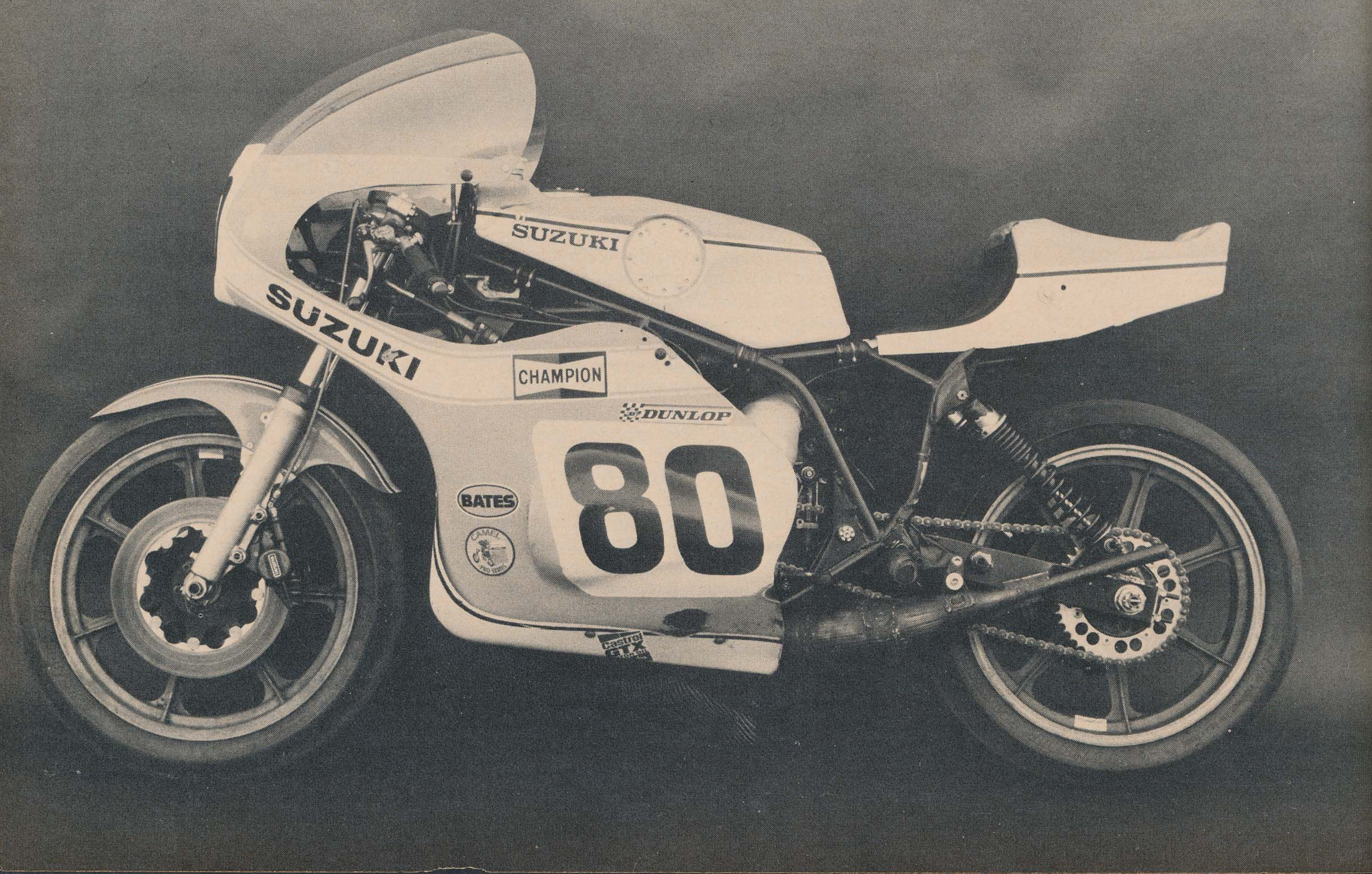
This Month's Cover: Three bikes, seven engines, and 900 horsepower—that's the substance of the machinery Larry Willett was asked to photograph for *Cycle's* February cover. To assemble that much power any other way would have taken ten Honda GL-1000s, 12 Kawasaki Z-1s, 45 Suzuki 125 MXers or 90 Honda CB-125s.



SUZUKI TR750:

AN INSIDE LOOK AT A 115-BHP, 180 MPH HOT ROD MOTORCYCLE



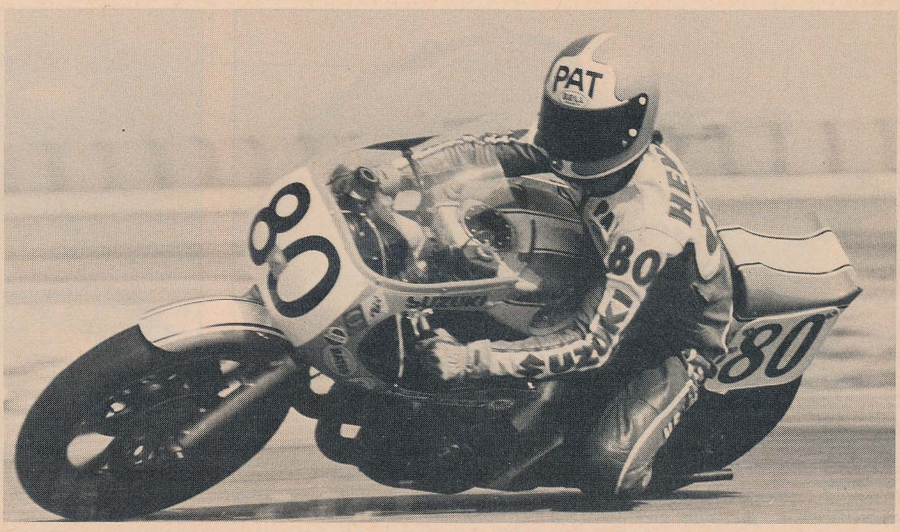
Suzuki's GT750-based road racing bike spotted its major competitor a cylinder, two thousand revs and a dozen transfer ports—and then matched the best for sheer speed.
By Gordon Jennings

● If there is any surprising aspect to the past couple of road racing seasons it is not that the awesome Yamaha TZ750 won so much, but that Suzuki's far less ambitious TR750 remained in such close contention. Yamaha's Four, after all, is the fastest and one of the most intricately-contrived racing motorcycles in history. A relaxation of the AMA's rules virtually invited manufacturers to field 750cc, full-house Grand Prix machines, and Yamaha responded to that opportunity in a manner verging on overkill. Though Yamaha did not initially go right to the displacement limit (the TZ750A's total cylinder volume was 694cc) the overall design followed state-of-the-art parameters. Experience with the touring-model-based TZ350 was reflected in the TZ750, but the latter came into the world a pure racing machine; its highway-cruising counterpart never came to market.

