SUZUKI

# V-Strom 650

# TECHNICAL INFORMATION

# VStrom 650

# TECHNICAL INFORMATION

# 1. INTRODUCTION AND CONCEPT

## 1) Nothing To Stop You

*Sport Enduro Tourer.*

*What else can we call the 2004 Suzuki V-Strom 650, also known as the DL650? It is a machine built for adventuring fun, whether that means climbing a mountain pass on a twisty two-lane paved road, exploring the center of an ancient city, cruising along the Autostrada to the seashore, or simple showing up at work with a mile-wide grin.*

*Or all of the above. Every day, or on two weeks of serious vacation. Alone, or with company.*

*All in a middleweight package that delivers in-town versatility and sporty on-road performance, with low seat height, wind protection, highway touring comfort and serious range.*

*Ready for two-wheeled adventure? With the new V-Strom 650, there's nothing to stop you.*

## 2) Concept

*"The Middleweight Sport Enduro Tourer"*

*The V-Strom 650(DL650)'s product concept is "The middleweight Sport Enduro Tourer".*
*In other words, the V-Strom 650 inherits the V-Strom1000's product concept "Sport Enduro Tourer" and is even more user-friendly.*
*The V-Strom 650 has been designed to be competitive in the 650cc class in terms of high power output, convenience for touring and versatile performance.*
*To achieve these objectives, the development team clearly identified the following three main aims:*

### ■ *Sporty Performance*

*The V-Strom650's engine maximum output and torque are higher than those of any other competitors.*

*And the V-Strom650 is equipped with 6-speed transmission while the competitors have 5-speed transmission. The primary ratio and 1st to 6th ratios are same as SV650's, however, the final ratio is different from SV650's in order to achieve greater versatility.*

*The V-Strom650 equips sporty suspension. Front fork preload is adjustable. And the hydraulic remote control adjustment is adopted for the rear suspension. Rebound damping adjustment is equipped.*
*The V-Strom650 uses 43mm-diameter-stanchion-tube front forks-the same as V-Strom1000-in order to obtain rigidity and absorb road shocks effectively.*
*Rake and trail have been adjusted for sport riding.*

*The frame and swingarm are based on the V-Strom1000's and are lightweight. The twin-spar aluminium-alloy frame provides the right amount of rigidity for smooth handling.*

■***Touring performance***

*Fuel tank capacity is 22 liters for long cruising range.*
*The carrier and the luggage tie-down hooks are designed to make it easy to fix luggage.*
*Top and pannier cases will be available as optional parts.*

■***User-friendly performance***

*A height adjustable screen is newly equipped with the V-Strom650. It contributes to wind protection and it can be adjusted in 3 steps. The distance between the lowest position and highest is 50 mm. This way, the model presents enjoyable performance for riding on a highway straightaway, an urban street or any other road.*
*A low and narrow seat contributes to riding comfort and user-friendly performance.*
*Seat height is 820mm. The seat height is low enough for beginners or female riders.*
*The instrument cluster has been newly designed for easy reading.*
*Newly equipped LCD panel displays odometer, dual tripmeters, water temperature gauge, fuel gauge and clock.*

## *A middleweight sport enduro tourer*

### ***Advanced performance as an enduro tourer***

- Long cruising range
  - 22ℓ fuel tank
  - Reduced fuel consumption
    - Fuel injection with SDTV (Suzuki Dual Throttle Valve)
    - 6-speed transmission
- Comfort
  - Relaxed riding position
  - Low vibration
    - V-twin engine
  - Wind protection
    - Height-adjustable screen
    - Knuckle covers (optional parts)
  - Tandem riding
    - Flat, continuous-surface seat
    - Luggage rack with grab bar
- Carrying capacity
  - Flat, continuous-surface carrier
  - Top case and pannier cases (optional parts)
  - Rear suspension with hydraulic spring preload adjustment system
  - Front suspension with preload adjustment
- Others
  - Environmental engineering
    - PAIR (Pulsed-secondary AIR-injection) system
    - Catalyzer
    - $O_2$ feedback system
  - Practical utility
    - Low seat height
    - Instrument cluster with fuel gauge and clock
    - Adjustable brake lever

### ***Sporty performance***

- Lightweight chassis
  - Aluminium-alloy frame
  - Aluminium-alloy swingarm
  - Hollow aluminium-alloy wheels
- Sporty suspension
  - 43mm-diameter-stanchion-tube front fork
- High engine output
  - DOHC V-Twin engine
- Sporty look
  - Multi-reflector headlights
  - Sporty-design instrument cluster

# 2. STYLING DESIGN

## 1) Overview

*"Sharp Looks, Relaxed Comfort And Extended Range"*
*The V-Strom650 comes with a sporty front fairing to deflect the wind, and an upswept silencer. The relationship between the seat, handlebars and footpegs is designed to deliver relaxed comfort.*



## 2) Fuel tank

- *The V-Strom 650's 22-liter fuel tank extends riding range between refueling stops.*
- *In order to provide ample space for the rider to move forward and backward for weight transfer, the section from the front of the seat to the rear of the fuel tank is shaped as a flat, continuous surface-this also preserves the integrity of the V-Strom650's styling.*


## 3) Luggage rack

- *The V-Strom650 is designed to accept a hard top case and pannier cases supplied from Suzuki.*
- *The seat's passenger section and the luggage rack compose a flat and continuous surface to carry large items.*

### 4) Windscreen

- *The V-Strom650's windscreen is carefully shaped to reduce wind reaching the rider-wide at the shoulders with a lip on the upper edge designed to direct the wind blast over the rider's helmet.*
- *The windscreen can be manually adjusted in three steps covering a total vertical range of 50mm*
- *The windscreen angle changes as it is raised, becoming more upright.*


### 5) Low and narrow seat

- *The seat is narrower at the thighs which makes it easier for the rider to reach the ground.*
- *The seat height is 820mm.*

### 6) High-mounted muffler

- *High-mounted muffler combined with the robust styling give it an adventurous look.*

## *7) Slim and compact front fairing and sidecovers*

- *The V-Strom650's front fairing and sidecovers are slim and compact in comparison with the V-Strom1000.*
- *The seat height is 820mm which is 20mm lower than that of V-Strom1000.*

