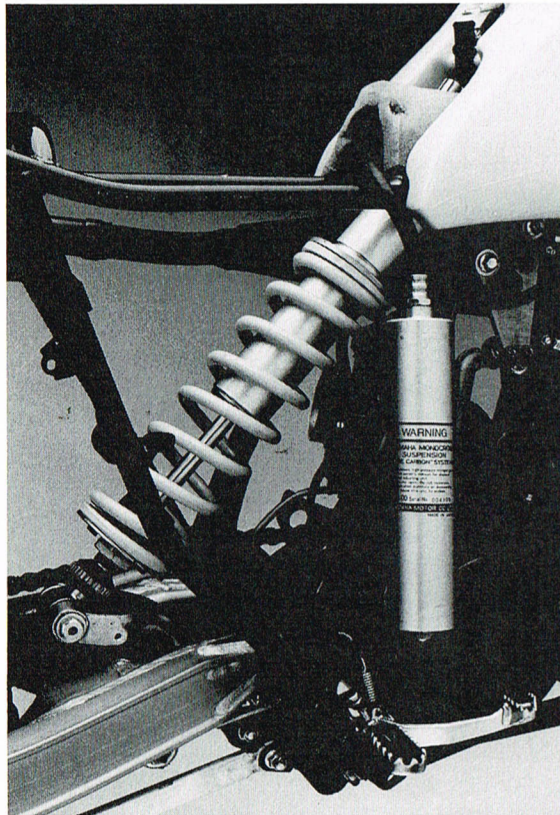


8 The Stock Exchange



This revised version of the rising-rate monoshock suspension was introduced on the K series of YZs and remained unaltered through to 1986

After the disaster of the previous year, 1983 would be critical for Yamaha. The poor showing of both production and works machines had severely tarnished their image as top motocross manufacturer and a poor image hit the sales figures hard. This wouldn't have been so bad if off-road motorcycle sales were booming; a lower percentage of high sales can still turn out to be a lot of motorcycles. But there was no boom. In fact motorcycle sales had been declining since the peak at the end of the 1970s, and in 1982 the drop in sales had steepened. So, in order to maintain a steady income, every company was forced to go for a greater market share. The machines had to be good and the image one of success. Yamaha had neither in 1982. If this didn't change, the real possibility existed that the YZs would fall seriously behind their native competitors' models in terms of excellence. This would probably prove fatal for the company since its philosophy of continuous evolution would stifle the technological innovation that would be needed to bridge the ever-widening gap. The result could be the end of the company's involvement with motocross.

Yamaha had no intention of letting this scenario develop and thankfully there were some bright moments at the end of the 1982 season as the first 1983 production machines became available. In the US, Glover and Johnson took pre-production YZ250Ks to 1st and 2nd place at the last Supercross event at San Diego.

The bikes were 100 per cent stock and were handed over to a local radio station after the night, to be raffled. The winter-run five-event Trans-Cal series was also dominated by Yamaha, Glover taking the 250 title and Bell the 500. It seemed as if Yamaha had seen the danger and had produced machines that would get them back to the top. In fact this was not entirely true.

Two of Yamaha's six-machine K-series line-up were not changed significantly. The YZ60K got a new cylinder with wider inlet port and wider and higher exhaust port to boost power a little, but nothing else changed. The YZ60 had been unchallenged in 1982, but with the arrival of hi-tech Honda and Kawasaki machines in the class, it was no longer the undisputed king. In particular the Green Meanie with its powerful engine, long-travel suspension and rising-rate suspension challenged the YZ for the title of class champion.

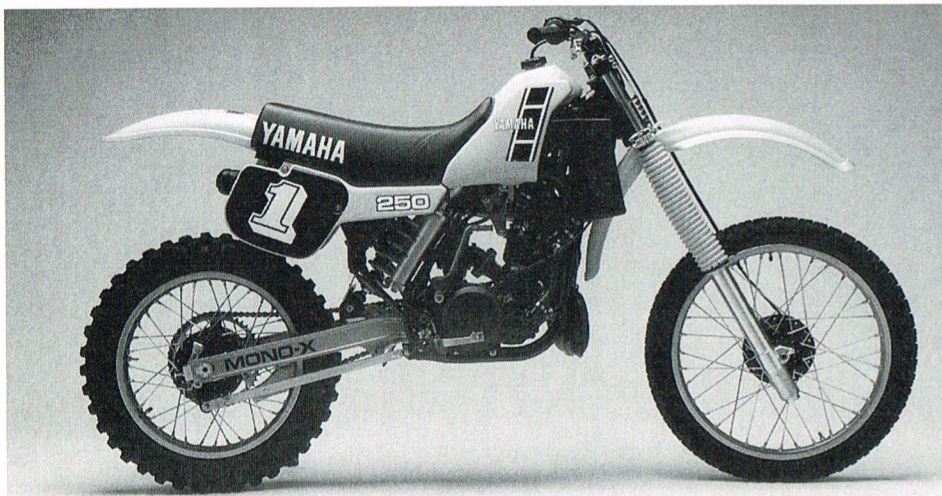
Without another manufacturer in the 100 class to compete with, the YZ100K was unaltered, apart from decal changes, from its predecessor. All other models underwent a considerable upgrade in two main areas, the cooling system of the liquid-cooled bikes and the rear suspension for all of the series. It was these two areas that had caused so many problems for the J models and it was clear that Yamaha were responding directly to the criticisms that had been levied at the two designs. A redesign of the layout of the cooling system resulted in the repositioning of the radiator. The fork-mounted radiator had upset the front-end steering and also affected the performance of the front fork due to the hot air raising the internal air pressure by as much as 10 psi.

On the YZ80K, the single radiator was now mounted on the front downtube of the frame, offset to the right-hand side of the engine to reduce clogging from the front wheel and to place it squarely in the airstream. In addition a plastic shroud on the outside of the radiator helped protect it from dirt and debris and a

crash-bar fitted to prevent destruction at the first slide-out. A simple two-hose arrangement carried the coolant from the base of the radiator to the pump mounted on the right-hand end of the crankshaft, returning via a hose from cylinder head to the top of the radiator. A safety vent in the radiator cap was piped to the rear of the bike out of harm's way.

The other major change adopted throughout the K series was a revised Mono-X suspension. After the criticism leveled at the J-series Mono-X by press and customers, fully supported by the opinions of their own factory riders, Yamaha redesigned the rear suspension. Of all the suspension systems produced by the competition, the new Mono-X was most like Honda's Pro-Link, in that the compression of the damper was imparted at the bottom of the spring rather than to the top via connecting rods as on the Uni-Track and Full-Floater systems. There was now a single aluminium pivot-arm with three mounting eyes. The front lower eye was attached, via a short connecting rod, to the frame. The rear lower eye was bolted to the forward face of the cross-bracing of the swinging-arm and the upper eye to the bottom of the damper. On the YZ80K all pivots turned on phosphor-bronze bearings, whereas the other models used roller bearings for the frame and swinging-arm pivots. Also grease nipples were fitted on the 125, 250 and 490 but surprisingly omitted on the 80. The upper end of the damper bolted to the end of the backbone rail of the frame and was therefore far shorter and, angled at about 45 degrees, closer to the vertical position of the other rising-rate systems.

