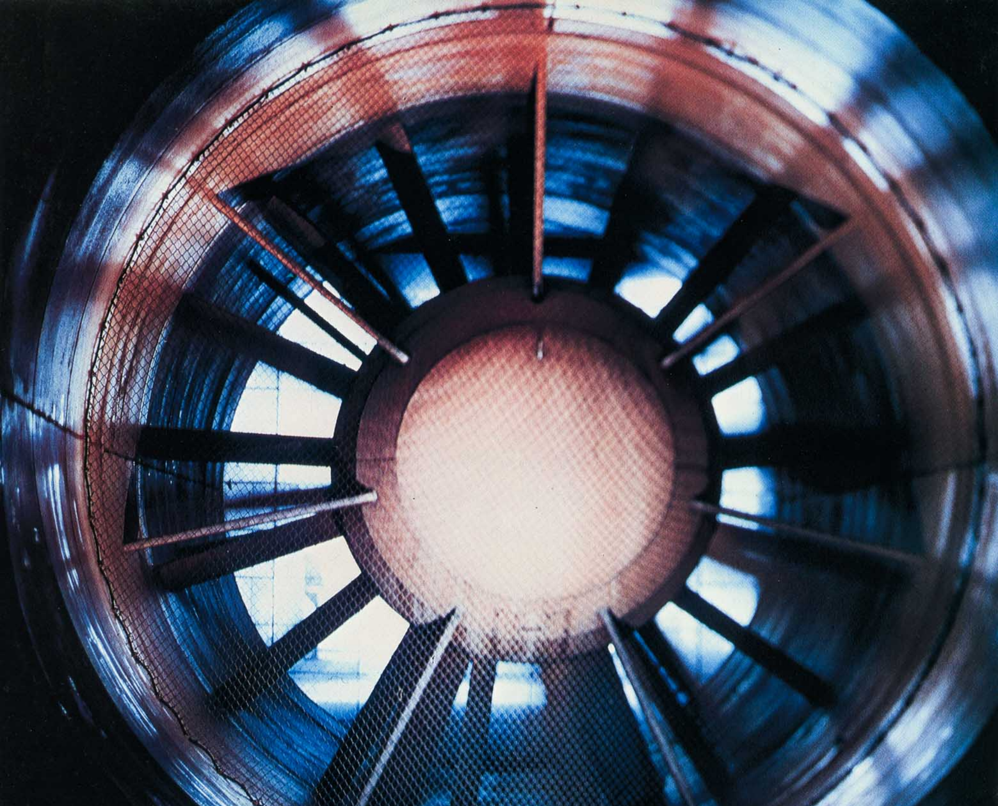
SHIMANO aero dynamics

SHIMANO



Shimano's Aerodynamic System Components

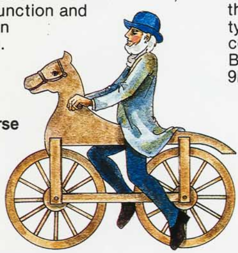
After 100 years of continuous history since the modern bicycle was developed, the scene is set to take the bicycle into yet another era in its evolutionary process.
Already major landmarks in its history were the invention of shifting mechanisms and, in more recent times, a tendency toward lighter weight. Now we are witnessing the bicycle's future challenge—the adoption of aerodynamic features for greater speed and higher energy efficiency.
The bicycle represents a machine of undisputed beauty, grace and power. And in furthering this image, we continue research on components to dynamically improve all-round performance.
Shimano first decided to investigate to what degree riding performance could be improved by means of decreasing air resistance.
In the realistic conditions of a wind tunnel, we carried out innumerable tests geared to research the effects on aerodynamically designed components. From these beginnings an innovative bicycle design was launched and as a result of accumulative experience and data, Shimano set out to achieve perfection in aerodynamic system components.

Wind tunnel tests carried out at the Bicycle Technology Research Institute Foundation, Japan, to determine mathematical data on air resistance.

The Bicycle Moves Toward An Aerodynamic Era

The Frenchman, M. de Sivrac, invented the original two wheeled vehicle first known as a "Celerifères", in 1791.
Since this forefather of the modern bicycle was conceived, there have been many changes relating to improvements in modern techniques such as biomechanics, structure, function and basic human engineering.

Hobby Horse

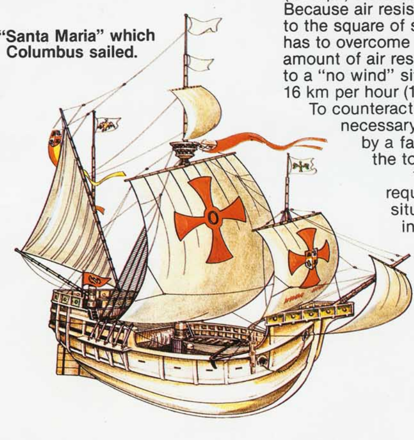


M. de Sivrac's "Celerifères" was improved in Germany and then became popular as a sport in England where it was named the Hobby Horse.

Among the most important improvements is one that changed the whole concept of the bicycle...the shifting mechanism invented 100 years ago.
The conditions which encouraged this new era were higher speeds, and the effects of wind strength and climbing hills. Until then, combating these elements was only the comparatively small human power factor. Even though shifting went a long way in improving the bicycle, there still remained many variables which contributed to the success or lack of success of human powered energy.

As history bypassed the innovative shifting era, the next major influence on the bicycle was the demand for lighter yet more durable bicycles. The bicycle has been gradually improved and refined in each phase of its development including the aforementioned shifting systems and lighter components. As an indication of this progress, the weight of a typical 19th to beginning of 20th century bike was 18kg (40 pounds). By 1965 the weight was halved to 9kg (20 pounds).

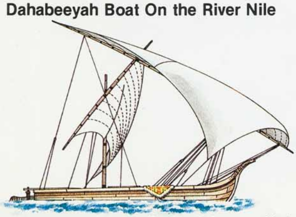
"Santa Maria" which Columbus sailed.



The epic voyage undertaken by this ship opened up relations between the Americas and Europe.

And yet in 1980, the ideal bicycle is still being sought after. Now attention is turned to one of the biggest areas least researched...- aerodynamics and how to decrease air resistance for higher energy efficiency.
A simple example of the effects of aerodynamics clearly illustrates the impact air resistance has. A bicycle travelling at 16 km per hour (10 mph) with a head wind of 24 km per hour (15 mph), suffers the equivalent air resistance force of a bicycle travelling at 40 km per hour (25 mph) without any wind.
Because air resistance is equivalent to the square of speed, the rider has to overcome six times the amount of air resistance compared to a "no wind" situation to maintain 16 km per hour (10 mph).
To counteract air resistance, it is necessary to increase power by a factor of one third of the total speed, which is 15 times the power required in a "no wind" situation. The research into transforming the effects of aero-dynamics into speedy, smooth and energy efficient cycling is a challenge to man against nature and its powerful ally, wind.

Dahabeeyah Boat On the River Nile

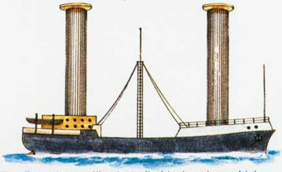


Mankind has used many different sail shapes to drive boats by means of wind power. Since ancient times, the Dahabeeyah boat on the River Nile has been propelled by a triangular sail utilizing the winds. In Greece, during the early and middle ages sailing boats as shown here were a common sight.

Wind and the Vehicle

Wind occurs when warm air expands and rises, while cold air contracts and descends.
Our ancestors learned a long time ago how to use the winds to their advantage. Sailing boats were among the first examples of man utilizing wind. Triangular, square and a multitude of other sail designs transported sailing ships in ancient times. There were many techniques involved using the wind such as simply being propelled forwards by a fair wind in the sails. Or the Dahabeeyah triangular sail of the River Nile, used from time

The Rotor Boat (BUCKAU)



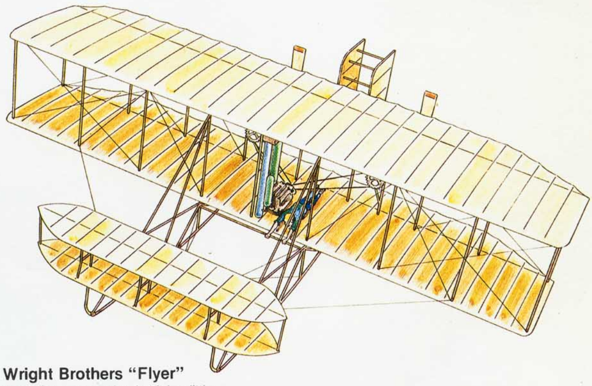
The Rotor boat utilized a cylindrical system which turned instead of the sail. The boat is propelled by the air pressure difference between bow and stern.

immemorial, which sails against the wind. The eventual successors combined these features and multiplied the amount of sail to cross oceans. The "Santa Maria", built in 1492, in which Columbus crossed the Atlantic to reach America, carried vertical sails, one horizontal sail and a triangular sail for a total square sail meterage of 330m² (3552 square feet).
An adventure of far reaching impact was accomplished by this magnificent sailing vessel.

The Wings of Ikarus

The tale of Ikarus has been told many times to describe the efforts of a human who challenged the skies at tremendous sacrifice.

Not only were sail boats refined to a remarkable degree, but a German scientist, Anton Flettner, invented the "Rotor" boat in 1926. The advance made here was based directly on the theory of aerodynamics.
In modern times, the airplane has taken up the challenge of the winds. However, Greek mythology has it that a young boy, Ikarus, made wings from hemp and wax and took to the skies. But in reality the first humans to fly were the Wright Brothers of America.
They initially succeeded in remaining airborne for a whole 20 seconds. Interestingly, they ran a bicycle shop and the connection

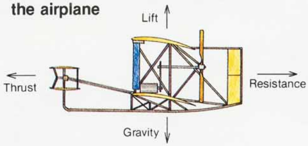


Wright Brothers "Flyer"

A very famous occasion, but it is a little known fact that they used to run a bicycle shop.
The influence of their aerodynamic research on bicycles may have played a big influence on mankind's first flight.

must have been apparent when they carried out their many tests while researching aerodynamics. From these tests they understood the dynamics of "Lift" as applied to inanimate objects. As we know today, the first human controlled flight resulted from these tests. Undoubtedly, there were many lessons learned from bicycling that contributed to the original handling techniques of flying.

Four "Power"factors which affect the airplane



The balance between these four elements is crucial for flying an airplane.

Even now there are many intriguing questions related to flying such as how can large objects, so much heavier than air, remain airborne? In answer, there are 4 different power sources necessary to make an airplane fly:

1) Lift, which works on the main wings.
2) Resistance, which works against the airplane's body and, ideally, should be small.
3) Strong engine thrust.
4) Light airplane body design with a minimum air resistance.

Of these four power sources, only lift (1) and resistance (2) are influenced by air and are responsible for supporting the airplane off the ground.

A New Bicycle Era-Aerodynamics

Research and actual proof of aerodynamics have not only been a subject for airplanes and sailboats but are found also in the design of most other vehicles.
This means that research is carried out on two fronts: using wind to power a vehicle, while decreasing air resistance so not to lose energy. On the one hand, working in harmony with the wind, and on the other, trying to captivate it to work for mankind.
Now in the bicycle field, aerodynamics is becoming more of an important factor. Aerodynamic impact is indispensable when used in relation to human power combined with the bicycle. The result: a more comfortable and less tiring ride with extra speed. Shimano's research encompasses the whole range of benefits derived from aerodynamics for more enjoyable and convenient cycling. Shimano's system component concept is now embarking on the first stage of researching the effects of wind on the bicycle.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Aerodynamics—And The Bicycle

Many improvements have occurred to the bicycle and its components in the course of a 200 year history. The first most notable improvement to the modern bicycle was the invention of the derailleur which made cycling a much more comfortable exercise.
The second historical innovation came about through the introduction of new metals which made possible lighter weight bicycles. In further efforts to lighten bicycles, the bicycle industry drilled out components to save even as little as one gram. The industry also attempted to reduce weight by changing the bicycle's specifications, as in the case with Shimano's 10mm pitch system for track bicycles. In addition, many other forms of progressive development were achieved through mechanical improvements which enhanced performance.

The Aerodynamic Era

Now another breakthrough of historical dimensions has revolutionized the bicycle industry—the aerodynamic bicycle. The whole bicycle's effectiveness is completely restructured to provide energy efficient cycling never before accomplished. The past great achievements in the bicycle's structure were identified by the contribution they made to comfort and speed. These elements took up most of the bicycle industry's time and effort in trying to improve the bicycle. By concentrating on reducing human effort, in the case of the derailleur, and increasing power output, in the case of light weight components, the industry considered these to be the most important areas for improvement.
Recently, however, Shimano through intensive wind tunnel tests and related research identified another area in need of much improvement—air resistance. Air resistance is now the biggest obstacle that stands in the way of the bicycle's progress with road resistance having already been dealt with by making progressively lighter components. By overcoming air resistance, the rider is able to win races and break time trial records, and most important all categories of cyclists benefit from the extra comfort derived from using energy more productively. This area was long neglected in the bicycle's development and now Shimano has researched and implemented the means to combat air resistance through aerodynamic components to suit all cyclists.
This achievement signifies another great landmark in the 200 years of the bicycle's history. 1980 will long be remembered as the beginning of an exciting new era of improvement for the bicycle and Shimano is proud to have pioneered the aerodynamic system components concept which will drastically improve cycling for cyclists the world over.

Shimano's great success at the IFMA Show, held in Cologne, West Germany, 1980, was attributable to the spectacular Aerodynamic Components and fashion shown there for the first time.