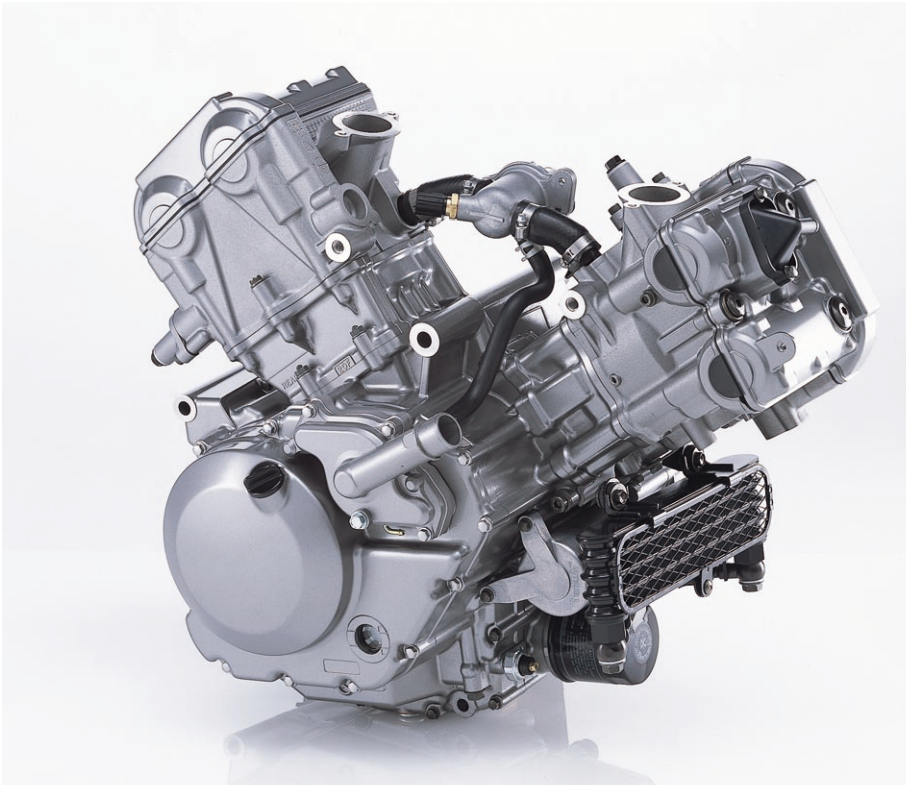

***2004 V-Strom650***


***2003 V-Strom1000***

# 3. ENGINE DESIGN

## 1) Overview

- *The engine is based on the SV650/S, however it has been revised to fit the V-Strom650's character as a Sport Enduro Tourer. The engine also features sporty performance and low emissions.*
- *The cam profile, air cleaner box and muffler are changed from that of SV650/S to achieve an even more versatile V-Twin engine.*
- *The V-Strom650 aims at about 5% increase in output from 4,000rpm to 6,500rpm from the SV650/S.*

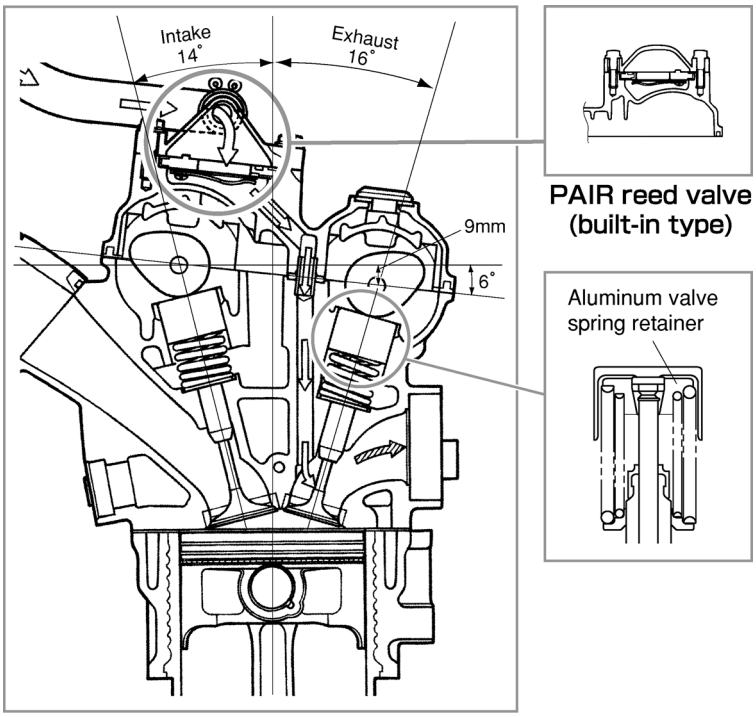


***645cc DOHC V-Twin engine***

| | |
|---|---|
| Engine type | 90°V-Twin, 4-stroke,4-valve, DOHC |
| Cooling system | Liquid-cooled |
| Bore X stroke | 81.0mm×62.6mm |
| Displacement | 645cc |

## *2) Cylinder head*

- *The cylinder head is a DOHC, 4-valve, direct-acting valve actuation and inner shim type, with straight intake-port shape.*
- *Valve angles are 14° for the intake and 16° for the exhaust, resulting in a compact combustion chamber.*
- *31mm diameter intake valves are used to increase high-rpm power output.*
- *Aluminium is used for valve spring retainer, reducing valve spring loading and achieving reduction of mechanical losses.*
- *By having the cylinder head cover attaching surface at a 6° down slope, the exhaust camshaft is offset 9mm lower, by which the exhaust-side cylinder-head height is reduced.*
- *The cylinder head has a built-in Pulsed-secondary AIR-injection (PAIR) reed valve, which contributes to lower emissions.*

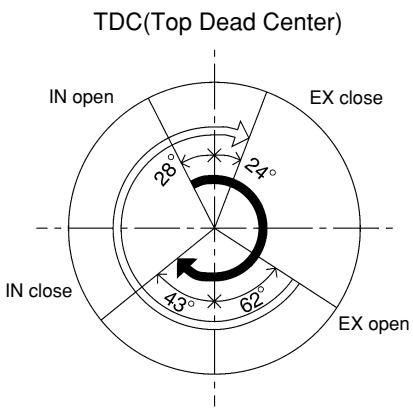



***Cylinder head***

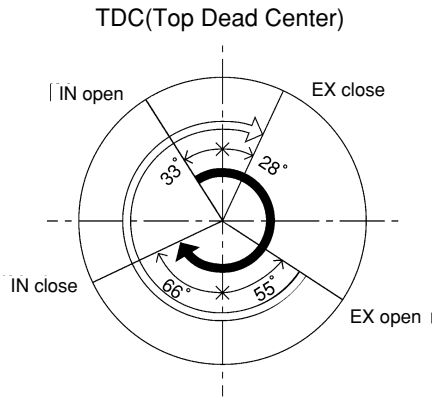
| | | 2004 V-Strom 650 |
|---|---|---|
| Valve system | | Direct-acting |
| Intake valve | Valve diameter | 31mm |
| | Valve stem diameter | 4.5mm |
| | Valve spring | Double |
| | Valve angle | 14° |
| Exhaust valve | Valve diameter | 25.5mm |
| | Valve stem diameter | 4.5mm |
| | Valve spring | Double |
| | Valve angle | 16° |
| Valve angle | | 30° |
| Compression ratio | | 11.5:1 |

### 3) Camshaft

- *Air cleaner box capacity is decreased from 8.5 liters to 7.8 liters in comparison to the SV650.*
- *The cam profile is changed from that of SV650/S to increase engine output feel in the low-and mid-range.*
- *The camshaft has a hollow construction, contributing to weight reduction.*