One thing was certain about the new system, there was no way of estimating the change of leverage ratio over the wheel's arc of travel with the naked eye. There were too many pivot points to get a feel for the way the spring would be compressed, but Yamaha claimed that it was softer over the first third of travel, to take in the stutter bumps, and harder over the rest to prevent the



In the hands of an expert, the YZ250K was the fastest stock machine in its class

bottoming that occurred on the J. On the YZ80K it worked well, after the rebound damping and spring preload had been set up for the rider.

Other new items on the 80 included a new cylinder, head and pipe, giving the engine slightly more low end and a good top-end boost. All shafts in the engine were drilled to cut weight and this contributed significantly to the 5 kg reduction. The transmission was not touched otherwise but the carburation was modified for the new engine porting. Actually the first batch of YZ80Ks delivered to the US did not have rejetted carburation and needed to be called in for a dealer service to put them right. The repositioning of the radiator forced the use of a cutaway petrol tank, and the frame needed some extra lugs welded to accompany the revised rear suspension. The only other significant change was the upgrade of the front suspension to 33 mm diameter stanchions and an additional 15 mm of travel, to complement the 20 mm increase at the rear end. The total package of the YZ80K was a great improvement over the J but as so often happens, the others had improved more. The KX80 of Kawasaki had the most powerful engine, and the rest of the package was good enough to make it the best 80 cc motocross machine of

1983. Both the YZ and RM were close second-bests, the RM handling better and the YZ having a better engine.

Apart from the new Mono-X suspension and liquid-cooling system, the YZ125K underwent a serious weight-saving programme that succeeded in paring off 3.5 kg and bringing the figure down to the FIM minimum for the class. The sources of the saving varied from the thinner walled frame tubing and lighter alloy wheel rims to plastic water impeller instead of steel and a round slimline cylinder jacket. The weight saved was probably as useful as an extra pony from the engine. The 1982 YZ125 had been the fastest of the class, but with a very peaky delivery. Yamaha decided to mellow the power a little, concentrating on increasing the mid-range. The most conspicuous consequence of this decision was the new exhaust that exited straight out from the exhaust manifold and didn't bend up and over the engine until it almost fouled the front mudguard. The longer header pipe would knock a little off the top end but increase the low-to-mid-range torque.

Many engine components were replaced in the general weight-reduction exercise but their design was not altered. Although two radiators

were used on the K, their total capacity was less than on the J and H models, so the water pump was geared up to circulate it faster. The sprocket on the rear wheel had been raised by two teeth to lower the gearing as had been standard practice on all Js, but another two teeth would have been better still.

The frame design was unaltered, although rake was raised slightly to just over 28 degrees, since the wheelbase had been brought back 15 mm. The front forks were of a new design with pressure-sensitive pop-off valves opening only under high loads caused by very sharp fork movement, and providing a dual-rate damping system, for gradual or sharp bumps. No increase was made in the already luxurious front wheel travel.

The YZ125K performed better in the company of its peers than had the YZ125J, but it was still bested by the Greens and the Red and Blues. The Kawasaki was a rocket ship, with a disc brake up front and excellent Uni-Track rear suspension, while the Honda's handling was superb. In the right hands and with the right mods, the YZ125K could be a winner, but the Honda and Kawasaki were awfully good motorcycles as stock. Performance mods for the YZ included narrowing each vertical bridge in the inlet port by 2 mm and lopping 5 mm out of the header of the exhaust pipe.

After Glover and Johnson's success at the end of 1982 with the pre-production YZ250K against full-factory machines, it appeared as if the new model would mark the company's return to the top of the pile. It transpired, however, that the new machines worked best in the hands of experts, especially Yamaha experts. As on the 125, Yamaha aimed to improve the mid-range power and the first step they took in achieving this was to change the engine dimensions to a square 68 mm. The lengthening of the stroke would lower the top engine speed a little and generally increase off-peak torque. The spring in the power-valve linkage was stiffened, delaying

the rotation of the valve in the exhaust manifold and thus increasing the mid-range power. Maybe the spring was a little too stiff, for there tended to be a slight flat spot around the transition to mid-range that could perhaps have been caused by the exhaust port roof being too low. Although not as noticeable as on the 125, the new exhaust pipe was a few centimetres longer, helping the low end a little. On the inlet side, the six-petal reed was replaced by an eight-petal item, as the inlet port was opened out some more and the 38 mm Mikuni rejetted.

Aware of the complaints of the gearing for the J, all transmission ratios except first were lowered a little and the rear sprocket gained three teeth. As on the 125, still lower gearing would have been possible, since stock the 250 could pull 80 mph in fifth, not much use on a motocross track. A number of clutch failures in 1982, prompted the return to a steel pressure plate, dating back 15 years to Yamaha's R1 350 roadster, in place of the fragile aluminium plate of the J.

After mid-range fatigue, excess weight was declared enemy number two by the Yamaha designers as they fought to get the obese 107 kg 250J down to the 98 kg FIM minimum. Amazingly enough they succeeded, although it was possible that they might have been a little too fanatical in their efforts as the strength of a number of chassis components was barely adequate. The same items were lightened as on the 125, namely a thin-walled frame, lighter wheels and in addition thinner walled fork stanchions. Fork bending on landing from high jumps, although rare, did occur. The engine also delivered up a few grams, in the cylindrical cylinder muff, drilled shafts, narrower primary gears, an aluminium kickstart lever and a shorter gearchange pedal.

The resulting machine was an unqualified improvement over the previous model which had finished fourth in a field of four in most of the shoot-outs. Although the fastest 250 available, it was not as easy to ride fast as the Honda with a far smoother power delivery. The YZ

required considerable concentration to be ridden hard, but the reward would be exceedingly fast lap times. There was no problem with getting the YZ to turn, despite the slight shortening of wheelbase and increase of rake caused by the new Mono-X suspension. There was a general agreement that the Mono-X was vastly improved but that it still had some way to go before measuring up to the competition from Japan. Some time spent setting it up for a track was essential and would produce a good ride, but not as plush as the others. Since Yamaha were the only company who still manufactured their own damper, a logical move would have seemed to be a switch to another company's product. In Europe, the company were developing close relations with Öhlins of Sweden, that were later to prove very profitable.