Suzuki must have felt badly caught short when the Yamaha TZ750 appeared on the scene in 1974, and there must have been some closed-door discussions about withdrawing from AMA competition rather than soldier on under a fundamental handicap, which was an accurate assessment of their situation. Displacement limits may encourage performance parity; they do not guarantee it. Not only had Suzuki been placed in an inferior position as regards numbers of cylinders, total port areas, maximum crank speeds and the like, they also faced the unhappy prospect of confronting Yamaha's quintessential racing machine with what may best be described as a hot rod. Behind all the flash and fiberglass Suzuki's TR750 was, and remained, nothing much more than a hyperthyroid version of the GT750 tourer, a solid but unpretentious two-stroke triple available to anybody with a few dollars and solid credit.

In the end a brave optimism prevailed, and Team Suzuki—resplendent in blue and white—did appear to contest the 1974 Daytona 200. And they very nearly upset Yamaha's lavishly-financed apple cart. By way of bracing itself for the Yamaha onslaught Suzuki had come up with new frames to cure the handling problems that had earned the earlier TR750 the nickname "Flexi-Flier," and fitted six-speed transmissions to make the most of the rather improbable horsepower they were wringing from their leaned-on touring engines. They also had the gritty, talented, Daytona-wise Gary Nixon going for them, and hoped they could count on teething problems slowing the all-new Yamahas. Totalled, every plus and minus taken into account, it seemed as though what they had might well be enough. But that kind of bookkeeping can be unbalanced by racing luck, which for Suzuki always has been wretched or worse. At Daytona, in '74, it was incredibly bad: Nixon literally had victory in hand when, in an uncharacteristic lapse of judgement, he decided to zap Agostini before Ago could make the final fuel stop that he, Gary, had already completed. Trying hard for the definitive drive out onto the oval Nixon threw his bike down the road, and Suzuki's win went with it.

That Daytona surely was an agonizing disappointment for Suzuki. Still, it demonstrated that their hot rod definitely was fast enough to run with the *pur sang* Yamaha TZ750, which was enough to keep them trying even though their luck went from bad to catastrophic. However rapid a team's motorcycles may be, wins are going to be very elusive unless it has the services of one or two absolutely first-order riders—of whom there are never more than perhaps a half-dozen in the entire world. Teams may be rounded out with second-magnitude Stars, usually young talents acquiring final polish, but fortune favors those who come to the contest with a couple of genuine Super Stars in good working order. Suzuki has had its share of stellar riders under contract, but all too frequently has not had them available when it counted.



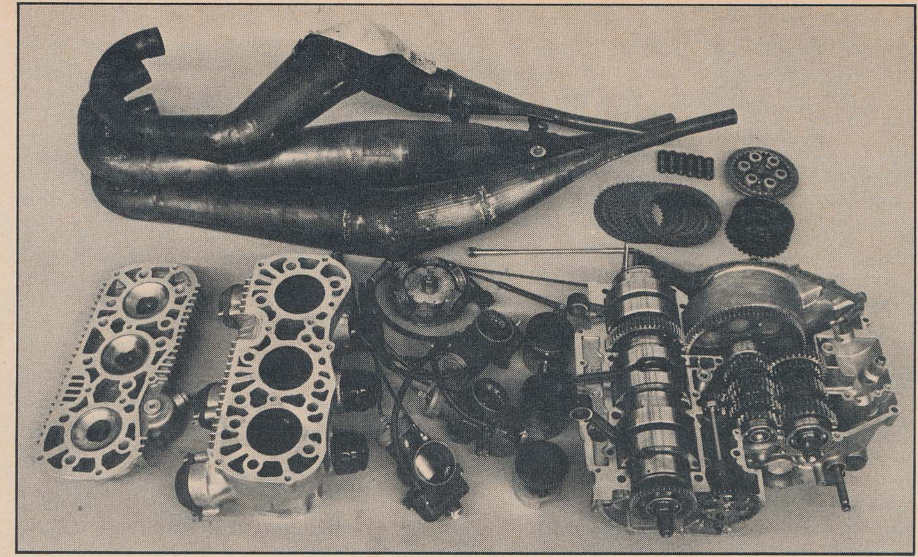
The team might have had Jody Nicholas on the line these past two seasons; he was injured into retirement. Suzuki signed the incredible Cal Rayborn for '74, but he was killed at an obscene little track in New Zealand before the season began. Barry Sheene is a supremely talented Suzuki Teamster, but he has spent more time in plaster than in his blue and white leathers these last 24 months. And Gary Nixon broke everything but his spirit while test-riding in Japan shortly after the '74 Daytona race and was unable to ride until the final event in 1975.

Last year's Ontario was a good one for Gary Nixon, who proved he could come hobbling back full of scar tissue and orthopedist's hardware (which may get rusty before he does) and run like he didn't know anything about pain. But last year's last seems to have been the last straw for Suzuki. Gary could have won Ontario for them had the mechanical demons struck down Kenny Roberts instead of him, only that's not how it was: the demons chose Suzuki again, and it was once too often. Shortly after silence once again settled over Indy-West, word came that Yamaha would not have Suzuki to kick around in 1976. (Kawasaki felt the same way and said the same things—but that's another story.)