**2004 V-Strom 650**




**2003 SV650/S**

| | V-Strom650 | | SV650/S | |
|---|---|---|---|---|
| | IN | EX | IN | EX |
| Open | BTDC28° | BBDC62° | BTDC33° | BBDC55° |
| Close | ABDC43° | ATDC24° | ABDC66° | ATDC28° |
| Max. valve lift | 8.7mm | 7.3mm | 8.7mm | 7.3mm |



### 4) Conrod

- *By using shot-peening treatment, the conrods are strong for high engine output.*

| | V-Strom 650 |
|---|---|
| Small end diameter | 20mm |
| Large end diameter | 41mm |
| Thickness | 8.0mm |
| Surface treatment | Shot-peening |

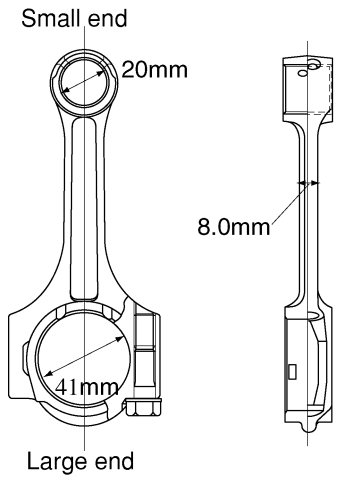
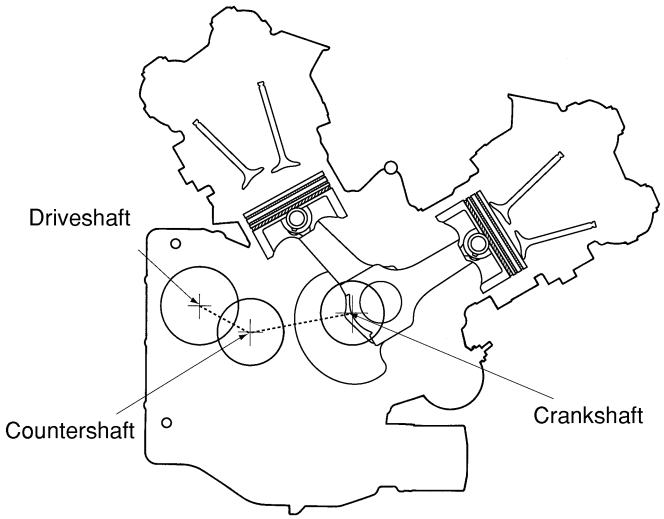



Diagram shows SV650/S conrod.

## 5) Transmission

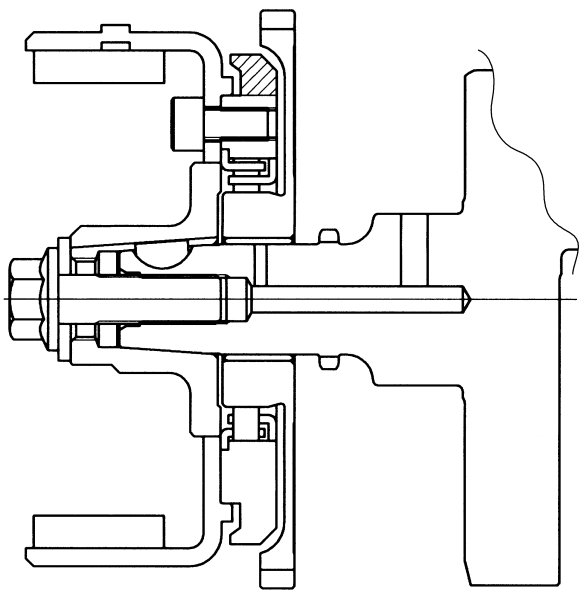
- *The engine has its three shafts in vertically staggered layout, enabling the engine's front-to-rear length to be shortened, which in turn contributes to a shorter wheelbase.*



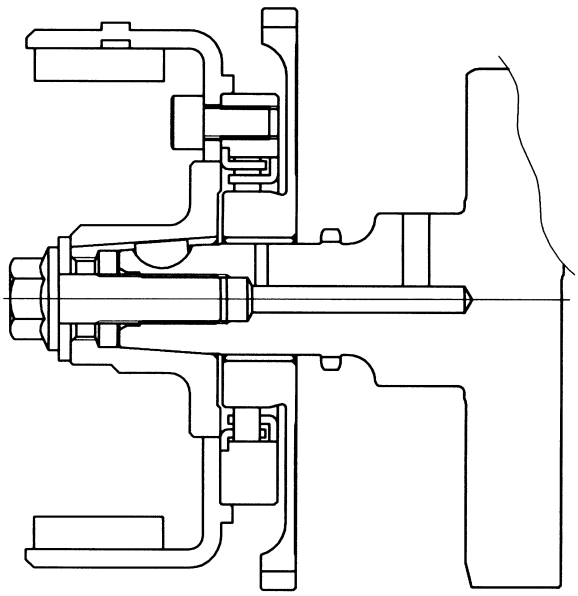

SV650/S



- *The crank inertial moment is increased by 4% in comparison with SV650/S in order to enhance the smoothness of the engine output.*