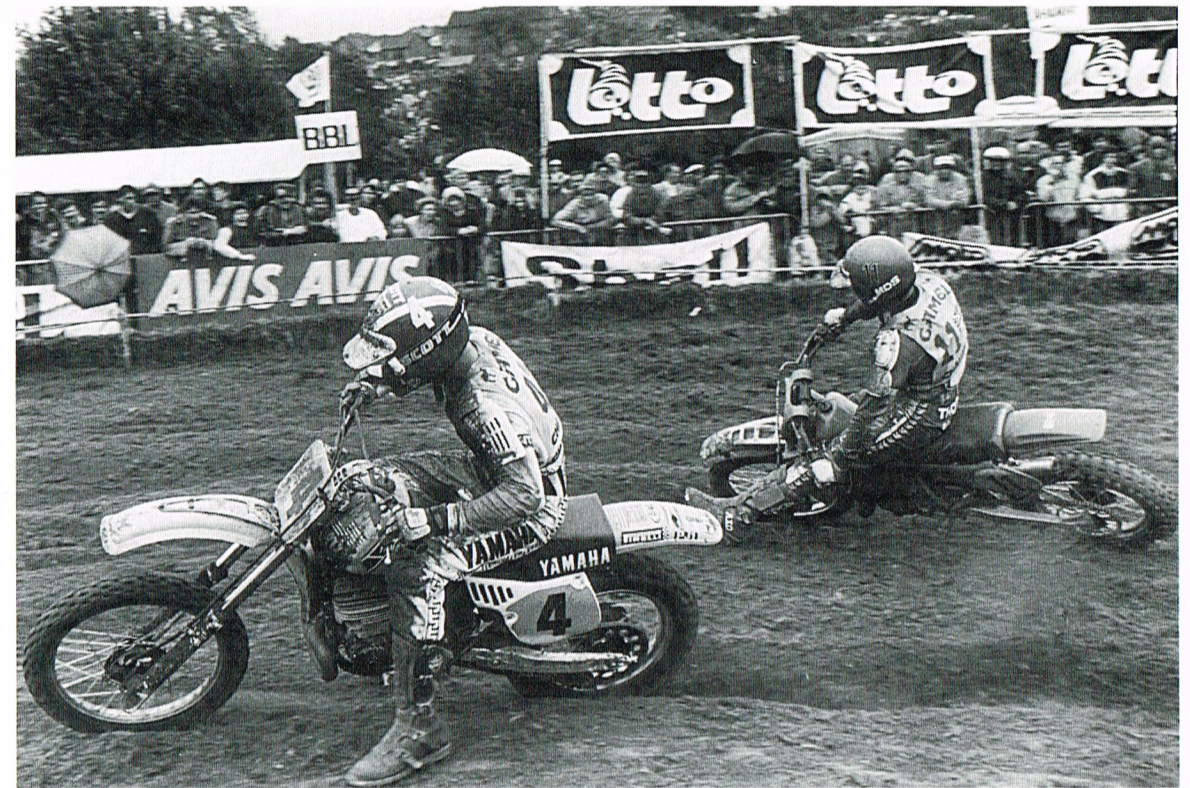
The same design criteria were applied to the YZ490 as had been applied to the 125 and 250. The weight came down by 9.5 kg, and the new power characteristics featured a very strong low- and mid-range power output. No power valve for the head of the family; without the need to tune for peak power, it was possible to port for off-peak power and take what there was at the top end. Similarly liquid-cooling was not deemed necessary since there was more power on tap than most people could use anyway, so if a couple of ponies disappeared during the course of a moto, it was no big deal. The header pipe of the 490K was longer than that of the J, but the overall length barely changed. No other significant changes were made to the engine, apart from the replacement of a few components for lighter items and the same clutch modification as the 250.

As on the 250, the majority of the weight saved came out of the chassis, with a lighter frame, wheels and suspension. The chassis geometry was not altered, despite the fact that the 490 had never been a very fast turner. In fact turning on the 490K through a tight corner was a real task, requiring a slightly open throttle and

weight on the front wheel, the latter being particularly difficult to achieve due to the width of the petrol tank. The suspension on both ends was too soft as usual, but worked reasonably well. It was the engine that really made the YZ competitive. Stump-pulling power right off the low end and a big fat mid-range powered it into the first corner well ahead of the competition. It was the holeshot king of 1983. But whereas the engine would have guaranteed the best of the class award a few years before, more finely balanced packages from Honda and Suzuki were given the nod over the YZ.

While not everyone liked the YZ490 in 1983, the two people most important to Yamaha did. Yamaha took both World Championship and US National titles in the 500 class and it was Carlquist and Glover that did the hard work in getting them. Glover pulverized the opposition with a mid-season series of wins that got him to the top of the table and kept him there. Kent Howerton's consistency brought him second place but a clear 33 points behind. In an injury-free year, Carlquist made a reasonable season start and got better as the summer progressed. From the fourth round in Sweden, he started reeling Malherbe in, taking over the number one spot with a win at Carlsbad in the USA. Apart from a DNF in France the next week, Carlquist kept a cool head and extended his lead week by week and clinched the title in the last round in the Netherlands.

These were the only two titles to go to Yamaha. Danny La Porte finished second to Georges Jobé on his Suzuki, but a long way behind. Jim Gibson had trekked to Europe to try for glory in the 125 class and Yamaha had produced a real factory special to make it worth his while. Jim Gibson, Pekka Vehkonen and Jack Vimond were provided with OW65 machines which were unusual in that the engine induction was controlled by a disc valve. Previously seen on the 1982 KTM factory 125, crankcase induction was provided via a disc valve mounted in



the position usually used for crankcase reed blocks. Driven by a train of gears from the crankshaft, the bike was initially down on power with respect to Rinaldi and Geboers' Suzukis but by mid-season it had an edge over them. Gibson could do no better than 3rd place in the final GP standings and 16-year-old Ron Lechien did well to finish 4th in the US 125 class on the same machine. In the US Scott Burnsworth was runner-up to Honda's Bailey in the 250 title, despite not winning a single event. The competition results of 1983 were better than those of 1982, but not a shadow on the halcyon days of 1979 and 1980.

So for 1984, Yamaha had at least some competition successes to boost sales of the new L models. Despite only being in the 500 class, where the sales of production bikes formed a

Broc Glover laps Dave Thorpe during the first race of the 1983 Motocross des Nations in Belgium

fraction of total motocross sales, there was considerable prestige attached to the class. A mixture of awe and admiration surrounded the riders who were able to tame the 50+ bhp monsters and hustle them round the track in anything close to the times of the lightweight 125s. If the bikes were also good, Yamaha might just scratch its way back to the top.

By and large, the engines of the K models had been good enough to be used as a base on which to build improved blocks, correcting the weaknesses exposed when running with the competition during the year. The chassis was fine, except for the unending saga of the rear suspension, which, after ten years of YZs, should

have been sorted. The YZs had got within sniffing distance of the leadership of several classes. A careful upgrade and they might just be there.