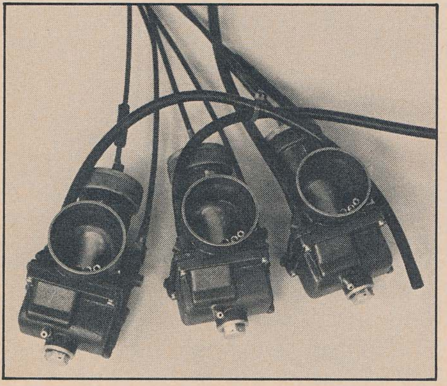
So it was all over but the grumbling. The AMA's records would show that Suzuki entered the TR750 triple in many races, with little consequence to the ultimate outcome. That's a fact. But it also is a fact that the Suzuki hot rod stayed very much in contention, right up to and including the race at Ontario, and that was sufficient reason for us to be very curious about the specifics of how they did it. Suzuki's riders have confirmed the general impression that the TR750 engine is the real chugger, comparatively speaking, that its exhaust note suggests. They tell us the engine pulls hardest at about 8000 rpm and begins to run out of breath well before reaching 9000 rpm. You have to assume it makes very nearly the same horsepower as Yamaha's Four, as the TR750 pushes close to the same amount of air and shows—give or take a click—the same top speeds. The level of performance reached seems natural in the Yamaha, which bests the Suzuki by one cylinder, a couple of thousand revs, and more than a dozen transfer ports; it's astonishing in a tourer-based triple with cylinder scavenging that dates back to Dr. Schneurle's original patents.

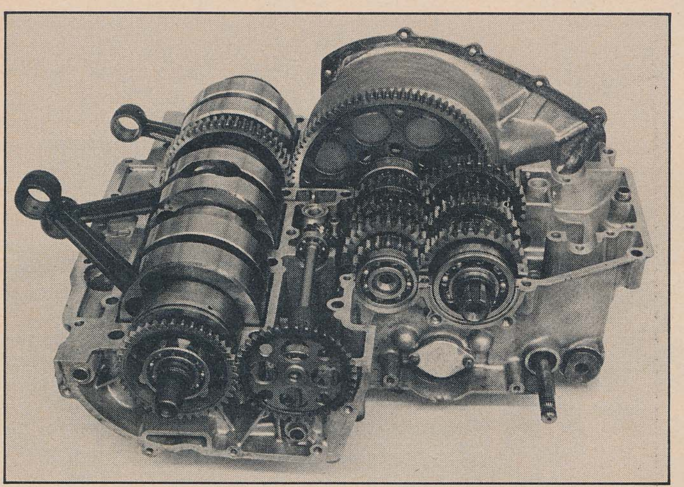
In fairness to Yamaha it must be said that Suzuki's engineers were not laboring against overwhelming odds when they set

In this collection of hardware mean working gas pressures of about 125 psi are generated, made to rotate shafts and gears, and emerge as a 115-horsepower yank at the TR750's final drive chain.

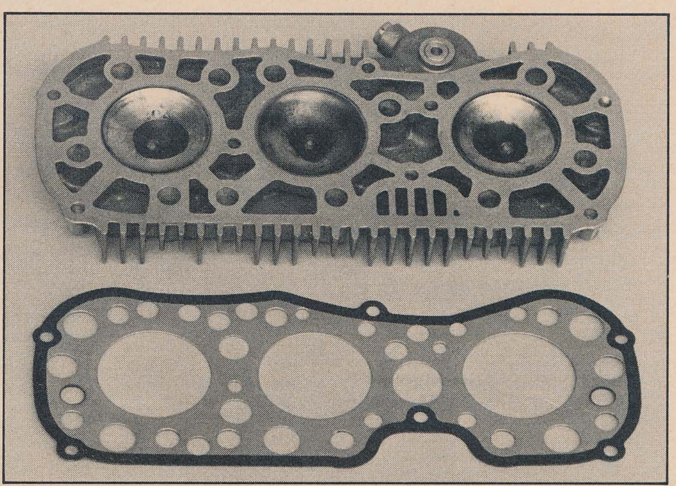


This trio of special, magnesium-bodied Mikuni carburetors cost U. S. Suzuki a staggering $900.

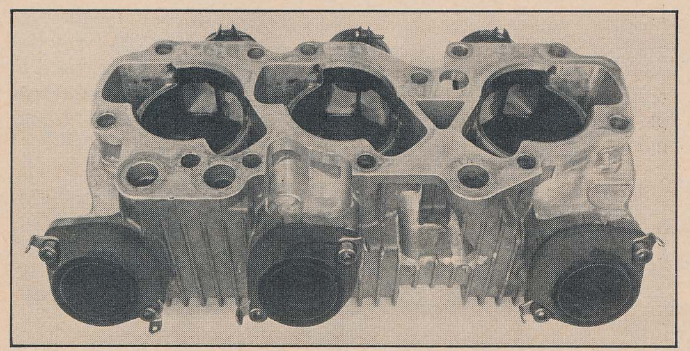




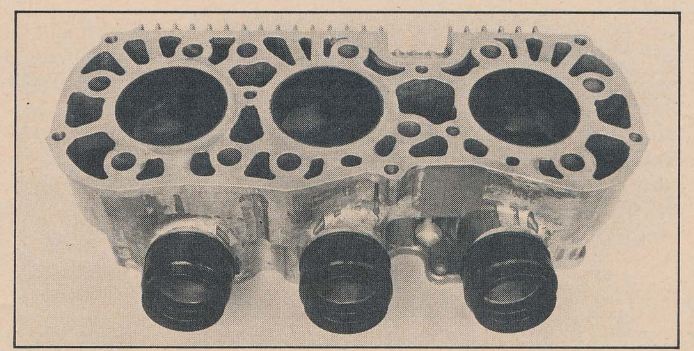
A special crankshaft, and numerous special gears: all those in the six-speed transmission, the primaries, and two of the four water pump drive gears.



The TR750 engine uses thinned GT750 cylinderheads, with the same non-squish combustion chambers, and special head gaskets in varying thicknesses.



Only two transfer ports per cylinder, but fed from very large passages made possible by the angular displacement of all the cylinders' ports.