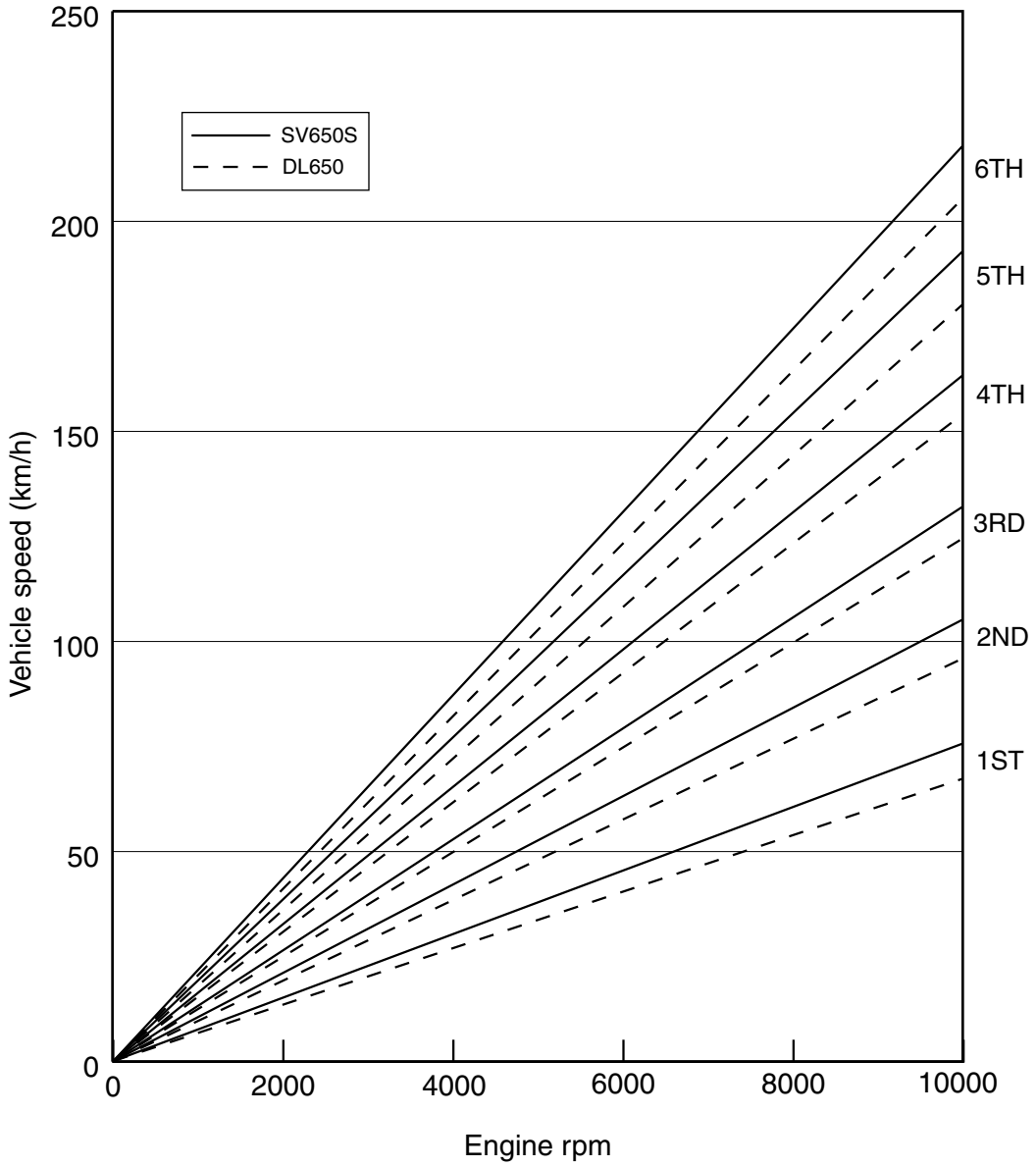
***2004 V-Strom650 starter clutch***



***2003 SV650 starter clutch***

- *The primary ratio and the 1st to 6th ratios are same as SV650's, however, the final ratio is different from SV650's in order to enhance versatility.*

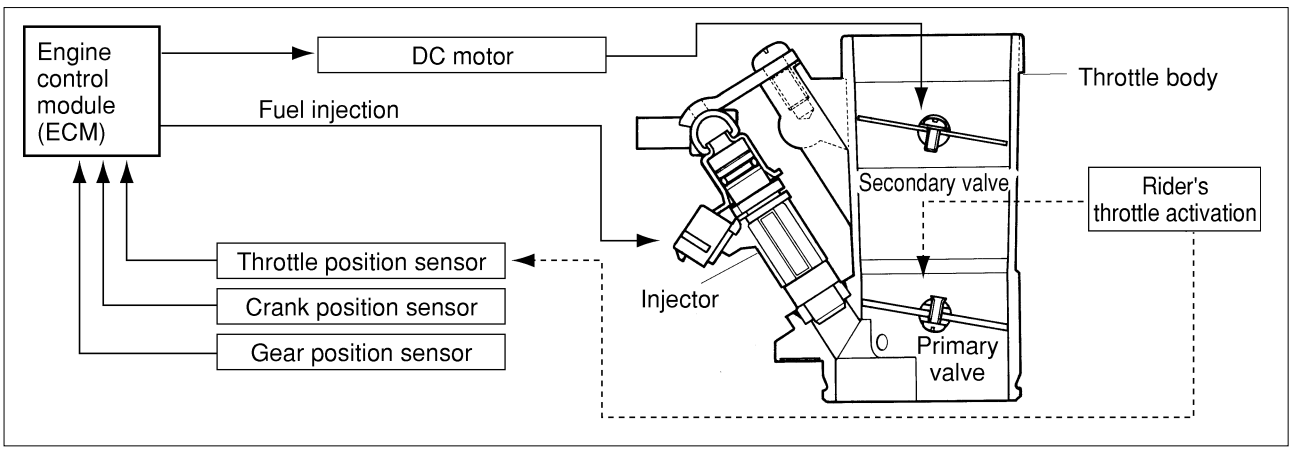
| | 2004 V-Strom650 | 2003 SV650S |
|---|---|---|
| Primary | → | 2.088(71/34) |
| 1st | → | 2.461(32/13) |
| 2nd | → | 1.777(32/18) |
| 3rd | → | 1.380(29/21) |
| 4th | → | 1.125(27/24) |
| 5th | → | 0.961(25/26) |
| 6th | → | 0.851(23/27) |
| Final | 3.133(47/15) | 2.933(44/15) |

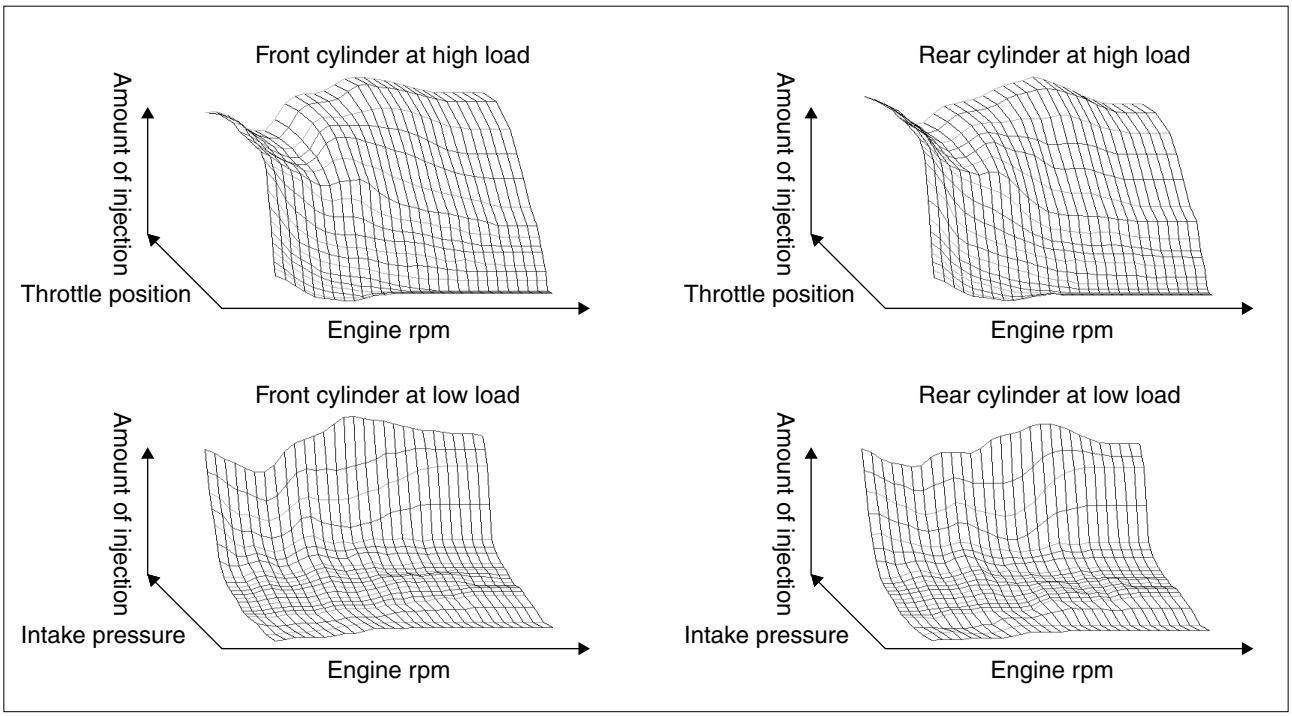



**2004 V-Strom650 and 2003 SV650S vehicle speed**

## 6)Fuel injection

- *The fuel injection system, controlled by high-speed 16-bit-CPU-equipped engine control module (ECM), conducts highly detailed fuel injection operation and contributes to keeping emissions low.*
- *Two injection maps - one for low engine loading and another for high engine loading - are provided for each cylinder.*