Aerodynamics—And A New Era is Upon Us

Riding Resistance Breakdown

Riding resistance consists of road resistance and air resistance. Of these two air resistance represents the biggest obstacle with human body resistance accounting for 2.39kg (5.27 lbs.) and bicycle air resistance for 1.22kg (2.69 lbs.) when riding at a speed of 50km per hour (31.05 mph). Shimano's intensive research into this important area has greatly improved performance through our new aerodynamic components.

Air Resistance remains the same in each case.

When in a "no wind" situation, a rider pedaling at 30 km per hour encounters the same amount of air resistance as a rider cycling at 10 km per hour into a head wind of 20 km per hour (Or, in a "no wind" situation, a rider pedaling at 30 mph encounters the same amount of air resistance as a rider cycling at 10 mph into a head wind of 20 mph.)

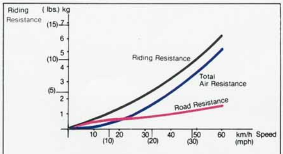
Thus, air resistance must be overcome to improve the rider's performance and provide a more comfortable ride. Shimano's research has centered around this problem resulting in new aerodynamic components for all cyclists.

Bicycle Speed	30 km/h	20 km/h	10 km/h
Head Winds	No Wind	10 km/h	20 km/h
Air Resistance	1.3 kg (Air Resistance remains the same in each case)		
Road Resistance	Remains almost constant at less than 1 kg.		

Air resistance is the biggest obstacle to a cyclist's progress.

When riding a bicycle, there are two major obstacles which impede the bicycle's progress. One is road resistance and the other is air resistance. All land forms of transportation—cars, motor bikes, etc.—are affected by this dual problem and in particular by air resistance. Shimano's research into this subject revealed just how much air resistance is a factor in restricting the bicycle's forward momentum, especially when compared with road resistance. As seen in the chart below, road resistance remains a fairly constant factor at 1 kg (2.2 lbs.), even when speed is drastically increased. On the other hand, the faster the speed, the greater air resistance becomes.

For example, when riding at 50 km per hour (31.1 mph), road resistance is 1 kg (2.2 lbs.) while air resistance climbs to 3.6 kg (7.9 lbs.). Riding resistance totals 4.6 kg (10.1 lbs.) with air resistance more than three times the total of road resistance.



While Road Resistance remains almost constant during speed increases, Air Resistance increases drastically by the square of speed.

Thus, the faster the rider cycles, the more he is impeded by air resistance and the more energy he has to burn up to maintain high speeds. When seen in practical terms, a rider who under perfect conditions propels a bicycle at 50 km per hour would also use the same amount of energy to propel the bicycle at 30 km per hour into a head wind of 20 km per hour. (Or, in a "no wind" situation, a rider pedaling at 30 mph encounters the same amount of air resistance as a rider cycling at 10 mph into a head wind of 20 mph.)

These conditions apply not only to road racers, but also to the regular 10-speed bicycle rider who also has to deal with the tiring effects of air resistance. The results of Shimano's tests are therefore crucial to road and track racers along with 10-speed touring and leisure riders.

Air Resistance

We carefully examined air resistance, subdividing it into two groups. One was the human rider's resistance and the other was the bicycle's resistance. At a speed of 50 km per hour (31.1 mph) we found the human body's air resistance amounted to 2.4 kg (5.3 lbs.) and the bicycle's air resistance amounted to 1.2 kg (2.6 lbs.). For Shimano, the 1.2 kg (2.6 lbs.) figure became the target of all our efforts to reduce the bicycle's air resistance.

In the history of bicycles, there have been many major improvements which benefitted not only racers but also ordinary riders. Among these developments was the discovery of the derailleur which made cycling much more comfortable. This was followed in more recent times by lightweight components which made the bicycle less cumbersome and even more efficient to ride.

The search to improve the bicycle continues and now the newest stage in the bicycle's evolution has arrived with the introduction of Shimano's aerodynamic components.

Here we have detailed some of the many interesting facts which came to light during our aerodynamic tests.

Accelerating Performance Improved

Air resistance increases by a factor of the square of speed, therefore it is easy to understand that when speed increases so does air resistance. Thus, the bicycle that is the most aerodynamically efficient can expect to encounter a reduction in air resistance. This means that acceleration can be achieved in a shorter period of time with less energy loss.

Maximum Speed Increased

Using data from our various tests we calculated mathematically the difference between a conventional bicycle and our aerodynamically designed bicycle in a 1,000 m (1,094 yard) time trial. We took into account figures obtained from our wind tunnel tests with both conventional and aerodynamic components and a model of a racer wearing a regular racing uniform and helmet. We also calculated 1 kg (2.2 lbs.) road resistance on a flat track without any acceleration or braking, and regular human pedaling power. The only difference between the two mathematical tests was the exchange of an aerodynamic bicycle for a conventional bicycle. The conventional bicycle result was calculated at 63 seconds to cover the course with an average speed of 57 km per hour (35.4 mph) and 5.7 kg (12.6 lbs.) air resistance. In total, 1.2 horse power was required to cover the whole distance. The aerodynamic bicycle, with a seven percent decrease in air resistance, was calculated with the same 1.2 horse power to run the distance in 61.6 seconds with an average speed of 58.4 km per hour (36.3 mph). Compared to the conventional bicycle, a saving of 1.4 seconds was possible with a gain of 22.2 m (24.3 yards) in distance. The figures quoted here are the basis of our mathematical calculations and clearly illustrate the tremendous effect aerodynamic streamlining has on the bicycle.

Wind tunnel tests demonstrate how air resistance builds up with speed.

10km/h (About 6 mph) Air resistance for rider and bicycle is 0.14kg (0.31 lbs.)

30km/h (About 18 mph) Air resistance for rider and bicycle is 1.30kg (2.87 lbs.)

50km/h (About 31 mph) Air resistance for rider and bicycle is 3.61kg (7.96 lbs.)

50km/h (About 31 mph) Measuring bicycle and rider separately

Human Body Air Resistance 2.39kg (5.27 lbs.)

Bicycle Air Resistance 1.22kg (2.69 lbs.)

Decreased Energy Loss

In a race there is a big mathematical difference in air resistance between the leader and followers. From Shimano wind-tunnel tests it was calculated that when riding at 50km per hour (31.1 mph), there was a decrease in air resistance of 45.3% between front and following riders: An important fact when discussing air resistance ratios. Naturally, among the benefits of decreased air resistance relative to the bicycle is a reduction in rider fatigue, especially on long road races. Thus, these mathematical evaluations on air resistance reductions are an important factor in improving overall performance.

Conclusion

The introduction of our aerodynamic components will make a big impact on the history of the bicycle's development. Already, at the world's most prestigious bicycle show, the IFMA Show held in Cologne, 1980, almost all the major European bicycle manufacturers (14 in total) chose to equip their top-line bicycles with our aerodynamic Dura-Ace AX Series.

In addition to our celebrated Dura-Ace AX Racing Series we also considered the other areas of cycling by developing and introducing aerodynamic components through our Shimano 600 AX, Adamas AX, and Shimano AX series for club racing, touring and regular 10-speed bicycles.

Shimano thoroughly researched aerodynamic components to bring the best of modern technology to all bicycles.

Shimano's Results: A combined aerodynamic package lightness and durability applied through our system co

aerodynamic bicycle

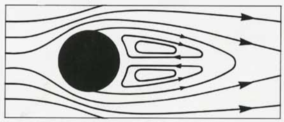
conventional bicycle

$$D = \frac{1}{2} \rho$$

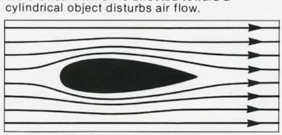
Air resistance is the drag an object exhibits when moving through air. Whether air resistance is large or small can be measured by applying the above equation.
"ρ" is air density, a fixed condition, and "v" is speed, a variable. Under these circumstances, the elements that decrease air resistance are "CD", drag coefficient, and "S", frontal area.
The factors affecting "CD", the drag coefficient, are: "shape resistance", relative to the shape of an object, "viscosity resistance", relative to the surface type of an object, and "induced resistance" relative to the edges of an object. All of the above properties are important elements in decreasing air resistance. "S", the frontal area, is the amount of total area facing the wind head-on.
In general, the smaller the frontal area, the more aerodynamically efficient the object.

Decreasing Shape Resistance

Shape resistance is a form of air resistance relative to the shape of an object. An ideal shape is one that allows an air stream to flow smoothly and continuously from one end to the other. When an air stream hits an object, in addition to surface or eddying flow, air pressure differences occur between the front and the rear, with air pressure most noticeable at the rear. The reason why a streamlined shape is ideally aerodynamic is because the air



Wind Stream which is directed toward a cylindrical object disturbs air flow.



Smooth wind stream with streamlined object.

# of function,
mponents concept.

$\cdot Cd \cdot S \cdot V^2$

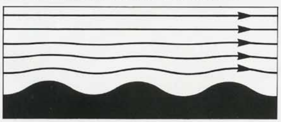
D = Air Resistance Value
ρ = Air Density
Cd = Drag Coefficient
S = Frontal Area
V = Speed

Aerodynamic shape of the Dura-Ace AX brake arch

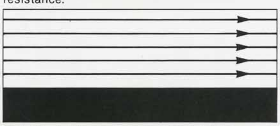
stream runs smoothly across it from front to rear without any air pressure build up occurring at the rear.
Shimano's aerodynamic system components took shape resistance very much into account to improve overall design.
All components, the AX brake body, the brake lever, DD pedal, gears, crank and seat pillar were designed with aerodynamic shapes created from extensive wind tunnel tests and outside field testing.

Decreasing Viscosity Resistance

Viscosity resistance is also known as surface friction resistance. When an object trys to go through viscous gases, friction, which occurs between the gas and the object, causes resistance.



Air disturbance resulting from friction resistance.



Smooth air stream due to surface finishing.

Dura-Ace AX Front Hub which has buff almite finish.

In fact, the reason why an airplane's wings and body are designed with a completely smooth, streamlined surface is not so much for the asthetic aspect but for decreasing viscous resistance as much as possible.
Shimano's aerodynamic system components use, wherever possible, a super-high level finishing treatment which can be seen in the buff almite finish. In another effort to diminish viscous resistance, we try not to put decals on our products but rather stamp-print our components.

Decreasing Induced Resistance

Most objects have edges. When an air stream hits this area, an eddying flow builds up and resistance occurs. To decrease induced resistance, it is necessary to eliminate all protrusions and corners by rounding them off into streamlined shapes.
The inner cable's end and head part's fairing cover, which are part of Shimano's aerodynamic program, were designed to reduce induced resistance.

Front Derailleur Cable End Attachment used on Dura-Ace AX, Shimano 600 AX and Adamas AX

Decreasing Frontal Area Resistance

Frontal area represents the square meter total of an object facing into the wind. Increase or decrease in air resistance is in direct proportion to frontal area surface. This means if the frontal area's total square meterage is decreased by half, then air resistance also becomes half.
When it is windy or speed increases, the rider reflexively takes up a crouching position over the handle bars. This is an automatic effort to decrease frontal area exposure to oncoming wind.
The same theory applies to Shimano's aerodynamic components. For example, the front derailleur was designed with a lateral link mechanism to decrease frontal area. And throughout our aerodynamic component series, wherever possible, frontal area has been reduced.

Dura-Ace AX Aerodynamic Shape alongside conventional Seat Pillar

In addition to aerodynamic properties, Shimano also achieved lighter weight components with increased durability. Wind tunnel tests and data related to air resistance were analysed for the prime functions of the bicycle such as riding stability against winds and other phases of the bicycle's operation.
We developed our products based on ideas conceived through our original Shimano System Components concept.

Aerodynamic Principles create new bicycling concepts.

Shimano reduced air resistance by an amazing 21.7%.

We arrived at our percentage evaluations by running identical wind tunnel tests on both conventional and aerodynamic components. Under 50 km per hour (31.05 mph) conditions, components were separated into four groups, as shown below. Each group was tested individually by taking an air resistance reading with conventional components. Comparisons were made by replacing conventional components one at a time with aerodynamic components. In the case of our front derailleur, the comparative figure showed the aerodynamic product to exhibit a decrease of 30.6 percent in air resistance—the equivalent of an 11 g (0.39 oz.) reduction. However, to give a clearer indication of this figure's impact on the total bicycle, we based our calculations on the 1.22 kg (2.69 lbs.) bicycle air resistance figure. Thus, the front derailleur's total percentage decrease is 0.65 percent. By applying this method to all our components and totaling the results, we arrived at a final percentage saving of 21.7 percent. Because of the nature of these tests, this figure represents a mathematical decrease based on the 1.22 kg (2.69 lbs.) bicycle air resistance figure registered at 50 km per hour (31.05 mph). Through these tests, however, Shimano was able to prove just how much air resistance can be decreased and how important aerodynamic components are to the performance of the bicycle. (To see our actual bicycle comparison test results, please turn to page 14.)

A Drive Chain and Shifting Section 1) Gear Crank 2) Pedals 3) Front Derailleur 4) Rear Derailleur 5) Freehub 6) Bottle
B Front Hub Section 7) Front Hub
C Handle Section 8) Handle Bar, Brake Lever, and Handle Stem 9) Front Brake Arch 10) Shifting Lever
D Seat Section 11) Seat Pillar 12) Rear Brake Arch

*Aerodynamic component is superimposed over cut-out shape of conventional component to show streamlined effect for great saving.

A Drive Train and Shifting Section

1) Gear Crank
AIR RESISTANCE DECREASED 0.9%

We decreased the thickness of the crank and streamlined design considerably for aerodynamic function.