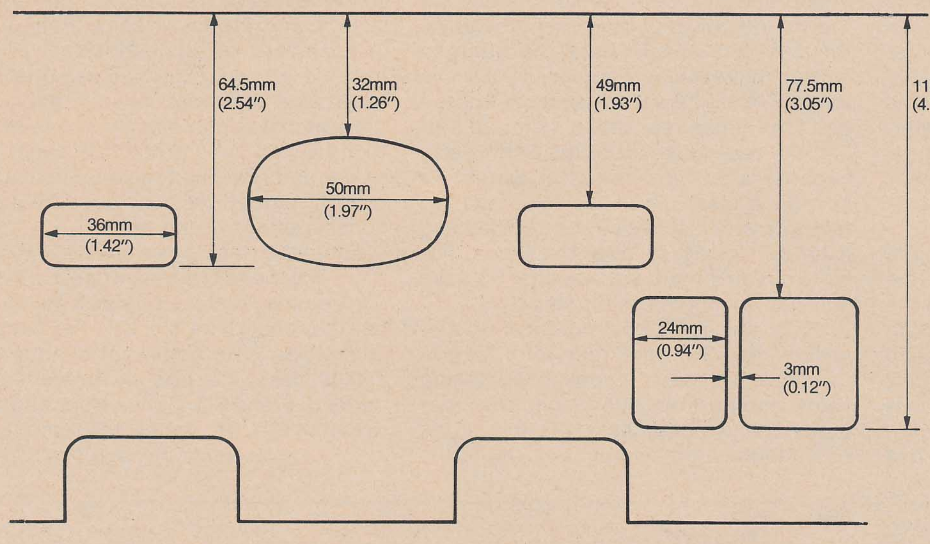


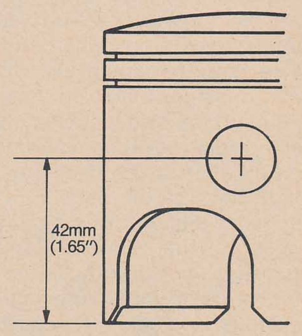
The TR750 cylinder block has been milled and rotary-filed back, front and sides where the casting is unnecessarily thick to remove mere ounces.

out to make the plain-vanilla GT750 engine into a big-numbers horsepower pump. The triple's crankcases are sturdy, its crank and lower-end bearings generously proportioned, and there's as much water in circulation around its cylinders as anyone could want. And though there are only two transfer ports in each cylinder, the port windows are fed by unusually large, well-shaped transfer passages. Instead of forcing the GT750 engine's transfer passages to bang elbows, as they do in most in-line designs, the block was laid out with the exhaust and transfer porting in cylinders one and two rotated about 35 degrees to the left. Cylinder three stands slightly apart from its fellows, to make room for the mid-crank power takeoff gear, and it is turned to the right. If you're going to make a stocker into a racer, you look for something that delivers pretty good power in standard form, offers the promise of more, and is so strong the average rider couldn't break it with a sledge hammer. Suzuki has precisely those characteristics in the GT750 engine.

Knowing all the above, we were still very curious about specifics—though without much hope of having that curiosity satisfied. Whatever the reasons, good or merely reflex, factory teams do not welcome the inquiring reporter into their garages and Suzuki always has been more secretive than most. They'd rarely let anyone past the door, and even when one gained admittance to the *sanctum sanctorum* questions were likely to be taken as impertinences. However, impertinence is the reporter's stock-in-trade and when word came that Suzuki had retired its AMA road racing effort and the TR750 would run no more, we asked for a last, closeup look. "It's all history," we said, "where's the harm?" To our im-

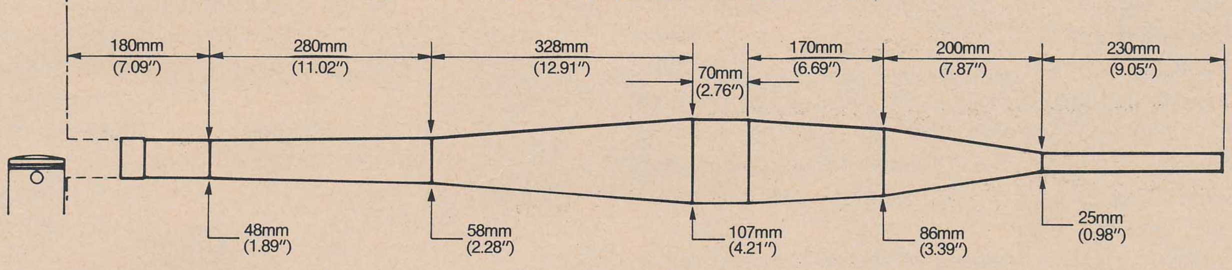
CYLINDER PORTING DIMENSIONS



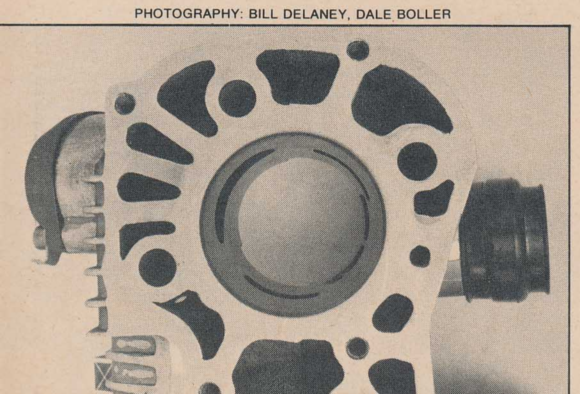


PISTON SKIRT LENGTH

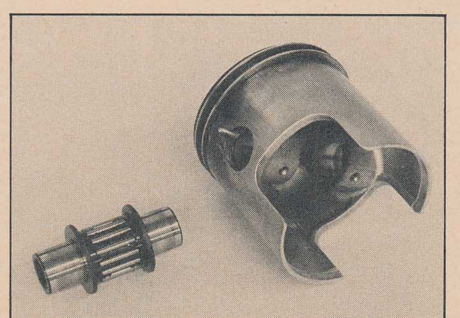
TR750 EXPANSION CHAMBER



PHOTOGRAPHY: BILL DELANEY, DALE BOLLER



The exhaust port's chordal width is no less than 71.4-percent of the bore diameter.