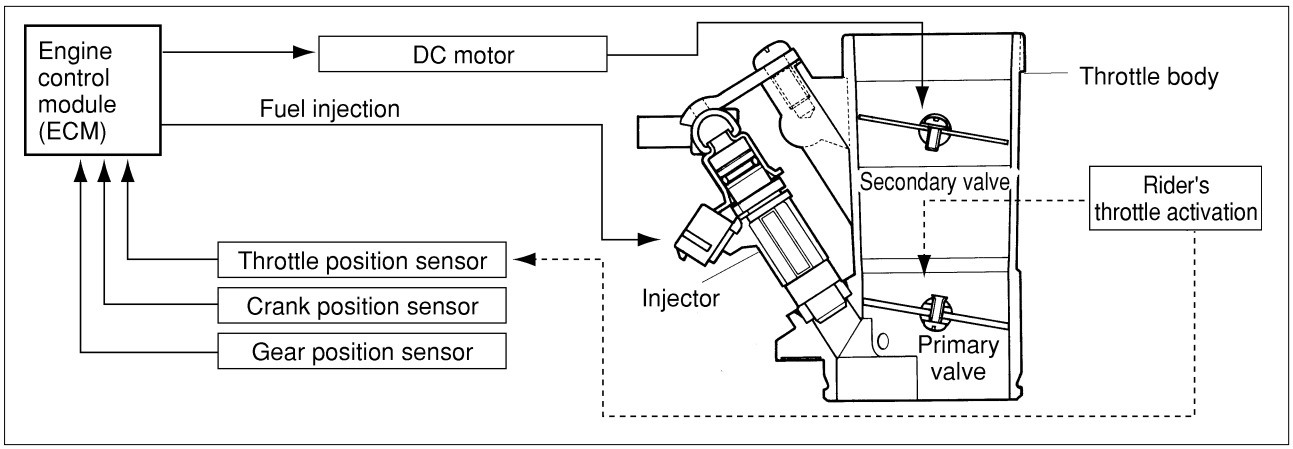


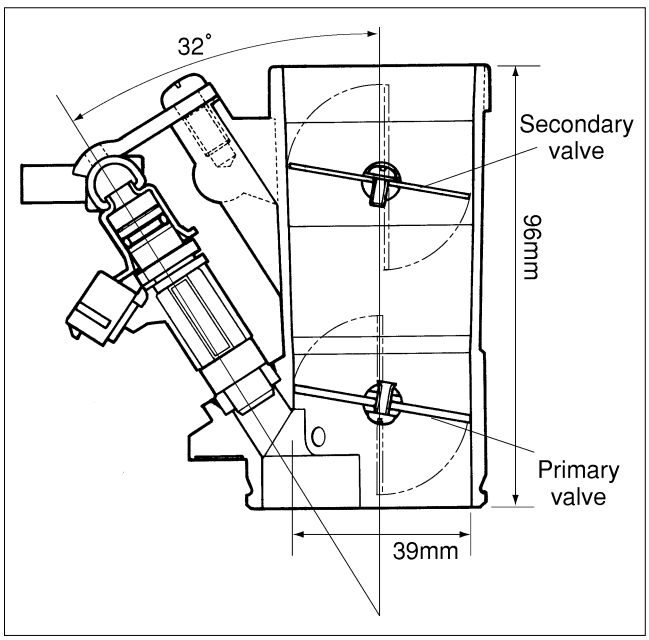




***2004 V-Strom650 injection maps***

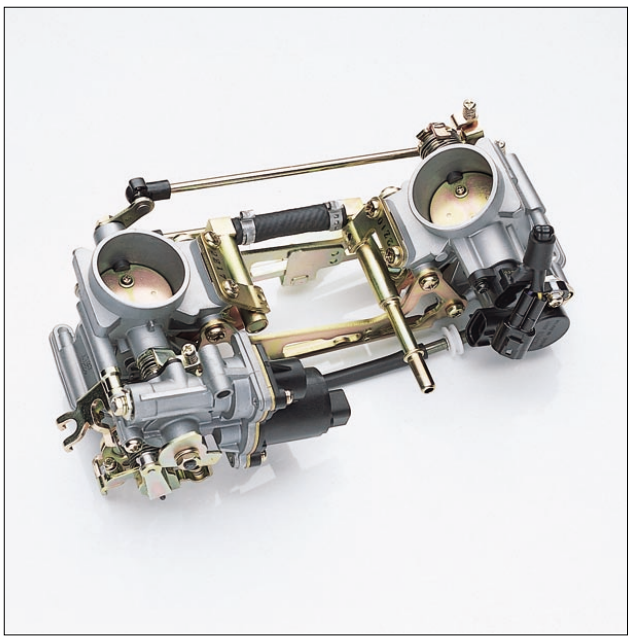
## 7)Suzuki Dual Throttle Valve (SDTV)

- *Suzuki Dual Throttle Valve (SDTV)*
  *By having two throttle valves - a primary butterfly valve and a secondary butterfly valve - inside each throttle body, the SDTV system helps the engine achieve linear low- and mid-range throttle response, as well as increased low- and mid-range torque output.*
- *Rider's throttle activation moves the throttle cable and opens/closes the primary valve, which also puts into motion the throttle position sensor.*
  *Based on information from the throttle position sensor, crank position sensor (engine rpm) and gear position sensor, the engine control module (ECM) activates the lightweight and compact DC motor to open/close the secondary valve. As a result, a linear and smooth throttle response, as well as increased low- and mid-range torque, are achieved.*