Firstly, the YZ100L was there looking neat and tidy with its L-series decals on a YZ100J. With 100 cc classes still being run in the US and miscellaneous other countries around the world and zero development costs being incurred, every bike sold delivered a pretty decent profit margin. Being a single manufacturer in a class can be quite lucrative.

The Kawasaki had ended up as best 80 ccer due to its rocket of an engine. If Yamaha could get close to the Kawasaki in terms of engine output, the superior chassis would ensure its choice as class best. A touch of the 'eyebrowing' first seen on the YZ250G was decided upon to preserve piston life and yet allow the exhaust port to be opened up. With slightly wider transfers and a lower inlet port floor, the 26 mm Mikuni needed rejetting and of course a new pipe was fitted. Complementing the higher compression ratio was a drop in spark advance of the ignition, to reduce the chance of detonation setting in. Both primary and final gearing was changed as well as the upper three gearbox ratios. The overall effect was to raise the gearing to take advantage of the extra low- and mid-range power. The combination of radiator dimensions and pumping capacity were juggled to provide a smaller radiator able to dissipate more heat.

On the chassis side, the new frame of the same design was lighter and suspension travel increased at both ends to approach the stroke found on the larger YZs. The design of the Monocross suspension, as it was now called, was not changed but the dimensions of the linkages produced a slightly different suspension rate. The usual annual cosmetic changes took place, emphasized this time by a fire-red frame that all 1984 competition models received.

Yamaha did well with the YZ80L, but the KX80 was still a little more powerful than the YZ and thus the choice of experts. Low end was better

on the YZ and the mid-range present on the K was as strong as ever, but the engine signed off before delivering much on the top end. Handling and front and rear suspension categories were all YZ strong points and only the disc brake of the KX at last bested the traditionally good Yamaha brakes.

For 1984, Yamaha produced the best handling and suspended motocross 125. At last they got it right after ten years of criticism of the rear-end inadequacies and, in the early days, slow steering. The engine hadn't been a problem for a good five years so the YZ125L had to be a winner, right? Wrong. As unbelievable as it might seem, the designers turned a delight of a motorcycle into an out-and-out loser by fitting a dog of an engine. In their obsession for improving mid-range power, they completely sacrificed the top end, producing a mill that pulled well but ran out of steam at a woefully low engine speed.

A lot of attention had been paid to the engine as witnessed by the cylinder casting. There were two unusual features in the porting arrangement, neither of which had appeared on production machines before, but had been adopted by some enterprising tuners. On the exhaust side, the oval-shape port, with a significantly wider top than bottom, found on the K was exchanged for a symmetrical rounded rectangle, giving the piston ring an easy time. To effectively increase the width of the port without compromising ring longevity, 10 mm circular sub-ports were cut on either side of the main exhaust, and they exited into the power-valve chamber and only opened as the roof of the main port was raised. This was essentially the same as 'eyebrowing' without the increased loading of the piston ring.

On the opposite side of the cylinder, the inlet manifold was modified to include an oblong sub-port on the right-hand side of the inlet port. The port did not exit on the wall of the cylinder but extended down into the crankcase, joining up with the base of the transfer passage of the right-hand auxiliary passage. The use of a single sub-



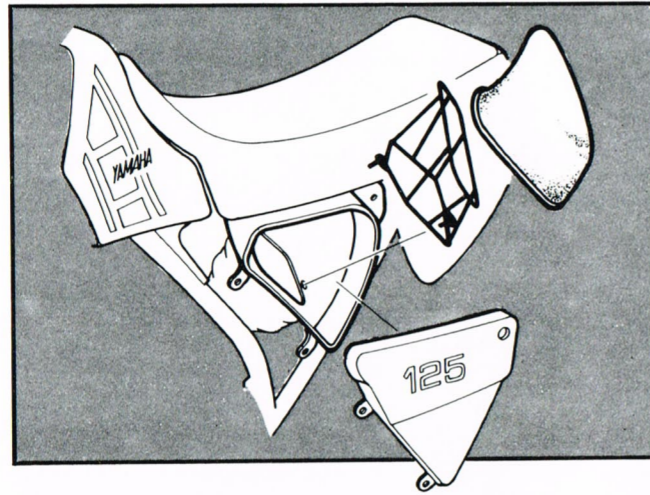
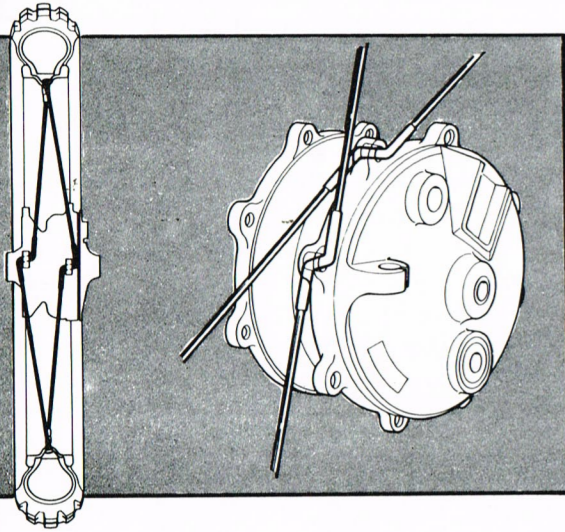
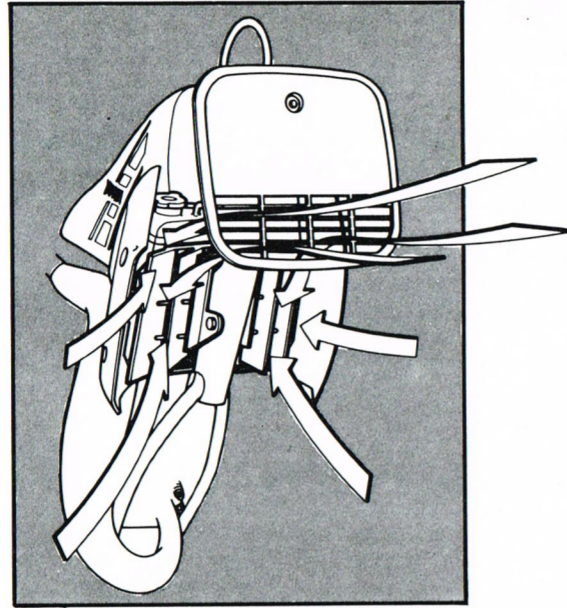
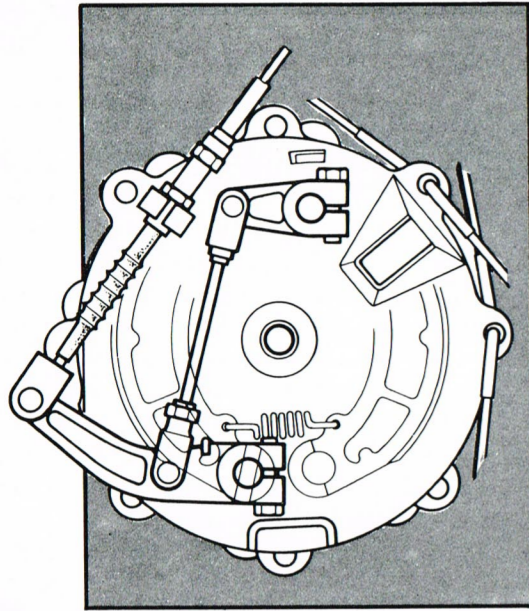
port was puzzling but the intention was clear and linked to a rethink that was taking place in the world of two-stroke engine design.