Lateral location for the connecting rod is provided by thrust washers on the wrist pin.

mense amazement the Powers That Be at U.S. Suzuki gave the project their blessing. They would bolt Pat Hennen's Ontario bike together, replacing its failed crank, and deliver it to our door. They'd even provide the services of a team mechanic. We couldn't ride or dyno-test the bike—they didn't want to put that much preparation time into a museum-piece—but we were free to fondle and measure and ask questions to our very heart's contentment.

Suzuki sent us the bike, as promised, and team mechanic Ken Bailey, an affable New Zealander who was trained for working on aircraft and got pulled into motorcycle racing by the late Geoff Perry. Bailey professed to know little about the TR750 other than how its parts are supposed to fit together, and that probably is the role his employers envisioned for him. But he impressed us as being the kind of man who puts a lot into his job rather than merely making the appropriate motions, who has experience and has learned from it (by no means the same thing), and who knows enough to be candid in admitting it when he doesn't have the answer to a question. Much of what we learned about the TR750, especially as regards its chassis, was information provided by Ken Bailey.

Our own scales furnished the first bit of interesting intelligence about the Suzuki TR750: its dry weight is 326 pounds—only four pounds more than that of the TZ750A we had for a similar study two years ago. Add oil, water and fuel and you've got a starting-line weight right at 375 pounds. That's very light, considering that a GT750 tourer has a wet weight of 556 pounds—and it starts one looking for a startling 180 pounds worth of difference. It can't all be in the fact that the race version doesn't have lights, battery or horn.

Some of the weight difference is in the TR750's front brake assembly. It has the dual-disc, twin caliper layout of the GT750, but that's where the similarity stops. For one thing, the GT750 uses floating calipers and fixed discs, and that order is reversed on the racing machine. The TR750 calipers are of the dual-piston type, visually similar to the British Lockheed calipers used on some Triumphs. The discs are two-piece affairs, each comprising an eight-point dished hub that appears to have been machined from an aluminum blank, and the disc proper—which is aluminum with a plasma-applied hard coating on its rubbed surfaces. Early versions of this brake had hub and disc solidly together, but it was found that heat-produced distortion made the disc wobble, the wobble would drive the actuating pistons back into the caliper, and the riders would find themselves having to pump away the slack by working the lever before the bike would actually begin to slow at the desired rate. Attempts to prevent disc distortion failed, so they attached the disc to the hub with large-diameter shouldered bolts, which serve as drive dogs engaging with half-circle cutouts in disc and hub. In that manner, even though the disc wobbles, the lateral movement can be accommodated away from the calipers; the disc runs true as it passes through the pads.

Ken Bailey told us, "Racing riders can't get enough front brake as long as the brake doesn't get grabby." This was the reason for using fairly soft, high-friction Mintex pads. Ken said the pads furnished with the original TR750s were extremely durable, but all the riders wanted more powerful braking even at the risk of finishing the pads before they finished a race, as once happened to Cliff Carr at Laguna Seca. But the rear brake is another matter, as Bailey explained:

"I use the harder pads on the rear brake, and cut them narrower, because they're too powerful for most of the guys. David Aldana doesn't care—he wants to lock up the rear wheel and go in sideways anyway—but riders who use more finesse don't like much rear brake. I started cutting the rear brake pads for Geoff Perry because after he crashed in Singapore he had a steel pin in his foot, and his foot was very insensitive. He kept locking it up and going all over the place. For him I cut until there were almost no pads left—just a couple of thin strips."

Oddly, the TR750 did not have an aluminum rear disc; the rear rotor was in cast iron, with cast-in cooling/lightening vents leading from hub to rim. The rear brake disc is bolted solidly to the Morris cast-magnesium wheel, but the drive sprocket on the opposite side of the wheel transfers power *via* a rubber-bushed cushion-type hub. The drive cushion is provided to protect the chain (Denselube, which Ken says "gets dry and rattles, but lasts"), and the bikes came from Japan with a roller-type chain tensioner pivoted from the left swing arm member. The bikes also came with wire wheels, and when the switch was made to Morris mags they found a clearance problem between tensioner and rim. The tensioners ultimately were discarded, without any unpleasant consequences to the chain.

About the wheels Ken says, "The riders really like them. The cast wheels are more rigid, so they feel the bumps a little more, but they really like the way the handling is steadied." He adds that although the TR750 has wide rims by present standards (2.5 and 3.5 inches front and rear, respectively) he thinks the motorcycle

(Continued on page 90)

SUZUKI TR750

ENGINE

Type	Two-stroke, piston-port, triple
Bore and stroke	70mm x 64mm
Piston displacement	738cc
Compression ratio	6.76:1 (variable)
Lubrication	Fuel/oil premix, 20:1 (Shell Super M)
Ignition	Suzuki P.E.I. (Pointless Electronic Ignition)
Spark Plugs	Champion N57G or N82G
Port Timings:	
Intake	opens/closes 90° below top dead center, 180° duration
Transfers	open/close 112° below top dead center, 136° duration
Exhaust	opens/closes 80° below top dead center, 200° duration
Carburetion	3; Mikuni VM38SC
Jetting:	
Main jet	280 to 330
Needle jet	R-2
Jet needle	6DP5-2
Pilot jet	45
Air jet	none
Slide cutaway	2.0
Idle air screw	1½ turns out
Bhp @ rpm	112–115 @ 8200 (estimated)

DRIVE TRAIN

Primary	Straight-cut spur gears
Clutch	Multi-plate, dry
Transmission	Six-speed, constant-mesh

Internal ratios (overall, with 17/41 Ontario sprockets)

(1) 2.19:1 (8.30:1) (2) 1.63:1 (6.19:1) (3) 1.33:1 (5.06:1)