**2004 V-Strom650 throttle body**

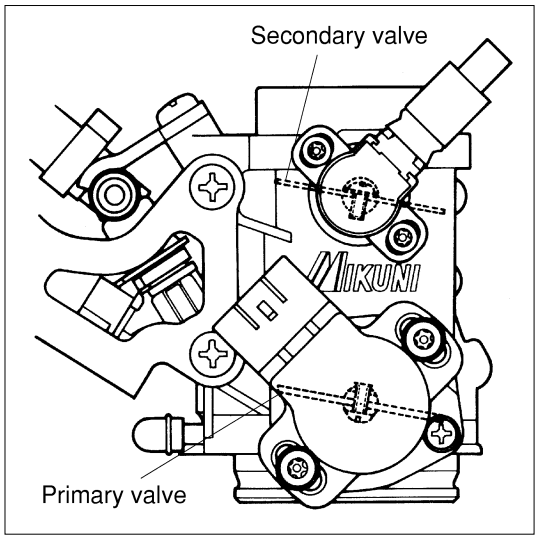


**Suzuki Dual Throttle Valve**

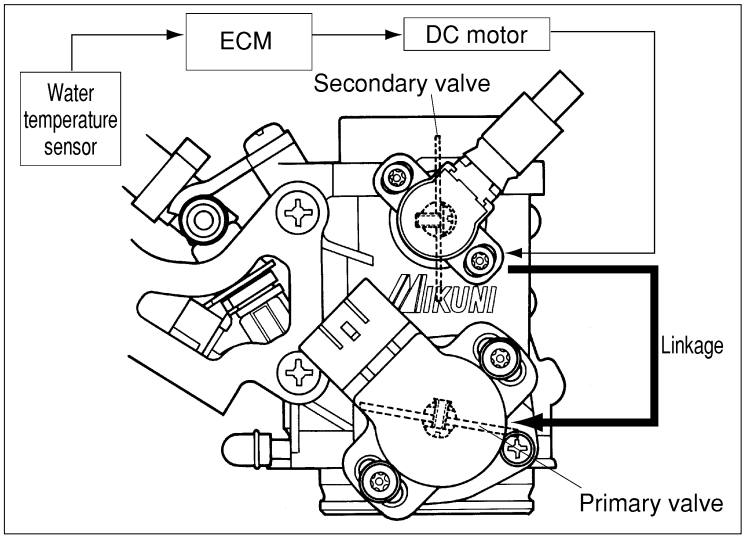
ENGINE DESIGN

### *8)Auto Fast Idle System (AFIS)*

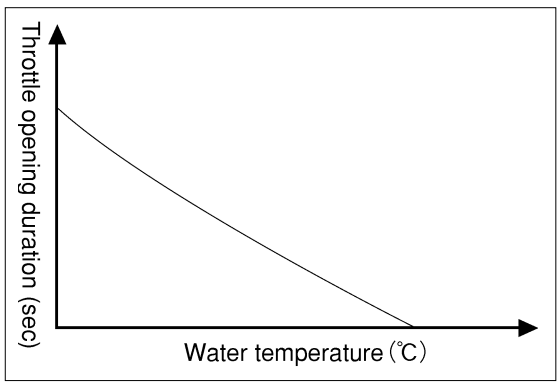
*AFIS is an idling system that is operated by the engine control module (ECM) monitoring the coolant temperature.*
*When the engine is started, the ECM, based on the information from the coolant temperature sensor, sends electrical signals to the DC motor instructing the amount and duration of throttle opening.*
*The DC motor (the secondary-throttle-valve actuator), upon receiving electical signals from the ECM, opens the secondary throttle valve to a proper position.*
*The primary throttle valve is opened to a proper position by a linkage from the secondary throttle valve.*




***When AFIS is not in operation***



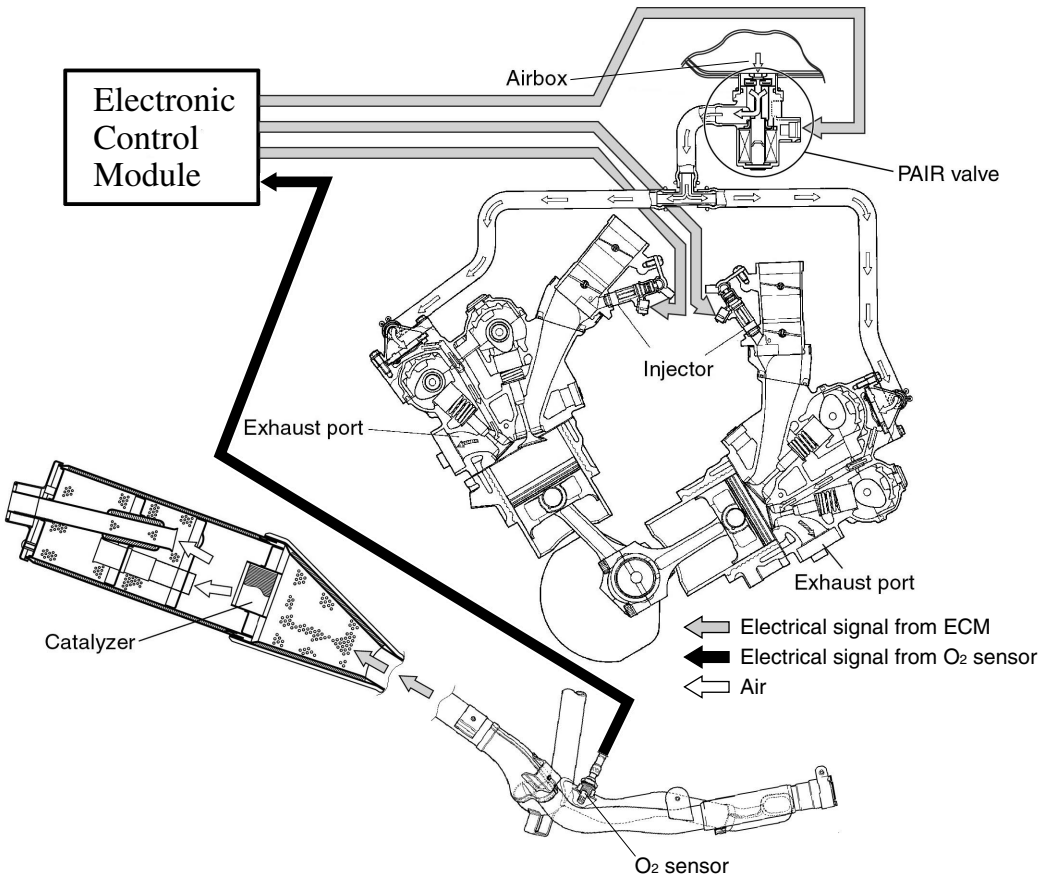

***When AFIS is in operation***



### 9) $O_2$ feedback system for lower emissions

• *The catalyzer and $O_2$ feedback system have been equipped for lower emissions.*

| | V-Strom650 | SV650 |
|---|---|---|
| Fuel injection | Yes | Yes |
| Catalyzer | Yes | Yes |
| $O_2$ sensor | Yes | No |