*

2) Pedal and Toe Clip
AIR RESISTANCE DECREASED 4.9%

The pedal section was designed to aerodynamic specifications and air-resistance was drastically decreased. We were also able to lower the platform without decreasing road clearance, allowing the rider's center of gravity to be lowered for an overall decrease in air resistance when riding.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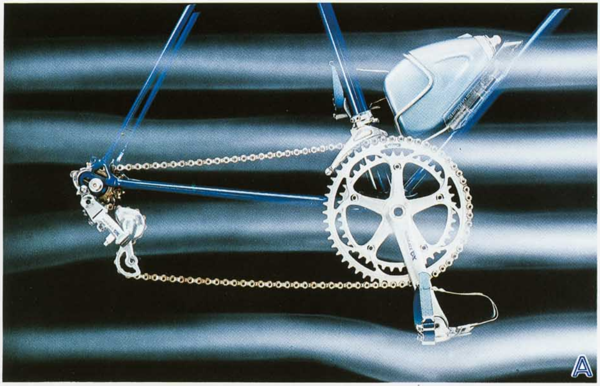
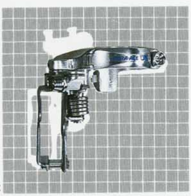


3) Front Derailleur
AIR RESISTANCE DECREASED 0.65%

By changing the direction of the link assembly, which used to stand at right angles against the wind, to a lateral link assembly we succeeded in reducing "frontal area" resistance. We also incorporated a "shape" resistant design to further reduce air resistance.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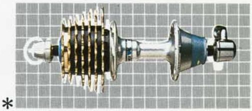
4) Rear Derailleur
AIR RESISTANCE DECREASED 0.82%

The tension spring, which used to protrude from the pulley, has now been built into the pulley itself to decrease "frontal area" resistance. This in addition to the whole shifting body mechanism designed to aerodynamic specifications eliminating all sharp edges and protrusions. And we eliminated the outer cable, so that air resistance could be reduced even more.


*

5) Freehub
AIR RESISTANCE DECREASED 0.65%

The dual purpose aerocap prevents dirt and water from entering the hub while improving the aerodynamic effect. Shape resistance and induced resistance between the fork end and the hub body are also reduced.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6) Aero-Bottle
AIR RESISTANCE DECREASED 3.77%

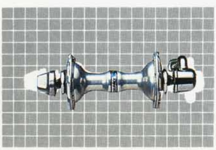
The conventional bottle was never designed to combat air resistance with its bulky shape. But now, the Shimano Aero-Bottle has an original shape designed to decrease air resistance and an Aero-Skirt, for assembly to the down tube, which also reduces "shape" resistance. The Aero-Bottle was designed especially to allow airstream flow to move smoothly over the whole frame triangle area. Total air resistance is reduced by this simple assembly procedure.


*

B Front Hub Section

7) Front Hub
AIR RESISTANCE DECREASED 0.65%

The special construction of the hub allowed us to shorten the dimension between the lock nuts without altering the flange dimensions compared with the conventional hub's 100mm (3.94″).
As a consequence, "frontal area" was reduced. The hub body itself is designed to aerodynamic specifications along with the quick release lever which eliminates the ordinarily protruding nut and hub cone.
The quick release shaft lock nut was also reduced in size. "Frontal area" resistance of both hub and quick release sections has been reduced considerably.



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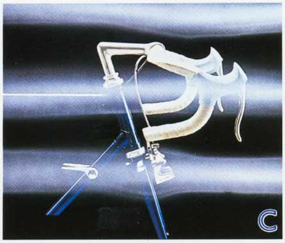


C Handle Section

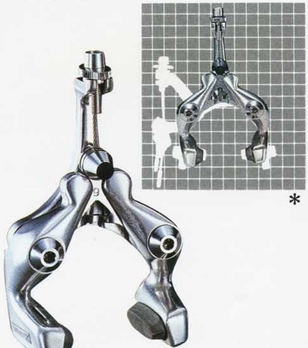
8) Brake Lever, Handle Stem and Handle Bar
AIR RESISTANCE DECREASED 4.5%

A significant decrease in air resistance was realised by fixing the brake cable outer casing to the handlebar, thus removing it from the airstream.
This innovation also gives the handle section a much "cleaner" more stylish appearance. The internal assembly of the brake lever has been redesigned to allow for more efficient operation as well as reducing frontal area. This reduction has allowed us to design more comfortable hoods that result in better hand positioning when riding.
All protruding parts of the handle stem have been eliminated reducing frontal area and "shape" resistance. The handlebar has been redesigned from the usual symmetrical tube shape into a more "tear drop" aerodynamic shape.

*

9) Front Brake Arch
AIR RESISTANCE DECREASED 1.96%

We made the brake as compact as possible based upon our original Para-Pull Mechanism. This meant brake assembly within the width of the front fork became possible. Thus we could decrease "frontal area" resistance, while the aerodynamic shape of the brake arch decreased "shape" resistance.



*

10) Shifting Lever
AIR RESISTANCE DECREASED 0.73%

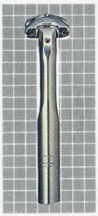
We exchanged the conventional bolt and ring system for an Allen Key style tightening bolt. So now the assembly lever is very slim. And the addition of a fairing cover with aerodynamic design helps decrease air resistance.

*

D Seat Section

11) Seat Pillar
AIR RESISTANCE DECREASED 1.55%

We redesigned the seat tube protruding part into an aerodynamic shape.
The concept here concentrated on durability and lighter weight, in order to reduce "shape" resistance considerably.

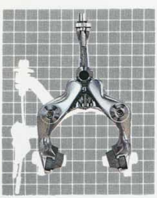


*

12) Rear Brake Arch
AIR RESISTANCE DECREASED 0.57%

In the same way as the front brake arch, we designed the assembly section to remain within the seat stay width thereby decreasing air resistance.

*



*Aerodynamic component is superimposed over cut-out shape of conventional component to show streamlined effect for great saving.

Shimano's Bicycle Comparison Test: Fully equipped aerodynamic bicycle showed a reduction of 20.6% air resistance!

Aerodynamic bicycle

Conventional bicycle

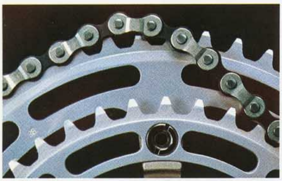
*

Finally, as a result of tests comparing our aerodynamic bicycle with a conventional bicycle, we were able to decrease air resistance by an incredible 20.6%.
Shimano carried out wind tunnel tests in the biggest facility of its kind in Japan at the Japanese Car Research Institute Foundation, at Tsukuba City in Ibaraki Prefecture. We compared an aerodynamic bicycle fitted with Shimano's aerodynamic components, and a conventional round-tubed frame bicycle with regular components. The result was a decrease of 20.6% in air resistance. Also stability and operating tests were carried out on the effects of side winds on the straight and when cornering to ensure data was perfect in every detail.
The highly significant reduction of 20.6% opens up the way to another major era in the bicycle's development—Aerodynamics!

SHIMANO AERODYNAMIC SERIES FEATURES: DRIVE TRAIN MECHANISMS

W-cut Mechanism
All AX Series

When shifting the chain on a conventional front chainwheel from high to low, a tremendous effort is required to lift it up on the gear teeth, especially while under a heavy load.
To help rectify this situation, Shimano developed the W-cut Teeth and greatly improved this gear changing operation. We simply shortened the length of the two sprocket teeth behind the crank arm and the two teeth directly opposite. These are the points where the least amount of chain tension is present when cycling and thus the perfect position to readily release the chain.
Because of Shimano's thorough research activities, shifting from high to low gear is a completely smooth operation.


Gear shift on W-cut Teeth

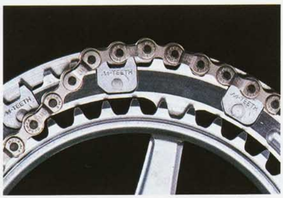
M-Teeth
Shimano ADAMAS AX

The M-Teeth on the front chainwheel have added another dimension to the smoothness of gear changes. Now the low to high gear change is also as efficient as the W-cut Teeth's change making a perfect combination. Made of heat-treated steel, durability is increased to take the wear and tear of constant gear shifts.


M-Teeth

Twin Gear
Shimano Adamas AX, Shimano INTEGER AX

The Twin Gear Front Chainwheel was developed by Shimano with outer and inner gears as a single unit. And gear teeth perfectly aligned for improved gear changes.
The reason behind Shimano's decision to align the outer and inner chain ring teeth stems from the fact that when shifting from low to high gears, off the W-cut Teeth, the chain rides up onto the outer gear. Because the chain links are equidistant from each other, there are few points where engagement can actually take place. It was here that Shimano decided to concentrate; the distances between the teeth on the outer and inner chain rings, and the distance between the chain rings themselves. The research resulted in the Twin Gear System where teeth are aligned at ideal changing points between top and low gears. Now when shifting to the outer gear, the chain does not catch the teeth tops impeding a smooth change. Because of the perfect alignment, the chain makes a clear engagement every time. When combined with the W-cut and M-Teeth, shifting performance is even more enhanced.

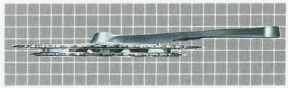


The Chain on Front Chainwheel with aligned large and small gears.


The Chain, on Front Chainwheel without aligned large and small gears, slips on the teeth.

Safety Crank Arm
All AX Series

In order to increase strength and reduce the likelihood of the ankle being struck, we shortened the crank axle and reshaped the crank arm. A perfect safety feature.



Offset Crank Arm
Dura-Ace AX, Shimano 600 AX

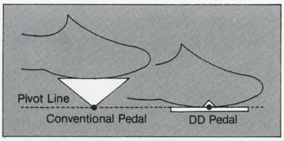
By repositioning the crank arm in relation to the front chainwheel spider arms, we could strengthen the structure drastically. The secret was to build it into the chainwheel making one integral unit. This allowed us to shorten the crank axle for reduced chainwheel flexibility.
Along with improving durability, the DD Pedal's performance has also been greatly improved. Pedaling power is directly transformed into driving power and the bicycle's overall performance is heightened.


Crank arm is offset against spider arm for increased durability.

DD Pedal
Dura-Ace AX, Shimano 600 AX

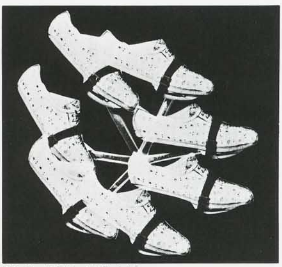
Shimano's in depth research into bicycle technology and biomechanics produced the DD Pedal, ideally suited for transforming the rider's energy into driving power.

When Shimano closely examined the conventional pedal, it soon became apparent that because the axle is lower than the pedal body, energy was easily dissipated trying to keep the pedal steady. This meant the rider was forced to use valuable energy "ankling" instead of concentrating soley on rotating the pedals.
In contrast, the DD Pedal's axle connects to the crank arm slightly above the pedal body. Now the pedal platform is on the same level as the axle. The pedal always maintains a stable position allowing full rider pedaling power to drive the chainwheel—and the bicycle. A tremendous improvement in performance.



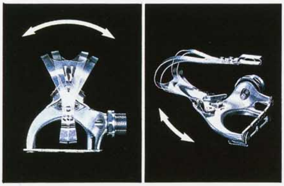
The conventional pedal's pivot is lower than the platform so that power input is dissipated maintaining pedal stability when pedaling.

In comparison, the DD Pedal is much more stable with full power centered on the pedal axle for maximum driving force.



Effective DD Pedal Rotation

The position of the DD Pedal has also lowered the center-of-gravity for both rider and bicycle. This means bicycle stability is increased and, in keeping with Shimano's aerodynamic policy, air resistance is lessened.

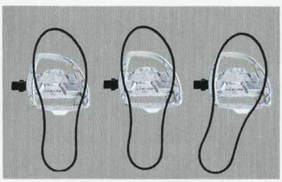


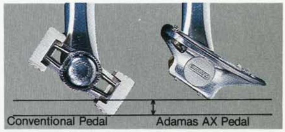
DD Pedal
The toe-clip adjusts back and forth by 10mm (0.39"), and also laterally to obtain the most comfortable setting.

Adamas AX Pedal

Shimano Adamas AX

Shimano's policy of utilizing aerodynamic design has manifested itself in the new Adamas AX Pedal which greatly reduces air resistance. Although only one side of the platform can be used, compared to both sides on a conventional platform, the specially weighted design always keeps the correct platform side facing upwards. This unique platform was designed by using the principles of biotechnology to shape it to the sole of the rider's shoe for any pedaling position. In addition, special spikes have been located to prevent slipping.
Another great feature is that road clearance, when cornering while pedaling, is increased over the conventional pedal.





The platform design is suitable for all pedaling and riding styles.

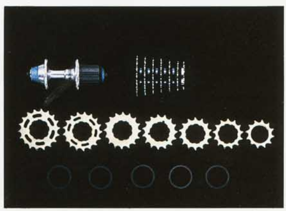
Because of increased road clearance, the Adamas pedal allows the rider to continue pedaling while cornering. The Adamas pedal permits the rider to bank by as much as 25.30° compared to the conventional bicycle's 22.28°.

Toe clip and toe strap are easily assembled with reflectors on front and back.

Cassette Freehub

All AX Series

The Freehub was another Shimano first. By combining the freewheel and hub into one unit, we were able to move the freewheel side ball bearing over toward high gear and widen the distance between both sides' balls. This adjustment reduced deflection on the axle while at the same time increasing durability. Furthermore, because of the reduced deflection, drive power could be used efficiently with power loss drastically reduced.
Another improvement followed the unification of the freewheel and hub. We were able to make the freewheel accept cassette sprockets; something not possible before. The rider is now able to choose gear combinations according to leg strength or touring conditions and make changes easily.
The Cassette Type Freehub has won international acclaim and is becoming a favorite with many of the world's top racers because of its unique features which include lightness, ease of changing sprockets, rigidity and increased power input without deflection on the axle.