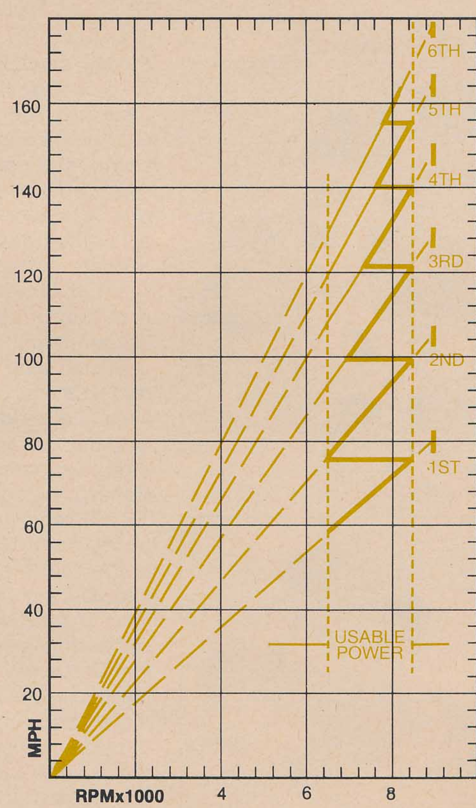
(4) 1.15:1 (4.38:1) (5) 1.04:1 (3.94:1) (6) 0.96:1 (3.65:1)

CHASSIS

Wheelbase	57 in.
Rake/Trail	29°/4.17 in.
Frame	Cradle-type, in chromium-molybdenum steel tubing
Wheels	Morris cast-magnesium, 2.5 x 18 front; 3.5 x 18 rear
Tires	Dunlop 3.25 x 18 front; 3.50 x 18 rear
Suspension	Fork and shocks by Kayaba (per Suzuki specifications)
Brakes	Dual-piston calipers, twin-disc front; single-disc rear

WEIGHTS & CAPACITIES

Weight, dry	326 lbs.
Oil capacity (trans.)	2.7 qt.



SUZUKI TR750 *Continued from page 54*

rims of the future will be made even wider because that's the way tire sizes are going. "Every time we go to a wider tire the riders like it better because the bike handles better and they can go faster. We can't use anything wider now because the chain's in the way; we'd have to move the chain line to use a wider tire."

The TR750's chassis is, in most ways, a study in contemporary orthodoxy. The rear suspension has its spring/damper units tilted forward to get more travel, as is the case with Suzuki's motocrossers: "There's six or seven inches of travel; I haven't measured it." The rear shocks and the front fork are supplied, to special order, by Kayaba, and the frame is yet another variation on the old Norton Manx theme but with the upper main tubes straightened in the modern manner to more closely follow the load path from steering head to swing arm pivot. The main frame tubes have an outside diameter of 29mm; those forming the rear subframe are 22.5mm. We didn't think it wise to saw frame tubes apart just to get wall thickness, and Ken couldn't provide that information, but frames' incidental bracketry usually is made in the same thickness as the tubes themselves and the TR750's brackets are of 2.35mm-thick material. The frame is all in steel, of chromoly specification, but the swing arm is fabricated from 35mm x 60mm rectangular aluminum tubing with a 3mm wall. The axle slips through machined aluminum blocks that are a slide fit in the swing arm ends, and positioned by two adjustment bolts on each side, with broad-based spacers and plates to make the whole assembly very rigid when the axle nut is pulled up tight.

Taken overall, the TR750's chassis is a very tidy piece of work, which is how such things should be, and the primary reason for the bike being as light as it is. Rumors about wide-spread use of titanium were true in 1974, Ken confirms, but most of the exotic-alloy fittings were duplicated in ordinary aluminum for the '75 season, and in either case the weight reduction obtained was very small. You can marvel at the beautifully machined titanium engine-mounting through-bolts, and handle the feather-light aluminum engine side-cover screws as though they were pearls, but the weight difference between those special items and stock parts in mundane steel is of less consequence than riders' appetites.

While we were having our conversation about weight, Ken was pulling the engine out of its rubber-bushed mountings, a job that begins with disconnecting wires, cables and radiator hoses, and slipping the carburetors out of their neoprene manifold spigots. And those carburetors *are* light. They're special magnesium-bodied mixers made by Mikuni (originally for the 500cc GP Four, Ken thinks), and three of them are a full pound lighter than the equivalent 38mm aluminum-bodied Mikunis. But the thing that really distinguishes them from the ordinary, off-the-shelf 38mm Mikuni is not their weight (0.33-pound lighter) nor what they do for power (nothing the earlier aluminum 38mm instrument didn't) but their price. Ken informed us that his understanding was the trick Mikunis cost U.S. Suzuki no less than $300.00 apiece; a staggering $900.00 a set.

The next ancillary component to come off the bike was the rotor and stator for the TR750's CDI ignition, and that too brought forth some surprises. First there was wonderment that the stator carried no spark-trigger coils. Ken cleared that point by telling us that the stator's six energizing windings also serve as triggers, their rectified pulses firing all of the engine's three spark plugs simultaneously at 120-degree rotational intervals. We would have supposed that arrangement might fire the charge in the cylinder being scavenged, as well as the one coming up on compression, but the engine obviously does run without anything of the kind happening. The surprise came when, while pondering the potential consequences of the simultaneous sparking, we asked Ken for an ignition timing figure . . . and he promptly said he didn't know. "The timing is built into the ignition," he said. "They don't even tell us what it is. This year they sent us three different types of ignition systems, and they'd say 'this one is more reliable' or 'it gives a slightly different timing' but I've never known what the timing was; they don't tell us anything like that."

All of us have devoted much effort to getting various engines timed just right to suit particular track conditions and fuels, and we wondered how Suzuki could get away with their mysterious, one-setting ignition. Ken couldn't explain beyond simply saying it worked, but he did add that the Team's fuel isn't the uncertain stuff you get at the nearest gas station. They use lab gas, which isn't necessarily made for a high octane number; it is compounded to very rigid specifications, with no surprises lurking in the can. And when you don't have to adjust for variations in fuel quality there's less reason to adjust spark.

With the TR750 engine free of encumbrances we lifted it out of the frame, placed it on the scales, and added the carburetors and ignition components already removed. The whole pile came to only 132 pounds, which is very light, and that set off some half-joking speculation about what might be missing inside the cases. Nothing was. It was all there, and most of it looked much like what you'd find inside a standard GT750 engine but with more gears in the transmission and bigger port windows in the cylinders.