The goal of every high-performance two-stroke engine is to scavenge the engine as thoroughly as possible of the exhaust gases. Even the most powerful engines of recent times have not achieved scavenging efficiency greater than 75 per cent, leaving the residual exhaust gases mixed with, and thus diluting, the fresh charge. The more charge flowed through the engine from the crankcase, the greater the purity of the ignited charge in the combustion chamber. This flow has always been achieved by pressure changes originating from two engine components, the exhaust pipe and the crankcase. In the early days of serious two-stroke engineering at the start of the 1960s, most credit for the transfer of the charge from the crankcase to the combustion chamber was given to the primary compression in the crankcase. In order to increase this pressure, small crankcase volumes were designed, resulting in primary compression ratios of 1.5 or higher. However, it was realized during the 1970s that correct exhaust design could achieve as effective a transfer of charge as a high primary compression ratio, which would then allow larger crankcase volumes to be used. The greater volumes would provide more charge to flow through the engine and improve the purity of the charge trapped and ignited.

Top The 1984 YZ80L almost put Yamaha back at the top of the minicrossers, but the Kawasaki still had the edge in power and handling

Centre Despite a fully-trick engine, the YZ125L was disappointingly uncompetitive

Left In the hands of Ricky Johnson, a standard YZ250L defeated the might of the Honda factory effort to take the 1984 US National title



The larger crankcase volume now had to be filled, requiring larger carburetors, bolted to inlet manifolds that could flow so much charge. The problem of the motocross machines was the reed valve sitting in the inlet tract and obstructing air flow. The only way to flow more charge was to make the complete reed cage wider,

Some of the goodies available on the 1984 YZ range

hence the move to eight-petal reed valves on some machines. This in turn caused problems with the reed-petal dimensions, since the reed needs to be supple enough to open under the low crankcase pressure at low engine speeds, but

stiff enough to close quickly at high engine speeds. This contradictory set of requirements had led to the famous dual-reed developed by Eyvind Boyeson, and so beloved by motocross riders from the end of the 1970s for the bolt-on power they seemed to provide. A relatively soft petal was clamped on the back of a stiffer petal which was cut away underneath the softer one. It turned out to be a smart application of a number of laws of physics that ensured that the petals would open and close, when they should, throughout the range of engine speed.

With the adoption of eight petals, individual thickness could not be reduced since this was determined by the need to match the natural frequency of the reed with the speed of the engine in its powerband. Consequently, the extra petals were pure extra weight that had to be opened by the same combination of crankcase vacuum and positive pressure in the resonant inlet tract comprising the manifold and carburettor. One way this could be helped was by exposing the inlet manifold downstream of the reed valve to crankcase pressure changes as early as possible and get the reeds thinking about opening again before the inlet port opens. This is what the sub-port found on the YZ125L achieved and it also helped fill the crankcase, without compromising piston life by reducing its support on the inlet face of the cylinder. The intended result was better scavenging and hence better power across the board.

As is so often the case, theory and practice, are not always in agreement and the 125L engine had a surfeit of mid-range power but not enough top end to make it competitive. No changes were made to the transmission, but a new pipe and a 36 mm Mikuni accompanied the cylinder changes. The frame design remained the same but the dimensions did not. The engine was moved forward 30 mm, helping get weight on the front wheel. The bulky radiators were lowered 50 mm and other changes resulted in a slightly steeper rake and 40 mm longer

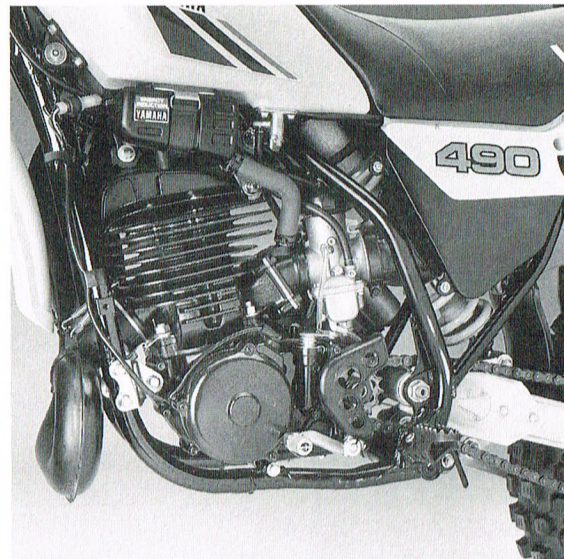
wheelbase. The resultant handling was extremely good inspiring total rider confidence. Kayabas of 43 mm diameter found their way to the 125, with 16-position adjustment to the blow-off valves fitted to respond to sharp suspension jolts. Both wheels were fitted with Yamaha's new Z-spokes that were single rods that laced to opposite sides of the rim and zig-zagged through the hub, giving them their name. Despite Honda and Kawasaki supplying disc brakes on the front end, Yamaha retained their excellent twin leading-shoe set-up, although the disc brakes were better. A slight alteration of the rising rate of the rear suspension completed a significantly changed YZ125, that unfortunately was the least effective 125 motocrosser coming out of Japan in 1984, due solely to the engine.

A larger version of the 125 cylinder porting was found on the 250, also with a single inlet sub-port to the right-hand auxiliary transfer passage. One modification on the factory 250Ls in the US was to cut a second sub-port on the left-hand side of the inlet port, confirming the idea that the extra crankcase/inlet manifold link would assist getting the reeds open. The pistons of both the 125 and 250 were unusual in that the cutaway around the gudgeon pin boss was only present on the inlet half of the piston. Yamaha's reason for this move was that the cutaway had overlapped the exhaust port and on opening, the suction of the pipe had been strong enough to extract charge from under the piston crown, through the gap between pin and boss and away into the pipe. Also ring thickness was reduced to 1 mm from the previous 1.2 mm, reducing the chances of ring flutter at high engine speeds. Transmission changes involved lowering the top three gears as an answer to the two-year-old criticism of too high gearing. The impeller shaft of the water pump was lengthened and supported by bushes in both the crankcase and crankcase cover in an attempt to cure the leakage that had occurred on some bikes the year before.