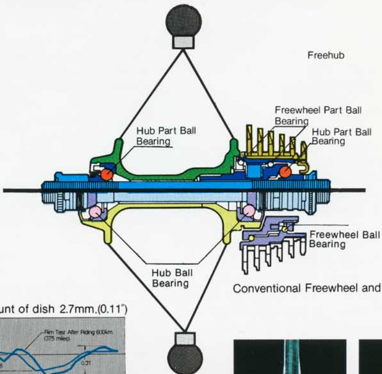


Top gear is threaded style with second onwards spline type.

Uni-Balance Mechanism

Shimano 600 AX, Shimano Adamas AX, Shimano DIRECTION-6 AX

The conventional dished wheel assembly with multiple freewheel was seen by Shimano to cause both vertical and lateral vibrations; a major cause of damage to both spokes and the rim. (The ratio of spoke tension on right and left side spokes causes an imbalance of 10:6. This is because the center of the hub and frame do not align with each other due to the multiple freewheel's positioning.)
The dished assembly, with its obvious demerits has been used for a long period. Not until Shimano tackled this long outstanding problem was a solution discovered. With the development of the Uni-Balance Mechanism, equal distribution of tension on both right and left side spokes was made possible. We were able to reduce the dish substantially while still keeping the usual distance between flanges.
The Uni-Balance Mechanism was responsible for improving durability of spokes and the rim along with solving vertical problems due to imbalance. In addition braking performance has also benefited from the inherent stability of the wheel assembly.
Another big problem solved was when the rider wanted to exchange a 5-speed freewheel for a 6-speed, it was necessary to change the frame also. Now, the Uni-Balance allows 5 and 6-speed freewheels to be used on the same frame.



Conventional Freewheel and Hub

Fig.1 Uni-Balance Amount of dish 2.7mm.(0.11")

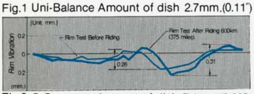
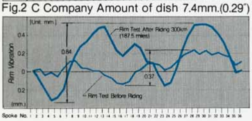
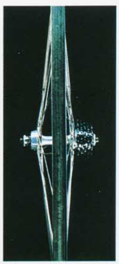


Fig.2 C Company Amount of dish 7.4mm.(0.29")



The above illustrates the difference in Vibration levels between a conventional dished assembly and the Uni-Balance assembly, using 36 spoke wheels, when tested before and after riding. The result of the rim Vibration difference for the conventional rim assembly is 0.47mm (0.02") [Fig. 2], while the Uni Balance is only 0.05mm (0.002") [Fig. 1]. Thus, the Uni-Balance has solved the problem of rim Vibration so apparent in the conventional assembly, and exhibits incredible rigidity.


Uni-Balance Wheel


Dished Assembly Wheel

Direction-6 Mechanism

All AX Series

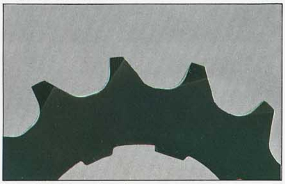
Rim assembly on a wheel is one of the most troublesome chores associated with the bicycle, needing time and skill. The Direction-6 Hub has greatly alleviated this problem with its specially designed flanges. Each spoke hole is designed to face the spoke in the correct direction with every other hole recessed. This means that all spokes can be threaded from one side of the flange. And they can be threaded on each side in separate operations which makes assembly much easier and efficient.
Another feature is the increase in spoke width assembly of 12% compared to conventional models. Also, the cross over system allows almost equal tension on each spoke thereby increasing vertical and lateral strength substantially. (20% increase for lateral force and 10% for vertical force according to Shimano data.)
Direction-6 is not only a great boost for racing efficiency but also a great benefit to touring.


Direction-6 Hub Rim Assembly

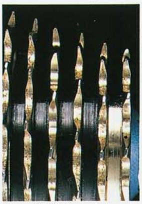

Conventional Hub Rim Assembly

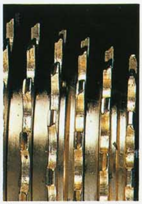
Super-Shift Sprocket
Dura-Ace AX, Shimano 600AX Series

Shimano's Super-Shift Sprocket has again revolutioned conventional thinking by its innovativeness and sheer effectiveness. We decreased the outside diameter of the sprocket and eliminated that part of the sprocket tooth which was responsible for preventing the chain from making smooth gear changes. This new design now allows the chain to be released quickly during a shift and onto the next gear smoothly and naturally.
By using Super-Shift Sprockets on the conventional UG Freewheel, we were able to improve performance to a much higher level. In addition, we designed a new teeth formation assembly, the alignment system.

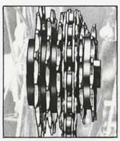

Wave form shaped teeth

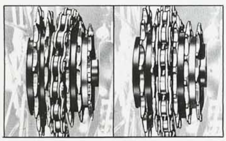
This allows the teeth to be closer to low side gears and high side gears in alternating sequence. As a result, the low to high and high to low gear changes are greatly speeded up. Further the Super-Shift Sprockets are responsible for improved shifting lever performance with no need for fine-tuning. Also pedaling power remains constant when shifting instead of slowing down as with conventional systems.
Features include no shifting shocks, no slipping during close ratio shifting, usually the most difficult case of all, and smooth shifting, even on a hill, without losing momentum.


Super-Shift Sprocket

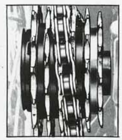

Conventional Sprocket Teeth

- **Shifting with Super-Shift Gear Freewheel (using UG Chain)**

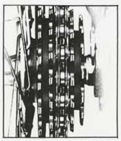

1. The chain is released smoothly and quickly from the gear teeth and is led easily onto the next gear without hindrance.

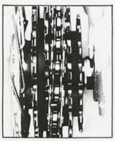

2. The teeth, located near the high gear side with Wave form shape receive the chain quickly without any slippage.

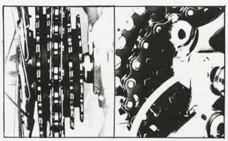

3. Smooth and reliable shifting can be done without stress on the chain.

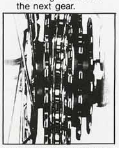

4. When shifting to the high gear side, the teeth which are inclined toward the low gear side, due to the Wave form shape, guide the chain links into position before releasing them onto the next gear.

- **Shifting with conventional Freewheel (Using conventional chain)**


1. The chain pin makes contact with the adjoining large gear teeth.


2. The timing of the gear change is delayed because the chain cannot detach from the gear cleanly.


3. The adjoining large gear teeth are diagonally opposed to the oncoming chain causing it to slip on the teeth.


4. Now stress is subjected to the teeth and chain and shifting as a result becomes unstable with considerable wear.

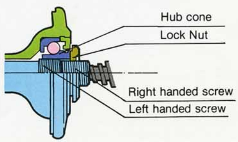

When removing sprockets, as seen in photograph, use the double wrap sprocket turning chain for easier operation.

Super Finish Treatment
Dura-Ace AX Series

Our new Super Finish Treatment is used on the ball race section of the hub. And the resulting increase in rotating performance and durability is an outstanding improvement.
The Super Finish Treatment, a highly technical process, was found to be far superior to conventional finishes. Because of this technique, we could achieve maximum surface precision, symmetrical durability and set new standards for product finishing of the highest quality.

Special Front Hub Structure
Dura-Ace AX

The hub is usually fixed by tightening the lock nut and spacer. But now because of the development of the hub axle structure, only the lock nut is needed to fix it. And we shortened the lock nut's dimensions without changing those between the flanges. This means, of course, lighter weight and reduced air resistance without any weakening of the wheel.



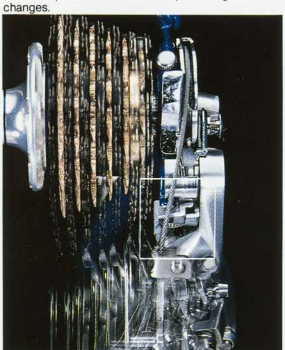
Special Front Hub Axle Structure

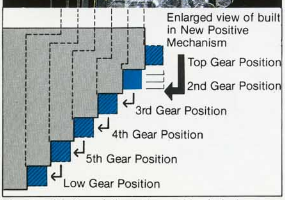
SHIFTING MECHANISMS

New Positive Mechanism
All AX Series

Shimano's New Positive Mechanism has eliminated gear changing problems, especially with close ratios, experienced even by the most seasoned of racers. Each gear is now positively indexed so that the rear derailleur automatically engages the chain on any gear from top to low. Thus, special techniques so often employed in conventional gear changes, with accompanying noise and slippage, are no longer necessary.
In addition, a positive "click" is felt from the shifting lever on completion of each gear change notifying the rider of a successful operation.
Smooth and reliable gear changes are possible at all times under the severest racing conditions with Shimano's New Positive Shifting Mechanism.

The built in Positive Indexing Mechanism of the rear derailleur provides continuous top to low gear changes.





The rear derailleur follows the positive indexing mechanism and thus directs the chain's precise movements as seen in above photograph.

Direct Cable Mechanism
All AX Series

A constant aim of our development planning has been to examine even the least likely areas of power loss. It was found that the outer cable was responsible for a slight loss in force and response, so we tackled the problem of disposing of the outer cable. We joined the inner cable to the rear derailleur, without outer cable, and transferred the shift lever pulling power directly. Now the inner cable maintains a constant length, unlike before due to outer cable shrinkage. Shifting lever and rear derailleur are perfectly coordinated and response is both faster and more efficient.
By removing the outer cable we also helped reduce the overall air resistance of our components and, of course, reduced weight.

Direct Cable Mechanism

Pre-Select Mechanism
Shimano Adamas AX,
Shimano POSITRON AX

When riding a bicycle, to shift down without pedaling causes undue stress on the freewheel, chain and rear derailleur. This clearly obstructs a smooth gear change operation. The Pre-Select Mechanism was developed by Shimano to eliminate this problem.
Even when not pedaling, gear shifts progress smoothly and are tension-free. The Pre-Select Mechanism is activated when the shifting lever is pulled causing the rear derailleur to move backwards thus allowing the cable end arm to absorb cable tension. The rider can select a gear before starting to pedal and upon commencing, the shift will take place. Irrespective of circumstances, the Pre-Select Mechanism allows smooth and steady gear changes at all times. And durability of related components, including the cable, is greatly increased.

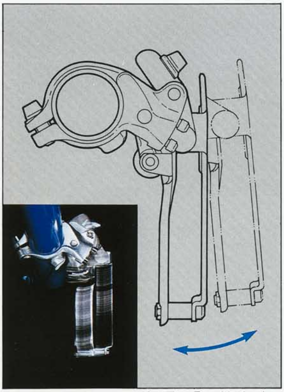
Pre-Select Mechanism and Rear Derailleur's Movement

Cable End Arm

New Trap-Ease Mechanism with lateral link design
Dura-Ace AX, Shimano 600 AX,
Shimano Adamas AX

Already Shimano's Trap-Ease Mechanism has won world-wide acclaim as an orginal, innovative technique for shifting. Now Shimano has taken it one step further by introducing a front derailleur with our New Trap-Ease Mechanism. The new design has improved shifting efficiency along with incorporating an aerodynamic shape reducing air resistance.
Further, another dimension has been added to the already efficient shifting operation of our Trap-Ease Mechanism. Now the special link design enables the front derailleur, when shifting from low to top gear, to transport the chain with a diagonally lateral thrust. This energy efficient movement is also given an added push from the outward swing motion of the derailleur rear end. As a result, an even faster shift is possible. By using the lateral link design, the front derailleur's low to top gear shift is a much more natural and reliable operation.

BRAKING MECHANISMS

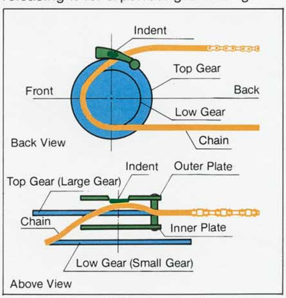


New Trap-Ease Mechanism

Chain Release Indent

All AX Series

Shimano has incorporated a unique device on the front derailleur's outer plate to prevent the chain from dropping between the large gear and crank arm. The device itself takes the form of an indentation which holds the chain back from overshifting the large gear—a hazard often encountered in conventional front derailleurs. Thus gear changes are carefully engineered to lift the chain to the ideal position before releasing it for a perfect gear change.



Chain Protector Release Indentation's movement

New Para-Pull Mechanism

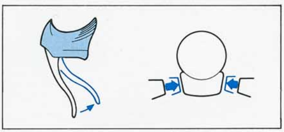
All AX Series

The new Shimano AX Para-Pull Mechanism was developed especially for speed control when riding in addition to a reliable braking function.

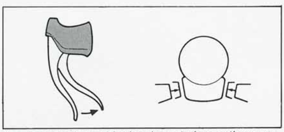
The Para-Pull Mechanism utilizes a unique braking system painstakingly developed by Shimano's engineers. The brake arm arches work on a parabolic movement caused by the triangular carrier with its special cut-away section on top.

This mechanism provides two great features:

1. When commencing to brake, the cut-away section on the triangular carrier is responsible for transmitting braking power to the brake arm arch immediately without delay. Thus, the brake shoes are activated toward the rims. The faster transmission of power means a wider dimension between brake shoes is possible and the quick release system is no longer necessary.
2. The precision design of the lower section of the triangular carrier (the slider) results in a steady flow of braking power, an important factor for reliable braking. And just as important, even when brake shoes are worn the special design of the brake arm and brake shoe compensates so braking can always be relied on. In addition, unstable braking due to rim width is now perfectly under control.



The first touch on the brake lever is quickly transmitted to the brake shoes which move toward the rim.

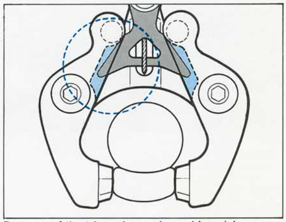


The lever stroke and brake shoe stroke are the same.