If there was anything special about the crankcases we couldn't spot it. Ken says some of the cases have been lightened by machining away a bit of metal here and there; this set hadn't been touched. There was a special side casting, in magnesium, to leave the TR750 clutch outside in the air instead of inside with the oil, but that apparently requires no change in the cases themselves. The clutch is one of your typical multi-plate assemblies, with 17 plates and an aluminum hub. Ken says it needs little attention and causes no problems.

Numerous special gears have been fitted inside the Suzuki racer's cases, including a steel replacement for the nylon transfer gear in the water pump drive. And while the stocker has helical primary gears, with a 49-tooth cog on the crankshaft and one with 82 teeth at the clutch, those in the race bike are straight-cut and the driven clutch-hub gear does not incorporate the touring model's drive-cushion springs. Also, the number of primary gear teeth has been reshuffled, with 54 at the crank and 85 at the driven gear, which changes the ratio from the standard 1.67:1 to 1.57:1.

Of course, most of the special gears are clustered in the six-speed transmission, which has been shoe-horned into quarters intended for a five-speeder. The effects of crowding are clearly seen in the widths of individual gears and in the proportions of the engagement dogs. Everything looks too frail to survive the hundred-plus horsepower being fed through the transmission. Stresses are greatest on gear pairs that provide the largest ratios (the smaller gear will be comparatively weak) and the Suzuki six-speeder's crowded cogs get only the width needed to cope with their particular load, and nothing more. First gear has the highest ratio (2.19:1) and gets the widest teeth—14.5mm; the teeth on the pair of gears that produce the transmission's 0.962 top gear have a 10.2mm width; the rest fall between those dimensions. Gary Nixon had a transmission failure at Ontario, but that was a consequence of clutchless shifting, itself required by a clutch cable failure (an end fitting pulled off). Bailey says abuse of that sort is the only thing that will break the TR750's gearbox. A few early problems ended after the Team began slightly overfilling the gearcase (2600cc instead of 2200cc) with Castrol hypoid oil.

The TR750's crankshaft is a special part—but not very, if its appearance is worth anything as evidence. Like the stock crank it contains a lot of metal, and is basically six flywheels joined with pressfit pins. The crank runs in upgraded mainbearings, and we are told that the balance factor is different than that built into the stocker. The connecting rods look like standard parts, but the rod bearings are high-speed specials. According to official factory specifications the engine's redline is at 9500 rpm, but our various sources say 9000 is a more realistic maximum, and 8500 is advisable if one plans to finish a race of more than a few miles duration.

Putative redlines become unimportant in light of the fact that the TR750 engine makes its best power at about 8200 rpm, which isn't much above what the stock crank will accept without immediate complaint. And the really remarkable thing is that this engine can be expected to pump out 112–115 bhp without having to be spun like a turbine. This output represents a brake mean effective pressure very close to 125 psi, far above the performance of the vastly more elaborately ported Yamaha TZ750. We do know, now, that the racing TR750 engine does retain the same basic porting layout as the touring GT750, has the same combustion chamber configuration, and pistons that look as though they came out of the same mold.

The pistons and rings are not stock; they only appear to be. Comparative measuring shows the racing pistons' skirts to be 1.5mm shorter than those of stock GT750 pistons, and the alloy has a higher silicon content (for better control of expansion and added strength at high temperatures). The number and positioning of rings on the racing piston is the same as stock, as is the 1.5mm ring thickness, but the rings are made of special nodular iron—which is ductile, unlike ordinary cast iron—and the piston crown is machined clean instead of being left in the as-cast condition. Suzuki long ago adopted the practice of providing lateral location of the triple's connecting rods by means of thrust washers inside the pistons, and this is continued in the racing engine. The conventional approach is to place the thrust washers flanking the rod's crankpin end; that is mechanically more convenient, and cheaper, but less satisfactory in terms of high speed reliability. Thrust washers on the crankpin are exposed to very high surface speeds where they scrub against the rod-end and crank cheek. The scrubbing, when it becomes really vigorous, will produce enough friction to overheat both the thrust washers and the bearing assembly, causing the lubricating oil film to flash into non-lubricating vapor. Bearing failure then follows within seconds. With Suzuki's piston-located rods there is only the comparatively slow movement of rod-swing against the thrust washers, and the point at which the bearings encounter difficulties is moved much higher.

It says something about the Suzuki triple's design, and the efficacy of using special hyper-eutectic piston alloys, when you consider that in both the racing and touring versions the correct piston/cylinder clearance is less than .055mm (.0022-inch). The cylinder block's iron liners are fairly thick and well-supported by surrounding masses of aluminum. Add to that all the water-jacketing and you get an engine that seldom suffers from the piston seizures once common in high-output two-strokes. Even the racing engine, which has a cooling system effectively identical to that of the tourer (the TR750's radiator is a bit taller and narrower than the one for the GT750), seldom has seizure problems. Ken Bailey says the racer's pistons will stick if something has gone terribly wrong, like a bad choice of jetting causing severe detonation or a blown head gasket letting the water escape, but those things don't often happen. The engines have no thermostats, and the water temperature will stay around 80–90° C. On a very hot day, as was encountered at the last Ontario event, the gauge may climb to 100° C. or even a little higher, but the pressure cap on the radiator keeps the water from boiling, and while there's a loss of power when the engine overheats, the pistons keep pumping.

Suzuki's choice of combustion chamber configurations makes a lot of sense in terms of their touring triple; they use a milled but otherwise unmodified cylinder-head on the racing engine and it is, in racing context, something less than a perfect choice. The combustion chambers are wide open, having no squish bands at all, and that's good for fuel economy; it doesn't provide a degree of combustion-process control compatible with high compression ratios. Ken says the Team adjusts compression ratios to suit conditions, and that they have to be careful. "We've got heads that have been milled from .5mm to 1.5mm, and three or four types of head gaskets. There are several combinations we can use, but some will blow the head gaskets very readily. When we want more acceleration we'll go to a thinner head or head gasket, if we can get the combination to live, but the higher compression does cut down the top speed a little bit."