There had been a number of occurrences of frames cracking at the headstock of the 250K models and so extra gusseting was added in this area. All the major chassis dimensions remained the same, and the only change to the 43 mm Kayabas up front was the addition of the 16-click blow-off valve adjustment also found on the 125. At the rear end, the Mono-cross suspension was recalibrated with a slight change to the pivot-arm linkage dimensions. As a result, the rear damper was slightly shorter. To make the adjustment of the compression damping a ten-second job instead of a ten-minute job, the knob was moved from the top of the damper hidden under the petrol tank, to the fully exposed base of the reservoir. On the wheels, the Z-spokes were new but the drum brakes were not. Once again Yamaha were leaving it a bit late in adopting new chassis technology, although it must be said, the YZ brakes were very good.

Despite a similar shortage of top-end power as experienced on the 125L, the 250 was a very competent machine. With a better engine the YZ would undoubtedly have been the top 250 of 1984. Yamaha racing support were quickly aware of this shortcoming and determined that 15 mm out of the header pipe really helped get the bike to rev. With this change it was more than a match for the Honda that was generally considered to be the best stock 250 of that year.

In comparison to its kid brothers, the YZ490L was beginning to look downright antique, both inside and outside the engine. Air-cooled and still using a boost bottle, instead of the YPVS-equipped liquid-cooled engines of the 125 and 250, were the external signs of antiquity, while the inside of the engine looked remarkably conventional without the use of sub-ports. The truth of the matter was that it was the best 500 production machine Yamaha or anyone had ever manufactured. All that was needed to turn the flawed package of 1983 into the winner of 1984 was careful refinement in the areas that had proven deficient. After the praise heaped on the



engine the previous year, one would have expected the development work to have been concentrated on the chassis. This was not entirely the case.

There were not so many changes made to the engine, but there was a noticeable improvement over the K, with a broader, more manageable powerband, that was still mid-range-based but extended into the top range enough to let the 490 rev out. On the exhaust side, this was achieved by centring the port and making it narrower! On first thoughts a pretty strange thing to do, but greater consideration reveals some logic to the move. The strength of the suction pulse in the exhaust pipe is dependent on the temperature of the exhaust gases. The higher the temperature the stronger the pulse. Road-racers found that a few hundred revs extra could be found from their highly tuned engines, if the header pipe of the exhaust was wrapped in asbestos cloth to insulate, and thus raise, the exhaust gas temperature. The same effect can be achieved by preventing the gas from expanding too quickly by limiting the width of the exhaust port. This was the step Yamaha had

Left The design of the 490 engine had remained essentially unchanged since 1982, but was still the best around two years later

Right Although the only air-cooled motocross machine in production, the YZ490L was the best 500 available



taken on the 490L.

On the inlet side, an even greater width reduction took place, with 10 mm narrower inlet port, and an eight-petal reed valve. Again a seeming contradiction, since the reed valve would be flowing more charge only to find a more restrictive port. However, although more restrictive, the air that does get flowed will pass through the port with a greater velocity and at the carburetor will produce strong vacuum to draw in the required fuel. The expected result was increased charge flow as witnessed by the 4 mm extra width of the main transfer ports and the move to a 40 mm Mikuni. As the Mikuni was set up in the factory, the 490 coughed and spluttered round the track. Slide cutaway, needle jet and pilot jet all needed to be exchanged and the cost of correcting the factory's mistake came to around \$50. This should of course have been a warranty replacement, since it fell outside the realms of 'setting up the carb'. The four-speed transmission was left unaltered.

Since the exhaust now exited in the centre of the cylinder, the frame needed modification to the wishbone downtube that had been fitted to

the YZ125J and YZ250J, when they had adopted power valves. A slight change in the geometry of the frame was made in order to place more weight on the front wheel, something riders themselves had needed to do on the K model, by moving around the bike. The wheelbase grew 25 mm, without a change in the rake and the already stable 490 tracked as straight as a die. The same suspension changes were made as on the 250 and once set up correctly, including stiffer springs on the front and heavier oil, worked very well. The combination of killer engine and razor-sharp chassis made the YZ490L the best 500 machine available, with only the Honda in the same class. The CR's tendency to shake its head at awkward moments and rather harsh suspension relegated it to second place behind the YZ. At last the company were back on top and it felt great.

The 125 excepted, Yamaha had produced a range of production motocross machines for 1984 that were the best or close to it. So confident were they of the quality of their 250 and 490 that Ricky Johnson and Broc Glover rode machines that were production items with modi-



Left Ricky Johnson astounded the US motocross world by winning the 250 National title on a virtually stock machine

Right 1984 was not to be Broc Glover's year on either his open class machine or the stadium bike shown here



fications that could be performed quite easily by any YZ owner. Honda's approach was different, with fully fledged factory specials and a battalion of helpers to guarantee success. In the face of the all-conquering Honda steamroller, Yamaha's only title, gained by Ricky Johnson in the 250 class, is all the more remarkable. Glover finished second to David Bailey in the 500, but it was Bailey's year with eight straight wins out of ten events. The 125 US title was denied Honda by Jeff Ward and Kawasaki, with Honda's O'Mara second and Mike Beier third on a YZ. Beier's effort was essentially a private one, with some technical assistance from the company, and is consequently especially commendable, although there was a 150-point gap between him and O'Mara. In Europe, Carlquist attempted to defend his title, but a pre-season broken thumb and mid-season broken finger meant he never ran with the leaders and ended tenth. In the 250, Jacky Vimond was supported by sport-conscious Sonauto of France and rode inconsistently well,

to finish second behind Heinz Kinigadner with the KTM. Vimond, fresh from the 125 class, had difficulty completing both motos in each race, only managing it in four of the 12 GPs. More finishes could well have brought him the title.

Whatever the R & D guys were doing back in Japan during the 1984 season, it was not designing new motocross models. When the N series appeared at the end of the year, it was clear that only the absolute minimum of work had gone into the new series. Two of the new models received very few updates, only the engine of the YZ80 and the chassis of the YZ490, while the others got some attention in both areas but nothing in comparison with other years. The steel petals of the reed valves were replaced on all the YZs by resin equivalents, which could open up further without risk of fracture. Apart from the cosmetic change to white and red in the US, departing from their traditional yellow, this was the only change made throughout the range.

The updates made to the YZ80 involved a higher compression ratio, higher exhaust port, lower inlet port, wider main transfer, revised jetting and a new exhaust. It had only been a slight lack of power that had forced the YZ into 2nd place behind the KX in 1984 and with the increase in power these modifications gave, Yamaha hoped that the stock YZ would match or surpass the stock KX. Their supposition was correct, since although the KX came into its powerband about 1000 rpm earlier, the slight top-end advantage of the YZ enabled the bike to pull back in most ground lost. It was the handling and suspension that gave the YZ the advantage over the Kawasaki. It was not much of an advantage and the CR80 was also pretty good, but the YZ engine could be tuned for a couple of bhp more with relative ease, while the CR and KX were close to the limit stock.