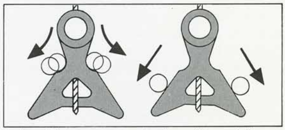
These two innovative features allow the rider to control exactly the amount of speed required by means of the ideal positioning of brake shoes and their operation.

Another feature is unbalanced braking to one side has been eliminated because the design of the brake arm arch interior follows the parabolic movement provided by the lower section of the triangular carrier. Thus, any bias to one side is immediately balanced by the special geometry of the related parts.

The assembly angle of the brake shoe holder, so essential for braking input, was decided upon by researching the frame's offset angle along with the most suitable brake shoe assembly angle.

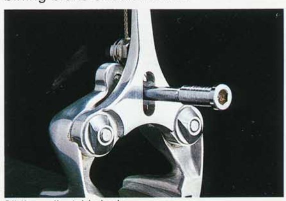


Because of the triangular carrier arch's quick transmission mechanism, the quick release mechanism is unnecessary.

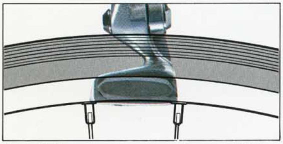


Arch quick response mechanism with specially designed triangular carrier.

We designed the brake shoe similar to the keel of a ship, so that fine assembly angle is no longer necessary. And also we solved the troublesome conventional brake shoe assembly method by combining brake shoe and arm.

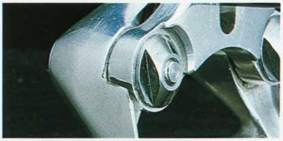


Sliding adjustable brake.



Fine adjustments are unnecessary because of the keel shape design of the brake shoes.

We built a spring into the arch and used a perfectly sealed mechanism. Therefore, reliable performance is always ensured and accidents prevented even in the rainiest weather or muddiest conditions.

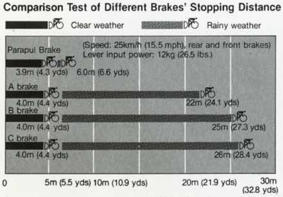


Sealed Mechanism preventing mud, water and unwanted objects from entering for smooth braking at all times.

AW Brake Shoe
All AX Series

This brake shoe has been designed to ensure safe and stable braking even under the wettest conditions. Shimano's brake shoe was developed from material with the biggest resistance against wet conditions. Continuous trials and tests were carried out in order to reach the exacting standards we set to satisfy ourselves of the quality of the AW Brake Shoe.
The AW Brake Shoe exhibits stable braking features in all wet weather conditions. This provides excellent braking at all times and, of course, is perfect for racing whether in rain or under normal conditions.

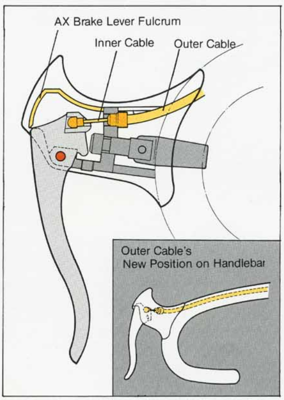
Comparison Test of Different Brakes' Stopping Distance

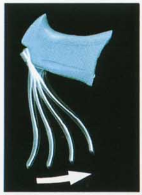


Comparison tests between AW brake shoe and conventional brake shoe for braking distances in wet conditions.

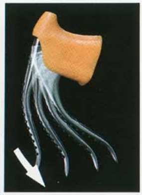
AX Brake Lever
All AX Series

In developing a brake lever suitable for today's modern cyclist we first closely examined the function of the original lever familiar to most people. To work effectively, the brake lever transfers power from a rider's grip to the cable. From our tests, we could find that ordinary brake levers required power input in excess of actual braking output. This meant that the rider was forced to find extra power when braking; an exercise both wasteful of energy and extremely tiring for long-distance touring.
Our solutions, which we incorporated in the AX Brake Lever, were to position the brake lever fulcrum in a more forward setting than before for increased leverage. To build the outer cable into a groove situated in the tubing. And to increase the pulling angle of the inner cable by 90%.
These features have all contributed in making the brake lever's operation more power efficient without using excessive energy, a great boon to long distance tourers, and as a result safer and more reliable.
The outer cable's new position on the handlebar improves appearance and, as part of our "Aerodynamics" policy, contributes to the overall reduction in air resistance.
All these innovative features are found only on Shimano's AX Brake Lever.



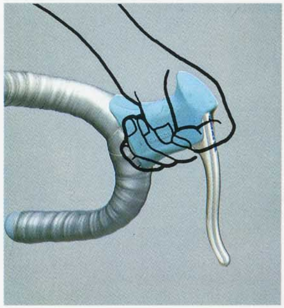


AX Brake Lever Action



Ordinary Brake Lever Action

The AX Bracket Cover has been designed especially to fit the shape of the rider's palm, the advantage being that the rider can maintain the same gripping position without tiring. Shimano researched this special shape by comparing the natural form taken by fingers and palm when gripping and utilizing the most efficient position in the design



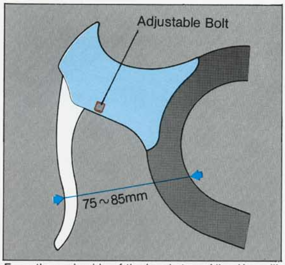
The thumb, middle and third finger grooves.
And in between finger notches.

Undulations which spread palm pressure power evenly.

Additional Features

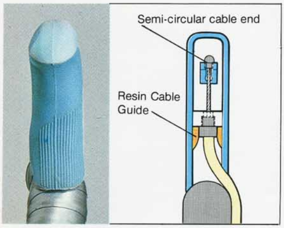
of our Bracket Cover. Now the hand and bracket act as one unit with an increase in power efficiency. The grooved design allows palm and fingers to slot easily and comfortably into the most natural gripping position. The result; the hand and bracket are so joined to form a streamlined unit thus reducing air resistance.

Taking a close look at tne brake lever stroke, we ascertained that about 80mm constituted the ideal distance for optimum power response. However, the wider stroke distance employed in present brake levers has persisted because of the mechanics of the brake body and lever. By overhauling the design, Shimano's Brake Lever now allows the rider to adjust gripping stroke between 75—85mm (2.95"—3.35") for perfect braking response.



From the underside of the bracket, an Allen Key will adjust grip stroke from 75mm to 85mm (2.95" to 3.35").

Improvements to the cable itself include reshaping the cable end drum to a semi-circular form for easier assembly. Now cable assembly can be performed simply by inserting the inner cable end to the bracket. A time-saving and trouble-free procedure.



One Key Release

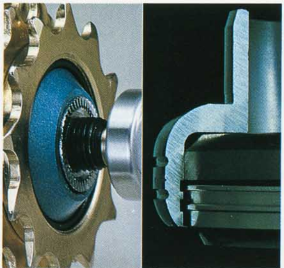
Dura-Ace AX, Shimano 600 AX

To disassemble the cotterless-type front chainwheel, a special tool plus monkey wrench are ordinarily used in a several-step operation. Shimano's One Key Release consists of one hexagon wrench key for detachment and of course, attachment—and all in one movement.

Hexagon wrench key (6 mm.) with Dura-Ace AX Front Chainwheel.

Sealed Mechanism

Altogether, we have incorporated numerous innovative and useful mechanisms into our AX Series.
The Sealed Mechanism is another of our ideas which we introduced to the DD Pedal, Freehub, Rear Derailler and Brake Springs to prevent revolving and exposed parts from water, dust and foreign particle invasion.
This mechanism is a great boost for component efficiency and in reducing tiresome maintenance and cleaning work.



Sectional Views of Rotating Head Part (Labyrinth seal) and Freehub Aerodynamic Sealed Cap.

Hexagon Release

Dura-Ace AX

Wherever possible, a hexagon wrench key is used to tighten all Dura-Ace AX Series components. Easy handling and secure tightening, along with a sportier appearance, are all added benefits.

Light weight

The AX Series not only incorporates many aerodynamic ideas, but also contains a number of new mechanisms. However, in spite of adding new mechanisms, they have not contributed to weight increases. Instead, such mechanisms have allowed easier rotation of moving parts and higher energy efficiency. Also, the new AX Series has many features which have decreased air resistance and in effect lightened the pedaling load for the rider.

Dura-Ace AX Road Ensemble.

SHIMANO DURA-ACE AX SERIES
ROAD RACING ENSEMBLE

DURA-ACE AX Front Chainwheel & Bottom Bracket Assembly

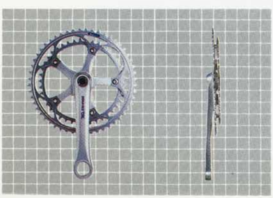
Model FC-7300
BB-7500 (B.B. Parts)

SPECIFICATIONS

- Weight • 32.1 oz. (909g.) 42T. — 52T. Type, (170mm)
  9.0 oz. (256g.) B.B. Parts
- Material • Light Alloy • Anodized Finish
- Type • Cotterless
- Chain Ring • 1/2″ × 3/32″ Chain
- Teeth • Inner Chain Ring; 39T. — 45T.
  Outer Chain Ring; 48T. — 53T.
- Crank Length • 6-1/2″ (165mm.), 6-3/4″ (170mm.), 6-25/32″ (172.5mm), 6-7/8″ (175mm.)
- Crank Thread • BC 1″ × 24 T.P.I.
- Cup Thread • English 1.37″ × 24 T./French 35 × 1.0/Italian 36 × 24T.
- Chain Ring Material
  • Light Alloy • Anodized Finish
- Features • Aerodynamic Design/Offset Crank Arm/W-cut Mechanism/ One Key Release Mechanism/ Safety Crank Arm
- Optional Use • (B.B. Parts) Polished Ball Race
  • With DURA-ACE AX DD Pedal (PD-7300) or SHIMANO 600AX DD Pedal (PD-6300)

B.B Parts Size

Part No.	B.B. Shell Width	Axle Length
1370110	68mm	107mm
1370111	70mm	109mm

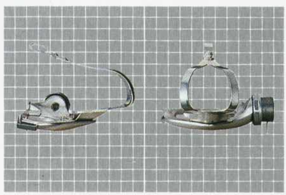


DURA-ACE AX DD Pedal

Model PD-7300

SPECIFICATIONS

- Weight • 7.5 oz. (214g.) (Including Toe Clip & Toe Strap)
- Material • Light Alloy • Anodized Finish (Body)
  • Chromium Molybdenum Steel (Cup • Cone)
  • Stainless Steel (Toe Clip)
- Crank Thread • BC 1″ × 24 T.P.I.
- Features • Aerodynamic Design/DD Mechanism/Sealed Mechanism/ Light Weight/Adjustable Toe Clip
- Use • With DURA-ACE AX Front Chainwheel (FC-7300)
- Option • DD Pedal Reflector



Dura-Ace AX Series

The Dura-Ace AX Series is our top-of-the-line component system and has received utmost attention in our research on air resistance. The result is a series which is without equal in the areas of precision, quality, function and energy. Our aerodynamic Dura-Ace AX Series is for the racer who wants only the best and appreciates the work Shimano has put into caring for his needs.

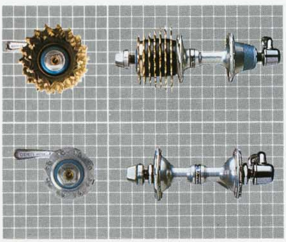
DURA-ACE AX Freehub

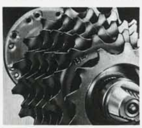
Model FH-7370 (Small/7-speed)

SPECIFICATIONS

Weight • Front; 7.1 oz. (200g.)
Rear; 14.0 oz. (398g.)
Over Lock Nut Dimensions
• Front; 3-1/4″ (82mm.)
3-15/16″ (100mm.)
Rear; 4-31/32″ (126mm.)
Amount of Dish • Rear; 13/32″ (10.5mm.)
Material • Light Alloy Anodized Finish (W/Light Alloy Nut)
Sprocket • Golden Finish
Teeth • Threaded Sprocket: 11T. — 19T.
Spline Sprocket: 12T. — 28T.
Spoke Holes • 32H./36H.
Features • Aerodynamic Designed Sealed Cap/Super-Finish Treatment/Super-Shift Sprocket/Aerodynamic Designed Quick Release Lever/Cassette Gear/Sealed Mechanism/Light Weight/Direction-6 Hub

Super-Shift Sprocket 11T.—20T. available.





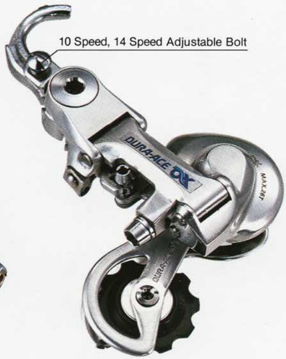
Ensure sprockets are fitted in correct direction by checking tooth number and arrow is facing you on assembly.