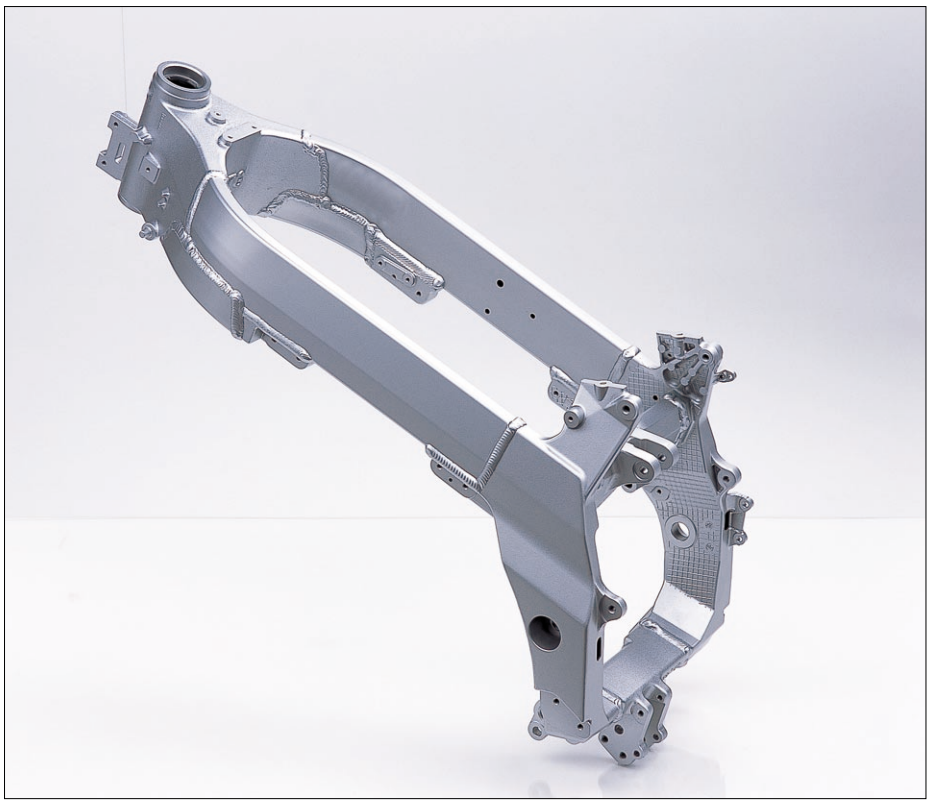
# 4. CHASSIS DESIGN

## 1) Overview

- *The chassis design is based on that of V-Strom1000. However, the swingarm is different from that of V-Strom1000. And dry weight is 17kg lighter than that of V-Strom1000.*
- *The well-balanced rigidity of the V-Strom 650's twin-spar aluminium-alloy frame and swingarm is designed to contribute to smooth handling, and the frame itself is lighter than the steel frames used on competing models.*

### *2)Frame*

- *The frame is built using cast and extruded pieces, while the swingarm combines extruded arms with a cast pivot section.*



***Frame***

### 3) Swingarm

- *V-Strom650 shares the same basic chassis design with V-Strom1000, the swingarm is slightly changed to achieve balance of rigidity suited for the 650cc class.*
  *(The swingarm is changed from rear axle bracket type to straight-pipe type.)*

**2004 V-Strom650**

**2003 V-Strom1000**

### 4) Front suspension

- *Font fork preload is adjustable.*

| | 2004 V-Strom650 |
|---|---|
| Brand | SHOWA |
| Spring Preload | Adjustable |
| Compression Damping | Not adjustable |
| Rebound Damping | Not adjustable |

**2004 V-Strom650**

- *The V-Strom650 uses 43mm-diameter-stanchion-tube-same as the V-Strom1000-in order to obtain ample rigidity and absorb road shocks effectively.*
- *Rake and trail is adjusted for sport riding.*
- *The front fork is changed from V-Strom1000's inner cartridge type to the free valve.*

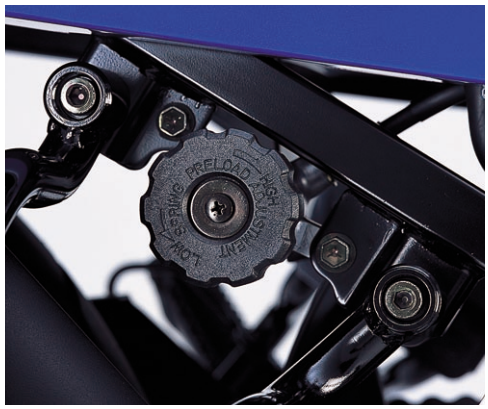
| | V-Strom650 | V-Strom1000 |
|---|---|---|
| Type | Free valve | Inner cartridge |
| Front Fork Diameter | 43mm | 43mm |
| Rake | 26.0° | 26.5° |
| Trail | 110mm | 111mm |

### *5) Rear suspension*

- *The rear suspension features a hydraulic spring preload adjustment system. Turning a knob conveniently located just below the right sidecover allows rear spring preload to be increased or decreased when, for example, picking up or dropping off a passenger, or to suit road conditions.*
- *Rear suspension rebound damping is also adjustable.*

| | 2004 V-Strom650 |
|---|---|
| Brand | SHOWA |
| Spring Preload | Adjustable (Hydraulic remote control) |
| Compression Damping | Not adjustable |
| Rebound Damping | Adjustable |

***Rear suspension***




***Hydraulic spring preload adjustment system***

## 6) Brakes

- *The front wheel carries two 310mm discs with dual-piston hydraulic calipers.*
- *The rear wheel carries a 260mm disc with a single-piston caliper.*

| | 2004 V-Strom650 | 2003 V-Strom1000 |
|---|---|---|
| Front Brake Disc Outside Diameter | 310mm | 310mm |
| Front Brake Caliper Type | 2 piston pin-slide | 2 piston pin-slide |
| Rear Brake Disc Outside Diameter | 260mm | 260mm |
| Rear Brake Caliper Type | 1 piston pin-slide | 1 piston pin-slide |

***Front Brakes***

***Rear Brake***



## 7) Tires

- *The V-Strom 650 features three-spoke cast alloy wheels and radial tires.*
- *The 110/80R19 M/C front tire a tread pattern and carcass construction specifically designed for the V-Strom650.*
- *The 150/70R17 M/C rear tire features carcass construction specifically designed for the DL series.*

| | 2004 V-Strom650 | 2003 V-Strom1000 |
|---|---|---|
| Tires | Radial | Radial |
| Front tire | 110/80R19 M/C | 110/80R19 M/C |
| Rear tire | 150/70R17 M/C | 150/70R17 M/C |

# 5. ELECTRICAL DESIGN

## 1) Overview

*The electrical design inherits that for the V-Strom1000, sharing its adventurous image.*

## 2) Sporty and user-friendly design with adventurous image

*(1) Headlights and turn signals*

- *Dual multi-reflector headlights with 60W/55W halogen bulbs. Both bulbs are illuminated at both low and high beam.*
- *Each headlight also carries a small position lamp for European markets.*
- *Hexagon shaped turn signals has been adopted for sporty image.*


**2004 V-Strom650**


**2003 V-Strom1000**

*(2) Instrument cluster*

- *The V-Strom 650's compact instrument cluster includes an analog speedometer and tachometer as well as digital LCD, odometer, dual tripmeters, coolant temprature gauge, fuel gauge and clock.*
- *LED neutral, turn signal and high-beam indicator lamps are also used, as is an oil pressure warning lamp. (Used both as FI system warning lamp and coolant temprature warning lamp.)*