The engine we examined had "0.5" stamped on its cylinderhead, meaning its combustion chambers were 0.5mm lower than stock. With the head gasket used at Ontario, a high-speed circuit, the trapped compression ratio (calculated from exhaust-closing to TDC) was only 6.76:1—almost identical to that of the first GT750, and below the new GT750's 6.9:1 ratio. That's not much compression for a racing engine, but it is probably about all the engine will tolerate. Open, non-squish combustion chambers expose the entire piston crown to the upper-cylinder conflagration, and the TR750 pistons we saw had been operating close to their thermal limit. The pistons' rings had been sealing beautifully, and there was little evidence of scuffing or scoring on their skirts, but the underside of each crown carried a layer of baked-on castor oil that had turned pitch black. That color is normal in a racing piston; it's what you see when the engine is working hard. It also is just a notch from the temperature that will make the baked oil char—and the piston crown cave in.

The castor-based oil in question is Shell's Super M, which is degummed, fortified and lots of other things . . . but not really available. Suzuki abandoned their automatic oiling pump when they installed six-speed transmissions; they pre-mix the Super M with the fuel, one part of oil to 20 parts of gasoline. There was some oil in the fuel (mixed about 35:1) when they were still using the pump, and it was the same Shell racing oil. Don't bother asking your local Shell service station operator for the stuff, because he can't get it and neither can anyone else who doesn't have contacts abroad.

Half the two-stroke horsepower battle is fought with expansion chamber exhaust systems, and for the benefit of those who may be tempted to try for a hundred-plus-bhp GT750 we have presented a dimensioned drawing of a TR750 chamber. We've tried to give you accurate measurements of the expansion chambers on the TR750, as we assume they were intended. The actual hardware is a little cobby, oval where it's supposed to be round, etc., and some error probably has crept into the picture. We think we're pretty close with the dimensions, and with the cone angles: two degrees for the first section of the diffuser; eight degrees for the second cone; and a shallow seven degrees into the first part of the baffle, which then steepens to 16 degrees (all these being included angles). The very short distance from the port window out to the first diffuser section, only 180mm, would give an extremely narrow power band if the exhaust pulses were puffing into a more divergent cone; the two-degree section probably behaves almost like a straight pipe, giving enough length between the engine and the main part of the expansion chamber to broaden the power spread. A final point worth mentioning is that although we have drawn the TR750 expansion chamber in a straightened configuration it does actually curve leaving the port. Those who want to construct similar expansion chambers should ponder the difficulty of hand-hammering a shallow cone into a curve, and think seriously about using ordinary parallel-wall tubing to bridge the 460mm distance between the port and the main diffuser.

Do-it-yourself types will have to think more than twice before they try to reproduce the TR750's transfer and exhaust port dimensions in a stock GT750 cylinder block. In the first place, the race-engine porting is too radical for anything but racing. Second, there isn't really enough metal above the ports in the stock block to let you carve to racing dimensions without running the risk of breaking through into the water jacket. The top of the exhaust port window, for example, is fully 6mm higher than the same opening in a new-type stock GT750 block, and 8.5mm higher than in the early one. Both old- and new-type blocks have their transfer port roofs 53mm down from the cylinder's top edge; the racing block has its transfers down 49mm.

People who have something more than a nodding acquaintance with the AMA's rules will wonder, knowing the above, if maybe the fact that the TR750 we examined had a non-standard cylinderblock casting didn't move it just a fudge-factor of distance to the wrong side of racing legality. We certainly wondered, enough to investigate the matter, but quickly found ourselves mired in a syntactic bog—the AMA rule book. Suzuki concedes that the TR750 cylinder block is a special casting, while taking the position that such castings are permitted by the AMA's rules—which forbid non-approved crankcase, cylinderhead and gear case castings but make no similarly specific mention of two-stroke engines' cylinders. That's odd, considering the book's straightforward prohibition of special cylinders for four-stroke engines, but that's how it reads, and the people who loaned us the TR750 for close study surely would not have done so had they thought it was an illegal motorcycle.

Our own perusal of the rule book had its usual effect—that of leaving us even more confused than ever—so we asked the A.M.A. to render an official opinion. After an entertaining display of semi-official and contradictory opinions, General Manager Ed Youngblood finally took charge and gave the Suzuki 750's special cylinder assembly his, and the AMA's, blessing—while conceding that "there might be a slight gray area with regard to the AMA rule book." Youngblood got in the Final Word by stating categorically that the specially-cast cylinder block was absolutely legal from an FIM point of view, and ended the conversation by saying, "The AMA is going to have to make it very clear before Daytona that people can change the casting." We find it difficult to imagine privateer foundries warming to the task, but there you are.

Before you back-yard experimenters abandon hope of having your own hundred-horsepower Suzuki, or start trying to pry a racing block out of the factory, you should know that the special block really isn't very special. Sure, the transfer and exhaust ports reach higher on the cylinder than their stock counterparts, but that's nothing you can't do by taking a different approach. The racing transfers have the same shape and width as those in a stock block, and there seems to be enough metal on both sides of the exhaust port to allow for plenty of lateral carving. All you need is height, and we have a suggestion about that: insert a 4mm-thick spacer under the late-series cylinderblock and cut a like amount off the top of the block to get the compression back. Then cut the bottoms of the transfer windows 4mm lower, and do the same to the exhaust port—there's plenty of solid metal below these port windows. You will then only have to trim 2mm above the stock exhaust port to get racing-block port dimensions for cylinder entry and exit. That leaves only the intake, which can be handled by lowering the port floor (and the port window's lower edge) 3mm, and trimming the rear of the stock piston's skirt 2.5mm.

Just in case anyone wants to go all the way with their Suzuki GT750 we've also provided specifications for all the racing carburetor jetting. We don't know what you'd have to do with the clutch to make it hold the power; we're sure anyone who'd tackle the rest of it would find a way. Making up a six-speed transmission obviously is out of the question for anyone but a millionaire, but we have a hunch that the stock five-speeder would be fine for a machine geared to do maybe 120 mph at the top. The power band is not too narrow, and there's such a lot of power that you'd have a really thrilling ride even if the engine dropped off the pipe every time you shifted. We've told you all about how Suzuki got the power; it's something to think about. ◉