DURA-ACE AX Rear Derailleur

Model RD-7300

SPECIFICATIONS

Capacity • Front Difference; 13T. or less
Rear Largest Sprocket; 26T. or less
Weight • 7.5 oz. (214g.)
Material • Light Alloy
Features • Aerodynamic Design/Built-in Pulley Tension Spring/Direct Cable Mechanism/New Positive Mechanism/Hexagon Release



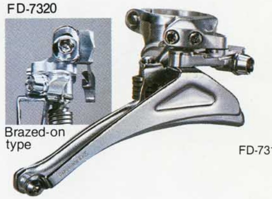
DURA-ACE AX Front Derailleur

Model FD-7300 (Band Type)
FD-7310 (Brazed-on Type)
FD-7320 (Brazed-on Type for oval Tube)

SPECIFICATIONS

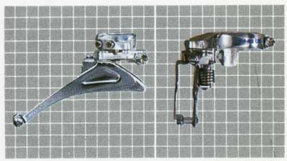
Capacity • 14T. or less
Weight • Band Type; 3.4 oz. (96g.)
Brazed-on Type; 3.1 oz. (88g.)
Brazed-on Parts; 0.5 oz. (13g.)
Material • Light Alloy • Anodized Finish (Body)
Steel • Chromium Finish (Chain Guide)
Inlet Diameter • Band Type/1-1/8″ (28.6mm.), 1-3/32″ (28.0mm.)
Brazed-on Type/1-1/8″ (28.6mm.)
Brazed-on Type (For Oval Tube)/1-1/4″ (31.8mm.)
Features • Aerodynamic Design/New Trap-Ease Mechanism/Indent Guide Mechanism/Hexagon Release/Inner End Guide

FD-7320



Brazed-on type

FD-7310



FD-7310

SHIMANO DURA-ACE AX SERIES
ROAD RACING ENSEMBLE

DURA-ACE AX Shifting Lever

Model SL-7310 (Brazed-on A Type)
SL-7311 (Brazed-on B Type)
SL-7321 (Brazed-on B Type for Oval Tube)

SPECIFICATIONS

Weight • 1.8 oz. (50g.) (SL-7310)
2.4 oz. (69g.) (SL-7311)
2.4 oz. (69g.) (SL-7321)
Material • Light Alloy • Anodized Finish
Type • Friction Type
Attachment Position • Down Tube
Lever Clamp Diameter • SL-7310; 1-1/8" (28.6mm.)
SL-7311; 1-1/8" (28.6mm.)
SL-7321; 1-1/4" (31.8mm)
Features • Aerodynamic Design/Sealed Mechanism/Light Weight/With Fairing Cover/Hexagon Release

SL-7310

SL-7310 Brazed-on Parts A Type

SL-7311 Brazed-on Parts B Type

SL-7311

DURA-ACE AX Parapul Brake

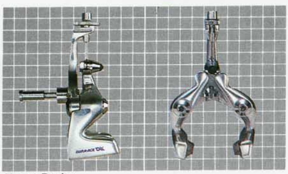
Model BR-7300

SPECIFICATIONS

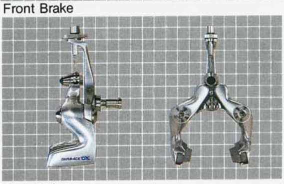
Weight • Front & Rear; 12.1 oz. (344g.)
Material • Light Alloy • Anodized Finish
Features • New Para-Pull Mechanism/Aerodynamic Design/Balanced Braking Mechanism/Quick Response Mechanism/Quick Release Lever Eliminated/Hexagon Release/AW Brake Shoe

Front Brake

Rear Brake



Front Brake



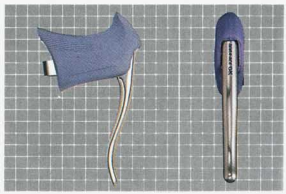
Rear Brake

DURA-ACE AX Brake Lever

Model BL-7300

SPECIFICATIONS

Weight • 3.8 oz. (107g.) each (with Pad)
Material • Light Alloy • Anodized Finish
Features • Aerodynamic Design/Grip Stroke Adjustment (75—85mm.)/One-Step Cable Attachment
Lever Clamp Diameter • 23.8mm., 24.2mm.



Dura-Ace AX Series

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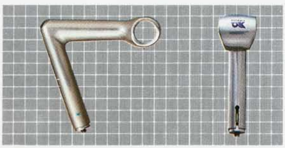
DURA-ACE AX Handle Stem

Model HS-7300

SPECIFICATIONS

Weight • 8.9 oz. 252g. (100mm.), 9.2 oz. 260g. (120mm.)
Material • Light Alloy • Anodized Finish
Handle Stem Diameter • 7/8″ (22.2mm.) • (22.0mm.)
Extension • 2-3/4″ (70mm.), 3-5/32″ (80mm), 3-1/2″(90mm.), 3-15/16″(100mm.), 4-5/16″ (110mm.), 4-11/16″ (120mm.), 5-1/8″ (130mm.)
Features • Aerodynamic Design/One Key Release/Hexagon Release
Handle Bar Clamp Diameter • 26.0mm., 25.4mm.

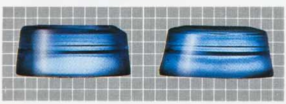


DURA-ACE AX Head Parts Cover

Model SM-HP10

SPECIFICATIONS

Weight • 0.2 oz. (6.6g.)
Material • Plastic
Colour • Clear Blue
Use • With DURA-ACE EX & SHIMANO 600 EX Head Parts



DURA-ACE AX Seat Pillar

Model SP-7300 A-Type
SP-7310 (Semi Oval Tube) B-Type
SP-7320 (Order Made Oval Tube) C-Type

SPECIFICATIONS

Weight • 7.9 oz. (224g.) (SP-7300; 26.8mm.) 8.6 oz. (244g.) (SP-7310; 26.8mm.)
Material • Light Alloy • Anodized Finish
Outside Diameter of Pillar • SP-7300, 7310/25.4mm., 26.0mm., 26.2mm., 26.4mm., 26.6mm., 26.8mm., 27.0mm., 27.2mm., SP-7320 (Oval Tube) Made under special condition
Features • Aerodynamic Design (SP-7310, 7320)/Hexagon Release/Light Weight

SP-7300 SP-7310 SP-7320

Rubber cover is assembled on Model SP-7320.

SP-7300

SP-7310

SP-7320

DURA-ACE AX Handle Bar

Model HD-7300

SPECIFICATIONS

Bar Width & Weight • 380mm. 10.6 oz. (300g.), 400mm. 10.8 oz. (306g.), 420mm. 11.0 oz. (312g.)
Material • Light Alloy
Handle Bar Clamp Diameter • 1-1/16″ (26.0mm.)
Use • With DURA-ACE AX Handle Stem & Brake Lever (HS-7300, BL-7300)
Features • Aerodynamic Design/ Bar End Cap Included

Handle Bar End Cap

SHIMANO 600 AX SERIES
ROAD RACING ENSEMBLE

SHIMANO 600 AX Front Chainwheel & Bottom Bracket Assembly

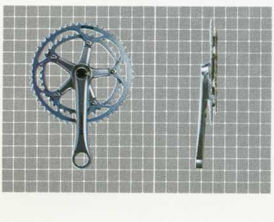
Model FC-6300
BB-6200 (B.B. Parts)

SPECIFICATIONS

Weight • 24.0 oz. (680g.) 42T.—52T. Type, (170mm)
10.8 oz. (306g.) B.B. Parts
Material • Light Alloy • Satin Finish
Type • Cotterless
Chain Ring • 1/2″ × 3/32″ Chain
Teeth • Inner Chain Ring; 39T. —45T.
Outer Chain Ring; 48T. — 53T.
Crank Length • 6-1/2″ (165mm.), 6-3/4″ (170mm.)
Crank Thread • BC 1″ × 24 T.P.I.
Cup Thread • English 1.37″ × 24T./French 35 × 1.0/Italian 36 × 24T.
Chain Ring Material
• Light Alloy • Anodized Finish
Features • Aerodynamic Design/Offset Crank Arm/W-cut Mechanism/ One Key Release Mechanism/ Safety Crank Arm
Use • With SHIMANO 600 AX DD Pedal (PD-6300) or DURA-ACE AX DD Pedal (PD-7300)

B.B Parts Size

Part No.	B.B. Shell Width	Axle Length
1480101	68mm	116mm
1480100	70mm	119mm

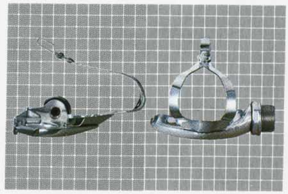


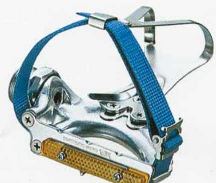
SHIMANO 600 AX DD Pedal

Model PD-6300

SPECIFICATIONS

Weight • 8.4 oz. (237g.) (Including Toe Clip & Toe Strap)
Material • Light Alloy (Body)
• Chromium Molybdenum Steel (Cup • Cone)
• Steel (Toe Clip)
Crank Thread • BC 1″ × 24 T.P.I.
Features • Aerodynamic Design/ DD Mechanism/Sealed Mechanism/Light Weight
Use • With SHIMANO 600 AX Front Chainwheel (FC-6300) or DURA-ACE AX Front Chainwheel (FC-7300)
Option • DD Pedal Reflector





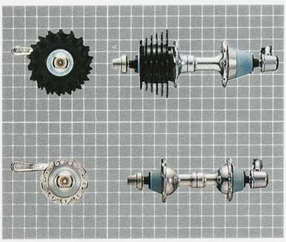
Reflector is optional.

Shimano 600 AX Series

We applied our aerodynamic research to the Shimano 600 AX Series in the same way we did with the Dura-Ace AX Series.
With a complete array of innovative mechanisms in compliance with our system components policy, the Shimano 600 AX Series is a great choice for the serious racer and bicycle tourer.

SHIMANO 600 AX Freehub
Model FH-6361 (Small/6 speed)
SPECIFICATIONS

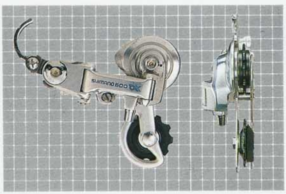
Weight • Front 8.5 oz. (242g.)
Rear 13.9 oz. (394g.)
Over Lock Nut Dimensions
• Front 3-15/16″ (100mm.)
Rear 5″ (126mm.)
Amount of Dish • Rear 5/32″ (4.3mm.)
Material • Light Alloy
Sprocket • Silver Finish/Option; Black Finish
Teeth • Threaded Sprocket; 12T. — 16T.
2nd Sprocket; 13T. — 17T.
Spline Sprocket; 15T. — 28T.
Spoke Holes • 32H./36H.
Features • Aerodynamic Designed Sealed Cap/Super-Shift Sprocket / Aerodynamic Designed Quick Release Lever/Direction-6 Hub/Uni Balance Mechanism/ Light Weight/Cassette Gear/ Sealed Mechanism



Ensure sprockets are fitted in correct direction by checking tooth number and arrow is facing you on assembly.

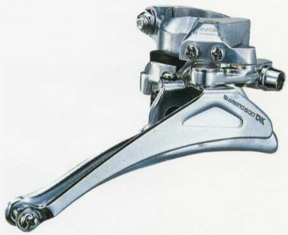
SHIMANO 600 AX Rear Derailleur
Model RD-6300
SPECIFICATIONS

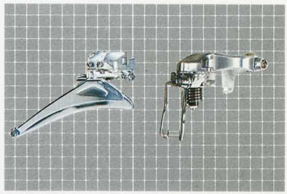
Capacity • Front Difference: 13T. or less
Rear Largest Sprocket; 28T. or less
Weight • 7.7 oz. (218g.),
9.0 oz. (254g.) with Bracket
Material • Light Alloy
Features • Aerodynamic Design/Built in Pulley Tension Spring/ Direct Cable Mechanism/ New Positive Mechanism/ Light Weight/Hexagon Release



SHIMANO 600 AX Front Derailleur
Model FD-6300 (Band Type)
SPECIFICATIONS

Capacity • 14T. or less
Weight • 3.8 oz. (107g.)
Material • Light Alloy (Body)
Steel (Chain Guide)
Inlet Diameter • 1-1/8″ (28.6mm.)
Features • Aerodynamic Design/New Trap-Ease Mechanism/Indent Guide Mechanism/Inner End Guide





SHIMANO 600 AX SERIES
ROAD RACING ENSEMBLE

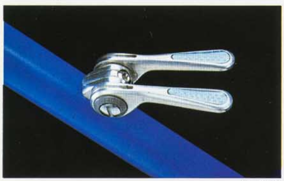
SHIMANO 600 AX Shifting Lever
Model SL-6310 (Brazed-on A Type)
SL-6311 (Brazed-on B Type)
SL-6321 (Brazed-on B Type for Oval Tube)

SPECIFICATIONS
Weight • 1.8 oz. (50g.) (SL-6310)
2.3 oz. (64g.) (SL-6311)
2.2 oz. (63g.) (SL-6321)
Material • Light Alloy
Type • Friction Type
Attachment Position • Down Tube
Lever Clamp Diameter • SL-6310; 1-1/8" (28.6mm)
SL-6311; 1-1/8" (28.6mm)
SL-6321; 1-1/4" (31.8mm)
Features • Aerodynamic Design/Hexagon Reiease/With Fairing Cover/ Sealed Mechanism

SL-6310

SL-6310 Brazed-on Parts A Type

SL-6311 Brazed-on Parts B Type



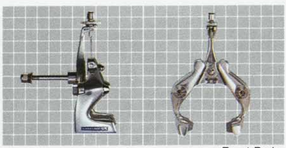
SL-6311

SHIMANO 600 AX Parapul Brake
Model BR-6300

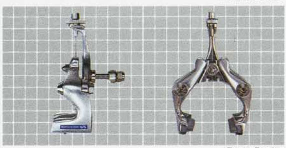
SPECIFICATIONS
Weight • Front & Rear; 13.2 oz. (375g.)
Material • Light Alloy
Features • Aerodynamic Design/ New Para-Pull Mechanism/ Balanced Braking Mechanism/ Quick Response Mechanism/ Quick Release Lever Eliminated/ Hexagon Release/AW Brake Shoe

Front Brake

Rear Brake



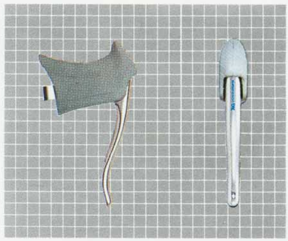
Front Brake



Rear Brake

SHIMANO 600 AX Brake Lever
Model BL-6300

SPECIFICATIONS
Weight • 3.8 oz. (109g.) each (with Outer Pad)
Material • Light Alloy
Features • Aerodynamic Design/Grip Stroke Adjustment (75—85mm.)/One-Step Cable Attachment
Lever Clamp Diameter • 23.8mm., 24.2mm.