**2004 V-Strom650**

*(3) Tail light*

*V-Strom650's tail light is the same as the V-strom1000's, sharing the sporty image.*

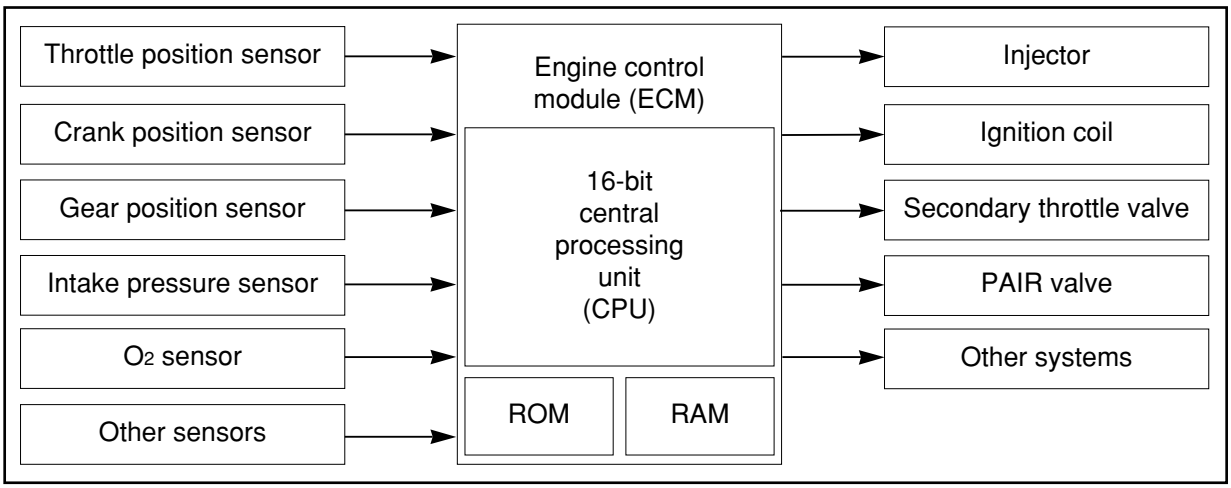
*The tail light uses two 21/5W combination brake-light and rear position bulbs, increasing visibility.*

***Tail light***

## *3) Newly designed ECM (Engine Control Module)*

*The engine control module processes electrical-signal information from various sensors - including throttle position sensor, crank position sensor, gear position sensor, intake-pressure sensor and $O_2$ sensor - and sends instructions for fuel injection volume, ignition timing, the secondary throttle valve, PAIR valve, etc.*

*The ECM contains a high-speed 16-bit central processing unit (CPU), delivering increased processing performance.*



## 6. Specifications

| | | V-Strom650 |
|---|---|---|
| Overall length | | 2290mm (90.2in) |
| Overall width | | 840mm (33.1in) |
| Overall height | | 1390mm (54.7in) |
| Wheelbase | | 1540mm (60.6in) |
| Ground clearance | | 165mm ( 6.5in) |
| Seat height | | 820mm (32.3in) |
| Dry mass | | 189kg (417lbs) |
| Engine type, valve system | | 4-stroke, 90°V-Twin/DOHC, 4-valve |
| Displacement | | 645cc |
| Bore x stroke | | 81.0×62.6mm |
| Compression ratio | | 11.5:1 |
| Cooling system | | Liquid-cooled |
| Combustion chamber shape | | TSCC (Twin Swirl Combustion Chamber) |
| Engine red zone (meter indicated) | | 10,500rpm |
| No. of valves per cylinder | | 4 |
| Valve actuation system | | Direct actuation, chain cam drive |
| Valve adjustment intervals | | 24,000km |
| Intake valve | No. per cylinder | 2 |
| | Valve angle | 14° |
| | Diameter | 31mm |
| | Stem diameter | 4.5mm |
| | Maximum lift | 8.7mm |
| | Opening/closing timing | Open at BTDC 28° |
| | | Close at ABDC 62° |
| Exhaust valve | No. per cylinder | 2 |
| | Valve angle | 16° |
| | Diameter | 25.5mm |
| | Stem diameter | 4.5mm |
| | Maximum lift | 7.3mm |
| | Opening/closing timing | Open at BBDC 62° |
| | | Close at ATDC 24° |
| Fuel tank capacity | | 22.0L |
| Fuel delivery system type | | Electronically controlled fuel-injection system |
| Throttle valve size | | 39mm |
| Air filter shape | | Panel type |
| Exhaust system type | | 2-into-1 |
| Lubrication system | | Wet sump |
| Lubricant | Oil change | 2,300ml |
| | Filter change | 2,700ml |
| | Overhaul | 3,100ml |
| Coolant capacity | | 1.9L |

| | | V-Strom650 |
|---|---|---|
| Transmission type | | 6-speed, constant-mesh |
| Clutch type | | Wet multi-plate, coil spring |
| Clutch actuation system | | Wire type |
| Clutch spring type | | Coil spring |
| No. of clutch springs | | 6 |
| No. of clutch plates | Drive | 7 |
| | Driven | 6 |
| Primary drive gear ratio | | 2.088 (71/34) |
| Final drive gear ratio | | 3.133 (47/15) |
| Gear ratio | 6th | 0.851 (23/27) |
| | 5th | 0.961 (25/26) |
| | 4th | 1.125 (27/24) |
| | 3rd | 1.380 (29/21) |
| | 2nd | 1.777 (32/18) |
| | 1st | 2.461 (32/13) |
| Total reduction ratio | 6th | 5.574 |
| | 5th | 6.291 |
| | 4th | 7.906 |
| | 3rd | 9.036 |
| | 2nd | 11.632 |
| | 1st | 16.106 |
| Frame type | | Twin-spar (aluminium-alloy) |
| Caster angle | | 26° |
| Trail | | 110mm |
| Steering angle (left & right) | | 40° |
| Minimum turning radius | | 2.6m |
| Front fork | Suspension type | Telescopic |
| | Stanchion tube diameter | 43mm |
| | Spring preload adjustment | Fully adjustable |
| | Front wheel stroke | 150mm |
| Rear cushion unit | Suspension type | Link type |
| | Spring preload adjustment | Fully adjustable (Hydraulic remote control) |
| | Rear cushion unit stroke | 71mm |
| | Rear wheel travel | 150mm |
| Front brake | Type | Tokico hydraulic pin-slide 2-piston, dual discs |
| | Disc diameter | 310mm |
| | Lever adjustment | 6-way adjustable |
| Rear brake | Type | Nissin hydraulic pin-slide 1-piston |
| | Disc diameter | 260mm |
| Front wheel | | 19M/C×MT2.50 |
| Rear wheel | | 17M/C×MT4.00 |
| Front tire | Size | 110/80R19 M/C 59H |
| | Brand | Bridgestone TW101T |
| Rear tire | Size | 150/70R17 M/C 69H |
| | Brand | Bridgestone TW152F |
| Ignition type | | Fully transistorized |
| Headlight bulb | | 12V 60/55W×2 |
| Position light bulb | | 12V 5W×2 |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