Something went wrong with the lines of communication between the designers and the people in the field getting flak from angry YZ125L owners with a bike that needed almost as much spent on it as it cost, to get it into the winner's circle. Although there were no official 125 teams in either Europe or the US in 1984, certainly Yamaha personnel in the US were very much in touch with the racing community via their excellent competition support programme. There is also little doubt that, although filtered, many of the angry complaints they received were passed back to Japan. The result though was only a token attempt at improving the power delivery of the YZ, although it seems clear that Japan assured the national organizations that the YZ125N would be a winner. It certainly was embarrassing when the first units arrived from Japan and were found to have the basic flaw of their predecessor—no top end.

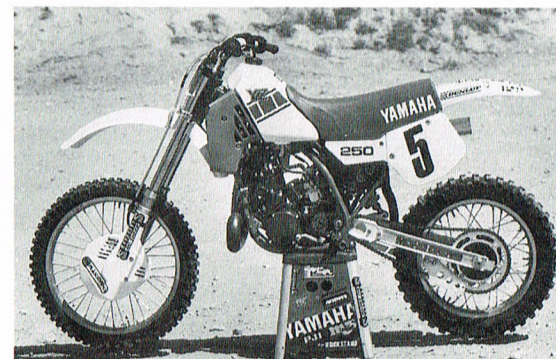
The usual collection of engine components were replaced in the quest for more power, namely cylinder head, cylinder, piston, exhaust pipe and carburettor. The cylinder porting was a mixture of old and new, perhaps in an attempt

at harnessing the best of both. The main exhaust port was identical to that of the K model of 1983, and the sub-exhaust ports were rectangular and of slightly greater cross-sectional area. The transfer ports were a fraction higher, but the main transfers were appreciably narrower. In contrast, the boost port was widened by 50 per cent, and was also fed by a passage leading straight back to the inlet manifold just downstream of the reed valve. It was clearly the intention to flow more charge through the boost port. The purpose of the sub-port above the inlet port, in addition to the retained sub-port on the right-hand side of the inlet port, was to enhance the charge flow from the crankcase with an extra shot directly from the inlet tract via the reed valve that had been opened fractionally by the exhaust suction wave. It was found that the carburation was better if a smaller 34 mm bore unit was used, probably due to the enormously wide inlet port that had remained of the same height but had grown 5 mm wider. This wide port would have altered the resonant frequency of the inlet tract that is so important for correct carburation. The exhaust pipe design changed from a three-section diffuser pipe to a five-section pipe that would keep the exhaust gas temperature high.

So a lot of changes were found in the cylinder and related components, but the designers seemed to have been on the wrong path for the result was an engine that was a little more powerful at all engine speeds than the L model, but still a mid-range mill with little on the top end. When lined up against the other three, the Yamaha's engine was the slowest, by far.

The basic geometry of the YZ was left untouched as it had been the best feature of the YZ125L. Showa forks replaced the Kayabas, but maintained the good operation of the old units. A detail improvement found on all the larger YZs was the use of tapped set screws to secure the ends of the swinging-arm, after some problems with the arm falling to bits on 1984 models. One obvious change was made to the chassis. The

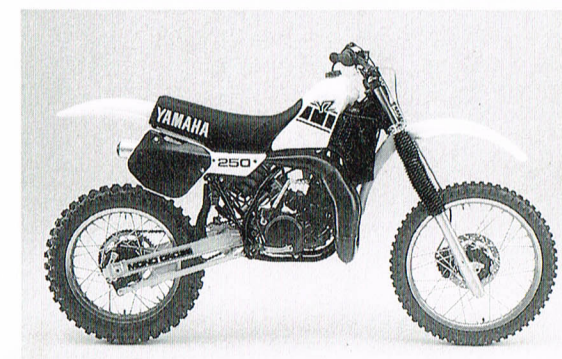
introduction of a front disc brake on the YZ125 and all large-capacity YZs was a welcome improvement and in-line with the general trend of development. A less conspicuous change, but one that Yamaha were especially proud of, was the introduction of a system of linking the operation of the rear brake with a reduction of compression damping in the rear damper. The theory was that the compression damping was reduced by about six per cent on application of the rear brake making the rear end track the bumps going into the corner and help stabilize the bike. In the early days of the monoshock, Yamaha had been plagued by a lively rear end and although considerably diminished there was still a trace of the 'Yamahop' as the phenomenon had been christened. A cable on the rear brake pedal activated a rod that closed the main oil passage-way into the damper reservoir and opened a larger passage, thus reducing the compression damping. The system worked well when braking for corners, and it worked, of course, whenever the brake was applied, such as slowing for a jump, leading some to question its effectiveness. In any case Yamaha made a mistake by introducing it on a motocross machine that was generally considered to be a failure. An acronym was of course needed to join the YEIS, YPVS, Monocross and Torque Induction. BASS was chosen, standing for Brake Activated Suspension System, and the testers had a field day with their fish jokes.



Funny how the fish jokes were notably fewer in the reviews of the 125's larger brother, the YZ250N. Probably due to the fact it was the best 250 of 1985, despite suspension flaws and the questionable merit of the BASS equipment. It could be coincidence but the presence of direct factory involvement in the 250 and 500 classes of the US and the 500 class of the GPs, seemed to be reflected in better models for 1985. Nothing too drastic was done to the engine of the quarter-litre. The drooping roof of the inlet port, offering more piston skirt support, was flattened off for the N, although the rest of the inlet port dimensions were unchanged. On the exhaust side, only the exhaust sub-port position was lowered by 3.5 mm and the port was cast rather than drilled as had been the case on the L model. The transfers were unaltered, although the boost port was fed from the inlet tract as on the 125N. The usual head, pipe and carburation modifications accompanied the revised porting and produced a slight increase in power throughout the range and a slightly higher top end, much like that of the 125. The one difference between the

Below left Broc Glover's 1985 stadium bike maintained Yamaha's tradition of campaigning near-stock machines

Below Handling and power delivery were so good on the YZ250N that they made up for the flawed rear suspension to offer the best package for 1985





Left Some decided to take over the YZ development from the company. Innovation Sports produced this YZ250 for Ricky Johnson with carbon-fibre tank and rear subframe

Right Johnson practising on the carbon-fibre YZ that could not be raced in 1986 after changes to the AMA rules allowing only stock machines

two was that the 250 was already on the top of the pile and could maintain its position by this evolutionary approach. The 125 was in need of a quantum-jump improvement to become competitive. The new cylinder casting also contained extra passages around the exhaust port to improve the cooling. The rest of the engine block was left untouched apart from a tougher big-end bearing, an external flywheel CDI ignition, an improvement to the clutch release mechanism making the clutch lighter and a new kickstart shaft.