Shimano 600 AX Series

We applied our aerodynamic research to the Shimano 600 AX Series in the same way we did with the Dura-Ace AX Series.
With a complete array of innovative mechanisms in compliance with our system components policy, the Shimano 600 AX Series is a great choice for the serious racer and bicycle tourer.

SHIMANO 600 AX Handle Stem
Model HS-6300

SPECIFICATIONS

Weight • 10.1 oz. (286g.) (100mm.)
Material • Light Alloy
Handle Stem Diameter • 7/8" (22.2mm.)
Extension • 2-3/4" (70mm.), 3-5/32" (80mm.), 3-1/2" (90mm.), 3-15/16" (100mm.), 4-5/16" (110mm.), 4-11/16" (120mm.), 5-1/8" (130mm.)
Features • Aerodynamic Design/One Key Release/Hexagon Release
Handle Bar Clamp Diameter • 26.0mm., 25.4mm.

SHIMANO 600 AX Seat Pillar
Model SP-6300 A-Type
SP-6310 (Semi Oval Tube) B-Type

SPECIFICATIONS

Weight • 9.5 oz. (268g.) (SP-6300; 26.8mm.)
9.5 oz. (270g.) (SP-6310; 26.8mm.)
Material • Light Alloy
Outside Diameter of Pillar • SP-6300, 6310/25.4mm., 26.0mm., 26.2mm., 26.4mm., 26.6mm., 26.8mm., 27.0mm., 27.2mm.
Features • Aerodynamic Design (SP-6310)/Hexagon Release

SP-6300 SP-6310

SP-6300

SP-6310

SHIMANO Aero-Bottle
Model SM-BT10

SPECIFICATIONS

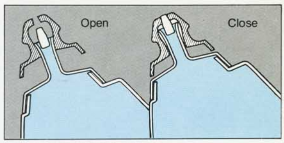
Weight • Bottle; 2.5 oz. (72g.)/Skirt & Cage; 2.1 oz. (60g.)
Material • Bottle; Polyethylene
Skirt; Plastic
Cage; Aluminum
Feature • Aerodynamic Design

Cage for Round Tube

Cage for oval tube

Easy to pick up

Easy to grasp and hold handlebar at the same time



Cap opens easily by mouth

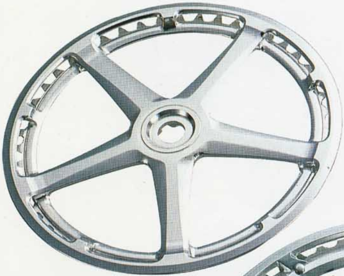
SHIMANO adamas AX SERIES
ROAD & TOURING ENSEMBLE

SHIMANO ADAMAS AX Front Chainwheel & Bottom Bracket Assembly

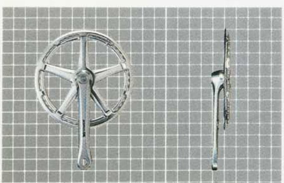
Model FC-AD11 (Single)
FC-AD21 (Double)
BB-SL31 (B.B. Parts)

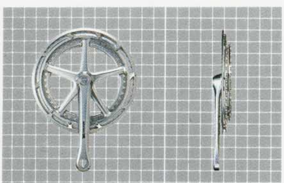
SPECIFICATIONS

Weight • FC-AD 11 • 7.9 oz. (224g.) 48T. Type
FC-AD 21 • 9.7 oz. (275g.) 36T. — 48T. Type
10.7 oz. (305g.) 42T. — 52T. Type
11.6 oz. (328g.) B.B. Parts
Material • Light Alloy
Type • Cotterless
Chain Ring • 1/2" × 3/32" Chain
Teeth • FC-AD11; 48T. only
FC-AD21; 36T. — 48T. Type
42T. — 52T. Type
Crank Length • 6-1/2" (165mm.), 6-3/4" (170mm.)
Crank Thread • BC 9/16" × 20 T.P.I.
Cup Thread • English 1.37" × 24T./French 35 × 1.0
Features • Aerodynamic Design/Twin Gear/M Teeth Mechanism/ W-cut Mechanism/Safety Crank Arm/Octa Joint Crank
Use • With SHIMANO ADAMAS AX Pedal (PD-AD10) or Conventional Pedals


FC-AD11


FC-AD21


FC-AD11


FC-AD21

Shimano Adamas AX Series

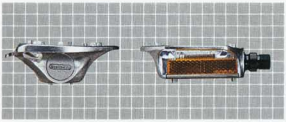
The brand new Adamas AX Series also benefitted greatly from our extensive research into aerodynamics. A series which will be immensely popular with bicycle tourers and cyclists in general, it is an integral part of our system components concept. Incorporating Shimano's innovative mechanisms along with newly developed aerodynamic principles, the Adamas AX Series is truly a modern system for today's bicycle.

SHIMANO ADAMAS AX Pedal

Model PD-AD10

SPECIFICATIONS

Weight • 18.3 oz. (520g.)
Material • Light Alloy
Crank Thread • BC 9/16" × 20 T.P.I.
Features • Aerodynamic Design/Increased Road Clearance/Specially Weighted Design
Use • With SHIMANO ADAMAS AX Front Chainwheel (FC-AD11, 21) or Conventional Chainwheel



SHIMANO ADAMAS AX Freehub

Model FH-AD61

(Small/6 speed—Nut Type)

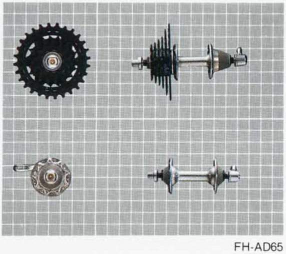
FH-AD65

(Small/6 speed—Quick Release Type)

SPECIFICATIONS

Weight • FH-AD61
Front 6.8 oz. (194g.)
Rear 13.7 oz. (389g.)
FH-AD65
Front 8.2 oz. (232g.)
Rear 14.5 oz. (410g.)
* Excluding Sprockets' weight.
Over Lock Nut Dimensions
• FH-AD61
Front 3-21/32" (93mm)
Rear 4-7/8" (124mm)
FH-AD65
Front 3-13/16" (96mm)
Rear 4-7/8" (124mm)
Amount of Dish • Rear 7/32" (5.5mm.)
Material • Light Alloy Buff Finish
Sprocket • Black Finish
Teeth • Threaded Sprocket; 13T.—15T.
Spline Sprocket; 14T.—34T.
Spoke Holes • 36H.
Features • Aerodynamic Designed Sealed Cap/Aerodynamic Designed Quick Release Lever/ Direction-6 Hub

FH-AD65



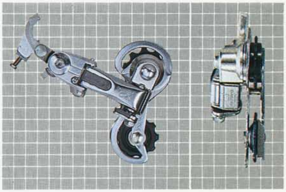
FH-AD65

SHIMANO ADAMAS AX Rear Derailleur

Model RD-AD10

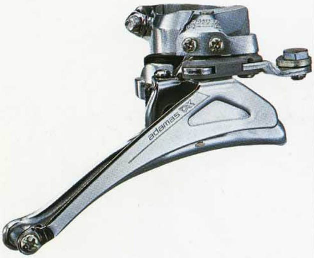
SPECIFICATIONS

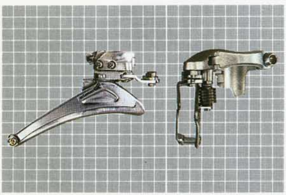
Capacity • Front Difference; 13T. or less
Rear Largest Sprocket; 28T. or less
Weight • 10.0 oz. (283g.),11.3 oz. (319g.) with Bracket
Material • Light Alloy
Features • Aerodynamic Design/Built in Pulley Tension Spring/Direct Cable Mechanism/Light Weight/New Positive Mechanism



SHIMANO adamas AX SERIES
ROAD & TOURING ENSEMBLE

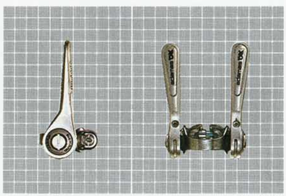
SHIMANO ADAMAS AX Front Derailleur
Model FD-AD10
SPECIFICATIONS
Capacity • 14T. or less
Weight • 3.9 oz. (111g.)
Material • Light Alloy (Body)
Steel • Chromium Finish (Chain Guide)
Inlet Diameter • 1-1/8″ (28.6mm.)
Features • Aerodynamic Design/New Trap-Ease Mechanism/Indent Guide Mechanism/Inner End Guide





SHIMANO ADAMAS AX Shifting Lever
Model SL-AD10 (A Type for Down Tube)
SL-AD11 (Brazed-on B Type for Down Tube)
SL-AD12 (B Type for Down Tube)
SL-AD14 (For Top Tube)
SPECIFICATIONS
Weight • 2.2 oz. (63g.)
Material • Light Alloy & Steel
Type • Friction Type
Lever Clamp Diameter
• 1-1/8″ (28.6mm.)
Features • Aerodynamic Design/Light Weight

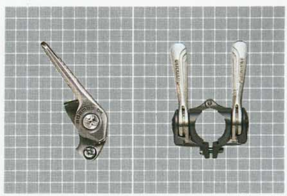
SL-AD10



SL-AD10

SHIMANO ADAMAS AX Shifting Lever
Model SL-AD20 (For Down Tube)
SL-AD24 (For Top Tube)
SPECIFICATIONS
Weight • 3.2 oz. (92g.) SL-AD20
5.3 oz. (150g.) SL-AD24
(Including Cable Guide)
Material • Light Alloy & Steel (SL-AD20)
Light Alloy & Zinc (SL-AD24)
Type • Friction Type
Lever Clamp Diametter
• 1-1/8″ (28.6mm) (SL-AD20)
1″ (25.4mm) (SL-AD24)
Features • Aerodynamic Design/Positive "Click" Shifting Lever/Pre-Select Mechanism

SL-AD24



SL-AD24

Shimano Adamas AX Series

The brand new Adamas AX Series also benefitted greatly from our extensive research into aerodynamics. AX series which will be immensely popular with bicycle tourers and cyclists in general, it is an integral part of our system components concept. Incorporating Shimano's innovative mechanisms along with newly developed aerodynamic principles, the Adamas AX Series is truly a modern system for today's bicycle.

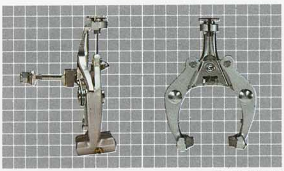
SHIMANO ADAMAS AX Parapul Brake
Model BR-AD10

SPECIFICATIONS

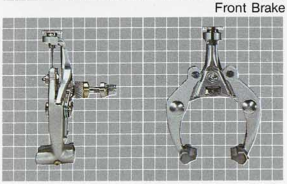
Weight • Front & Rear; 14.0 oz. (397g.)
Material • Brake Arch, Alloy/Support, Steel
Features • Aerodynamic Design/Para-Pull Mechanism/Quick Response Mechanism/Quick Release Lever Eliminated/AW Brake Shoe

Front Brake

Rear Brake



Front Brake



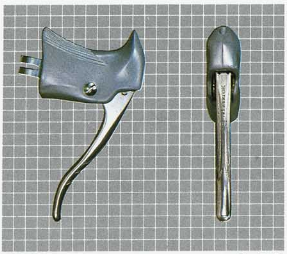
Rear Brake

SHIMANO ADAMAS AX Brake Lever
Model BL-AD10
BL-AD50 (With Dual Extension Lever)

SPECIFICATIONS

Weight • 4.9 oz. (140g.) (BL-AD10 with Pad)
7.7 oz. (220g.) (BL-AD50 with Pad)
Material • Brake Lever; Light Alloy/ Bracket; Steel
Features • Aerodynamic Design/Grip Stroke Adjustment (79 ~ 89mm.)
Lever Clamp Diameter
• 23.8mm., 22.2mm.

BL-AD10



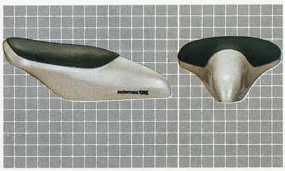
BL-AD10

SHIMANO ADAMAS AX Saddle
Model SD-AD10

SPECIFICATIONS

Weight • 20.5 oz. (580g.)
Material • Plastic & Vinyl
Size • 260mm × 150mm
Features • Aerodynamic Design/ Seamless Plastic Saddle/ Slant Nosed Design/Super Padded Seat/with Tool Pocket/ Enclosed Saddle/Reffector
Use • Conventional Seat Pillar

Reflector



SHIMANO ADAMAS AX Freehub Protector
Model CP-AX30
CP-AX50

SPECIFICATIONS

Weight • 1.1 oz. (31g.) CP-AX30
1.8 oz. (52g.) CP-AX50
Material • Resin (Blue)
Freehub Protector Dimension
• CP-AX30; 5.4″ (137mm.)
CP-AX50; 7-1/2″ (188mm.)
Use • AX Series Freehub 36H. only
Feature • Aerodynamic Design

CP-AX30 CP-AX50

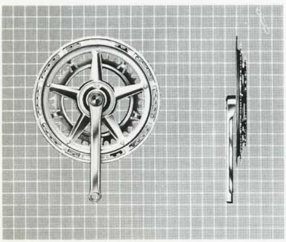
SHIMANO AX SERIES ROAD & TOURING ENSEMBLE

SHIMANO INTEGER AX Front Chainwheel & Bottom Bracket Assembly

Model FC-AX21
BB-SL32 (B.B. Parts)

SPECIFICATIONS

Weight • 15.0 oz. (425g.) 39T. — 52T. Type
4.8 oz. (135g.) Top Protector
11.5 oz. (325g.) B.B. Parts
Material • Steel
Type • Cotterless
Chain Ring • 1/2″ × 3/32″ Chain
Teeth • 39T. — 52T. Type
Crank Length • 6-1/2″ (165mm.), 6-3/4″ (170mm.)
Crank Thread • BC 9/16″ × 20 T.P.I.
Cup Thread • English 1.37 × 24T./French 35 × 1.0 (Special Order)
Features • Aerodynamic Design/Top Protector/W-cut Mechanism/Usable for 12-speed/Safety Crank Arm/Octa Joint Crank

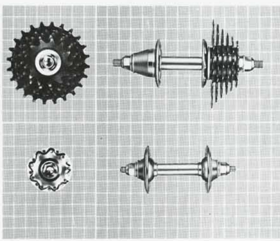


SHIMANO DIRECTION-6 AX Freehub

Model FH-AX61 (Small/6-speed)

SPECIFICATIONS

Weight • Front; 8.7 oz. (248g.)
Rear; 17 oz. (482g.)
Over Lock Nut Dimensions
• Front; 3-21/32″ (93mm.)
Rear; 4-7/8″ (124mm.)
Amount of Dish • Rear; 7/32″ (5.5mm.)
Material • Steel
Sprocket • Black Finish
Teeth • Threaded Sprocket; 13T. — 15T.
Spline Sprocket; 14T. — 34T.
Spoke Holes • 36H.
Features • Aerodynamic Designed Sealed Cap/ Aerodynamic Designed Hub Nut/Direction 6 Mechanism

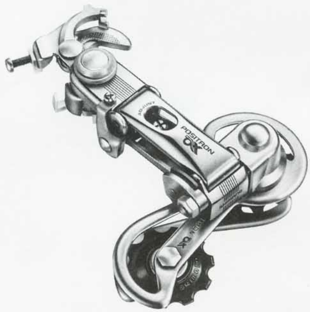


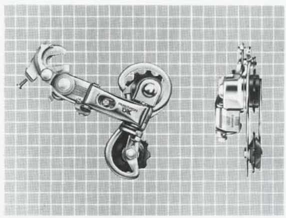
SHIMANO POSITRON AX Rear Derailleur

Model RD-AX10

SPECIFICATIONS

Capacity • Front Difference; 13T. or less
Rear Largest Sprocket; 28T. or less
Weight • 10.0 oz. (283g.), 11.3 oz. (319g.) with Bracket
Material • Steel
Features • Aerodynamic Appearance/Built in Pulley Tension Spring/Direct Cable Mechanism/New Positive Mechanism/Saver Mechanism
Option • Brazed-on Type





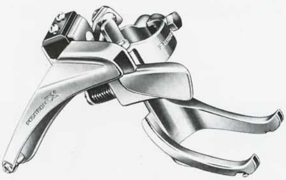
Shimano AX Series

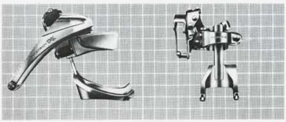
The Shimano AX Series was an integral part of our aerodynamic program. Although we made the Shimano AX Series especially for standard multi-speed bicycles, the many mechanisms and aerodynamic features will be admired by all bicycle enthusiasts.

SHIMANO POSITRON AX Front Derailleur
Model FD-AX10

SPECIFICATIONS

Capacity • 14T. or less
Weight • Body; 6.7 oz. (190g.)
Cable Guide; 1.9 oz. (55g.)
Material • Steel
Inlet Diameter • 1-1/8″ (28.6mm.), 1″ (25.4mm.)
Features • Aerodynamic Appearance/Inner Chain Protector/Trap-Ease Mechanism/Indent Guide Mechanism/Top Normal Type

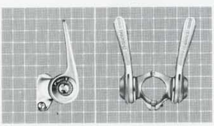




SHIMANO POSITRON AX Shifting Lever
Model SL-AX10

SPECIFICATIONS

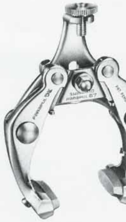
Weight • 3.9 oz. (110g.) Bracket (Steel)
4.9 oz. (140g.) Bracket (Zinc)
Material • Lever • Resin
Bracket • Zinc & Steel
Type • Friction Type
Attachment Position • Top Tube
Lever Clamp Diameter • 1″ (25.4mm.)
Features • Aerodynamic Appearance/With Fairing Cover



SHIMANO PARAPUL AX Brake
Model BR-AX10

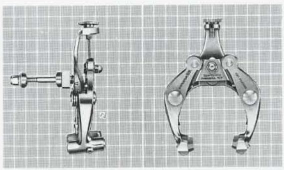
SPECIFICATIONS

Weight • 18.2 oz. (515g.)
Material • Steel
Features • Aerodynamic Appearance/Para-Pull Mechanism/Balanced Braking Mechanism/Quick Response Mechanism/Quick Release Lever Eliminated/AW Brake Shoe

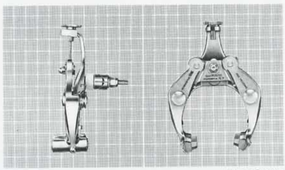


Front Brake

Rear Brake



Front Brake

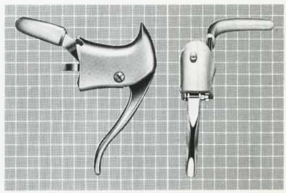


Rear Brake

SHIMANO DEL-80 AX Brake Lever
Model BL-AX10
BL-AX50 (With Dual Extension Lever)

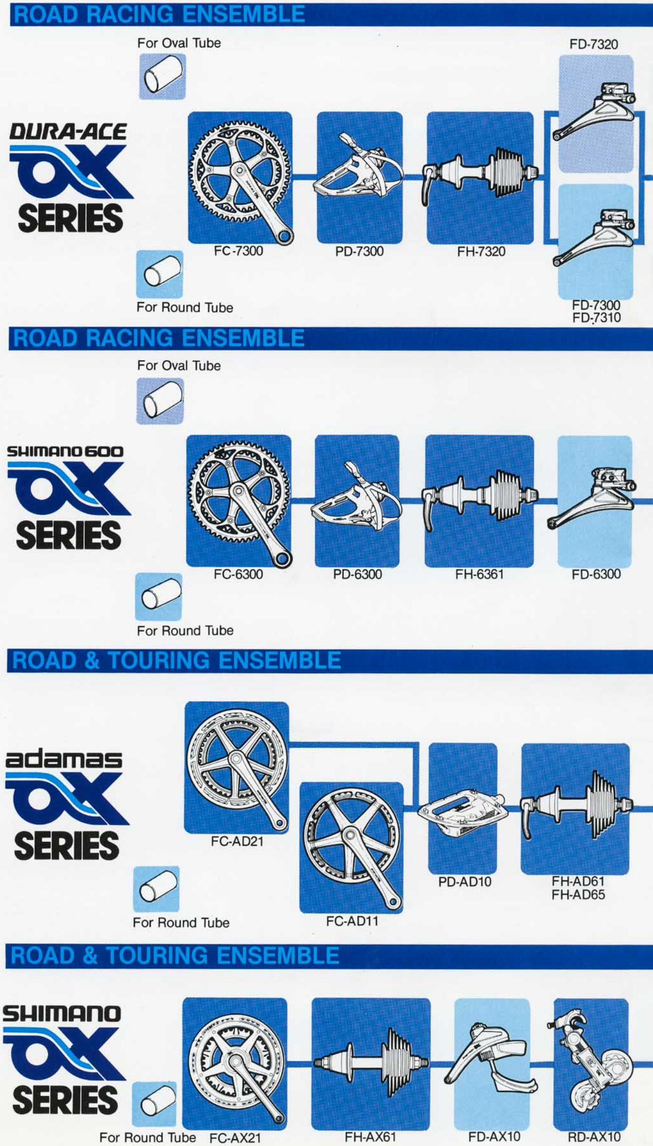
SPECIFICATIONS

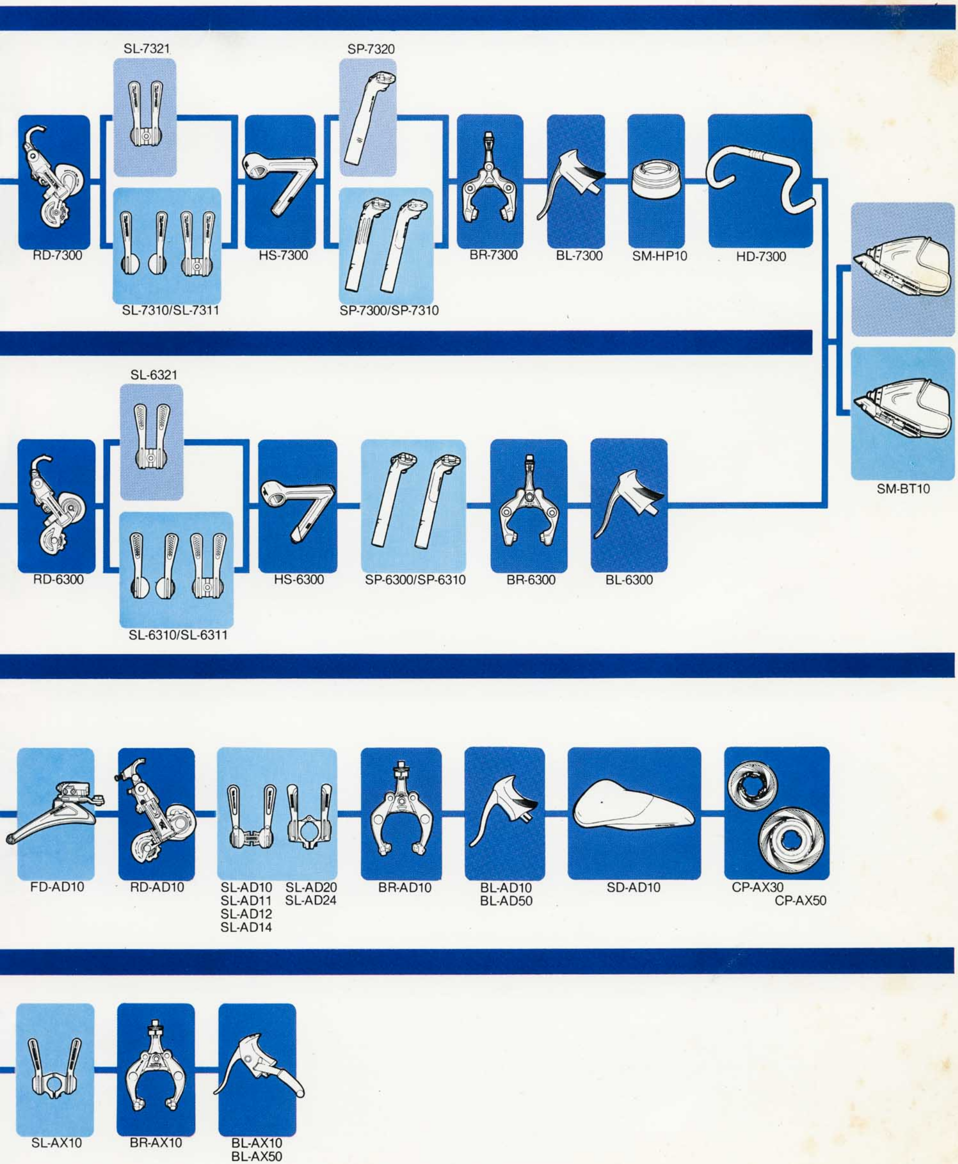
Weight • 6.0 oz. (170g.)
(BL-AX10 With Pad)
8.8 oz. (250g.)
(BL-AX50 With Pad)
Material • Steel
Features • Aerodynamic Design/Grip Stroke Adjustment (79 — 89mm.)
Lever Clamp Diameter
• 23.8mm., 22.2mm.



AX SERIES SYSTEM COMPONENTS CHART

Shimano pioneered the "System Components" concept which has been responsible for producing so many exciting and innovative systems for the bicycle's advancement.
And the latest development from Shimano is truly revolutionary in concept. A new aerodynamically designed component system which brings the bicycle into line with today's space-age developments and technology—Shimano's AX Series. In addition, these series are the beneficiaries of many of Shimano's world-famous mechanism innovations. Designed to enhance the bicycle's performance as a whole rather than concentrating on individual parts, great improvements have been possible due to this enlightened policy.
Each component series has been given special consideration with regard to its intended function. Whether designing top-of-the-line racing components or regular multi-speed components, we have applied the same high standards of research and development to improve performance. Thus, the best of our mechanisms and design techniques are incorporated into all our products, irrespecitve of class or use.
Furthermore, Shimano's aims have always been consistent: strength, lightness and research to decrease air resistance for a better bicycle. The cyclist enjoys a more comfortable and faster ride with efficient use of human energy. And these principles have been passed onto all our series where applicable. The "System" chart demonstrates the versatility of our products from top racing components through to regular multi-speed components.
Here you can see how each component works perfectly with the other and you can select the most suitable components to work in unison for a better ride.
Because of the nature of our System Components policy, which in the long run is for the improvement of the bicycle, it is not always possible to interchange our components with those of other manufacturers. However, in most cases our components are interchangeable.
The use of our components will, we are confident, demonstrate the dramatic differences between Shimano components and components which have stood still in their development.

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SM-HP10
HD-7300
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SL-6321
RD-6300
HS-6300
SP-6300/SP-6310
BR-6300
BL-6300
SL-6310/SL-6311
SM-BT10
FD-AD10
RD-AD10
SL-AD10
SL-AD11
SL-AD12
SL-AD14
SL-AD20
SL-AD24
BR-AD10
BL-AD10
BL-AD50
SD-AD10
CP-AX30
CP-AX50
SL-AX10
BR-AX10
BL-AX10
BL-AX50

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Specifications are subject to change without notice.