The frame was constructed from a lighter gauge tubing to compensate for the extra weight of the stronger rims and spokes, and the dual-piston floating caliper front disc brake common to all the larger YZs. The factory kept the weight down close to the FIM minimum for the class. The usual meticulous set-up procedure was essential for the suspension to get it to work properly, but once dialled-in and with stiffer springs up front, it worked well enough for the majority of riders. For those who were not satisfied, there was the expensive step over to an Öhlins rear shock, for improved sensitivity and race-length consistency. But the slightly flawed suspension was not bad enough to

prevent the YZ250N with its class-beating power and diamond-sharp handling being hailed by most as the class winner for 1985.

Not a lot was new in the engine department of the YZ490N. Everyone had expected Yamaha to follow suit and introduce a water-pumper, but the factory refused to join the club and produced the only serious air-cooled motocross machine in the market. All three changes made to the engine unit were effective. The starter jets of the 40 mm Mikuni were replaced and starting became a two- or three-kick affair, assisted also by the revised kickstart. Finally the clutch actuation was lightened. Frame and wheels were 490N items modified as on the 250 and the suspension and rear swinging-arm were borrowed from the 250. The King of 1984, was still close to the top in 1985, with ample power and good steering and suspension. A question hung over the stamina of the bike, in comparison with the liquid-cooled competition, and the vibration was still excessive but experts could live with that and its stamina was good enough for the 1985 US Open Class title.

With the exception of the mediocre 125, the N series was probably the best since the Gs of 1980, in terms of superiority over the competi-



tion. Just as well really, since all the factory riders in both the US and Europe were only supplied with stock machines for the 125 and 250 classes. In Europe the OW64 factory 490 was campaigned in the hands of Hakan Carlquist and fellow countryman Leif Perrson. Although air-cooled, the OW machine did have various goodies on display such as a power-valve and five-speed transmission. John van den Berk took a stock YZ125N to a solid 5th place in the GPs with some good rides throughout the season. In the US, privateer Keith Bowen had a tough time against the reds, greens and yellows and managed 7th place overall. Ricky Johnson was unable to pull off his superhuman feat of 1984 in beating pukka-works machines with his

breathed-on YZ250, but finished a strong 3rd despite an end-of-season broken finger. It seemed as if the 250 World Championship was to return to the Yamaha camp after a year's loan to KTM, as Jacky Vimond took his YZ250N into a start-of-season title lead and held it right to the last GP. With a 12-point lead over KTM's Kinigadner, the title was almost safe. The pressure was too much for the friendly Frenchman, who struggled round the German circuit to finish 12th in the first moto and 7th in the second, letting Kinigadner through to a two-point title win. That must have hurt. Hakan Carlquist must be one of motocross's most unlucky riders, for his 1985 season was ruined by a succession of injuries, beginning with a broken thumb and



This year, every manufacturer will have to race stock motocrossers. A rule that will affect some more than others.

For the last three years, factory motocross teams have been divided into two distinct camps. Those that race \$100,000 one-of-a-kind works bikes. And those that race \$2,000 stock bikes. Which, of course, seems like an unfair advantage. Until you consider this:

In 1984, Rick Johnson won the 250cc title aboard a stock YZ. In 1985, Broc Glover won the 500cc class aboard a stock YZ. And, in both years, stock YZs were responsible for more than their fair share of supercross victories.

All of which the competition undoubtedly saw as an unfair advantage. And so did the American Motorcycle Association. They stepped in and changed the rules. Now everyone will have to race stock bikes. Which either means we're three years ahead or they're three years behind.

The same difference as far as you're concerned.

Of course, it would be a lot easier for them to catch up if we were standing still. But we're not.

In the case of this year's YZ125, we've made a lot of changes. Not just superficial. And we've given it an ingenious cooling system that circulates coolant not only throughout the cylinder, but also throughout the crankcase. The charge stays cooler and denser. Translation: more horsepower.

There is, however, more to building a high-horsepower motocrosser than simply building in a lot of horsepower. You have to be able to get the horsepower to the ground.

cosmetic changes, but the dramatic kind. Like giving it a new engine that's more powerful than ever before. An engine incorporating a unique reed valve induction that delivers the mixture directly into the crankcase. We've given it a 34mm flat-slide carburetor that dramatically improves throttle response.

Which is why this year's YZ125 comes with a totally new frame with improved geometry. level goes down, handling ability doesn't. Much of the thinking

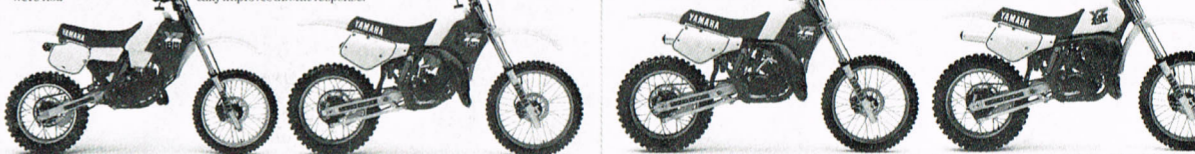
Glover takes stock bikes home and cleans house. A stock YZ did the usual in Seattle. It reigned.

After a day of hectic trading, Yamaha outperforms all other stocks. Glover and Johnson destroy the world in 90 minute battle.

A new Ohlins-type Yamaha shock absorber with a piggy-back reservoir for more accurate damping. A Brake Actuated Suspension System. Forty-three millimeter front forks with special stiction-reducing Alumite coatings. And a "vertical" gas tank that concentrates fuel at the center of the tank. (As fuel

There's one more thing to consider: When you buy a 1986 Yamaha, our Wrench Reports will keep you up-to-date on everything from how to set up your suspension to what tire pressure Broc Glover is using. The faster you read, the faster you ride. And the faster you ride, the more you'll appreciate our new YZ's. Bikes that are not only fast enough to win titles. They're fast enough to change rules.

YAMAHA
We make the difference.



Below left The YZ125N was one of the most disappointing YZs Yamaha had ever built

Below Yamaha advertisement at the start of 1986

culminating in a broken shoulder. With Carlquist more often absent than present at the GPs, it fell to 21-year-old Leif Perrson to wave the Yamaha factory flag in his first full season of GP competition. An erratic season meant that he was never in contention for the title but a good end-of-season 2-2 in Switzerland showed that he was capable of running with the class veterans, and augured well for the future. In the US, Glover was anxious to redress the hurt done by Bailey's overwhelming victory in 1984. Seeming to have

picked up some of the fluid smooth style of riding that Bailey had exhibited the year before, Glover got up to steam early in the season and had already sewn up the title by the time a wrist injury put him out of action before the penultimate round in Minnesota. This was Glover's sixth National title, equalling Hannah's record as America's most successful motocross rider of all time, and every title they had won, was won on a Yamaha.