

Press Release 1997

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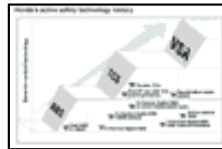
Technology  July 2, 1997

Vehicle Stability Assist Development Objectives

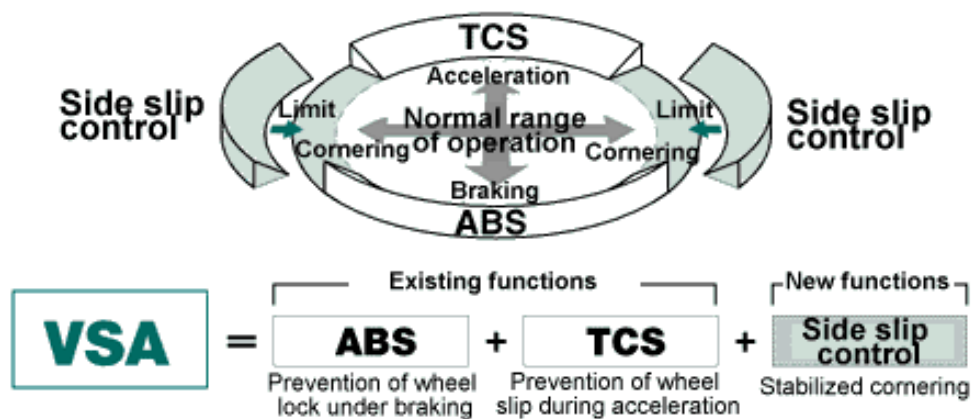
Tokyo, July 2, 1997 --- From the early days, Honda has looked at means to increase active safety. It was the first to offer a four-wheel anti-lock brake (ABS) system in Japan, and the first in the world to successfully develop a traction control system for front wheel drive vehicles.

The Vehicle Stability Assist (VSA) system we are introducing today adds side slip control to ABS and TCS systems. This new system controls sudden changes in vehicle behavior, giving the driver the time to keep control of the situation. When driving in the rain or on snow, the system stabilizes the vehicle, reducing counter-productive driver tension.

In order not to spoil driving pleasure we have devised a unique system based on the concept of "vehicle stabilization through control of the front wheels". VSA is a simple, reliable system enhancing performance and driving pleasure.



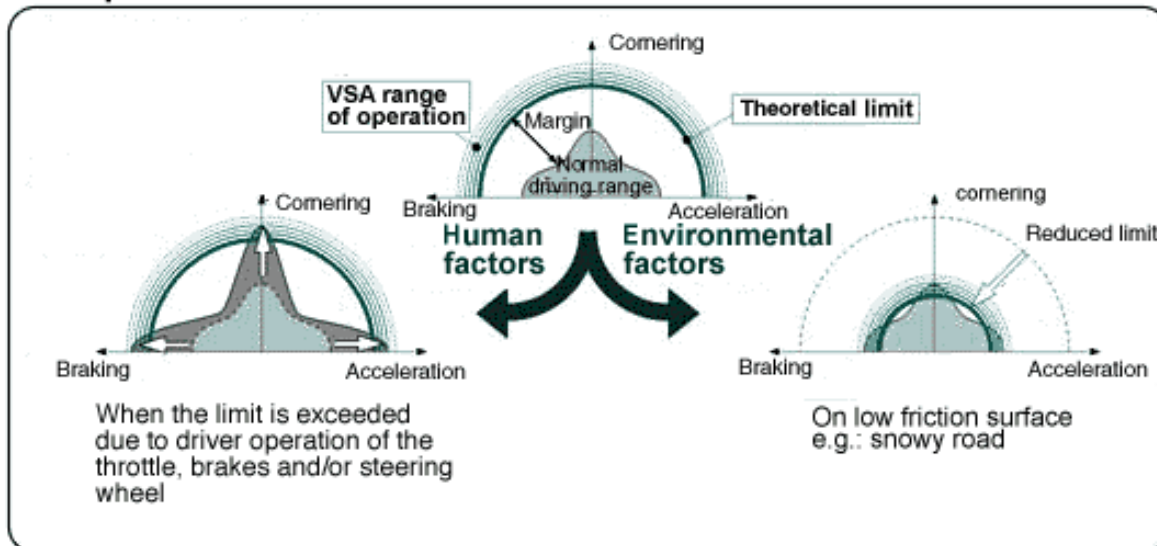
VSA's concept



What is side slip?When cornering forces exceed tire performance :

- the rear wheels slip sideways, resulting in a sudden change in heading toward the inside (spin) = oversteer.
- the front wheels slip sideways, resulting in a wider cornering line = understeer.

VSA Operation

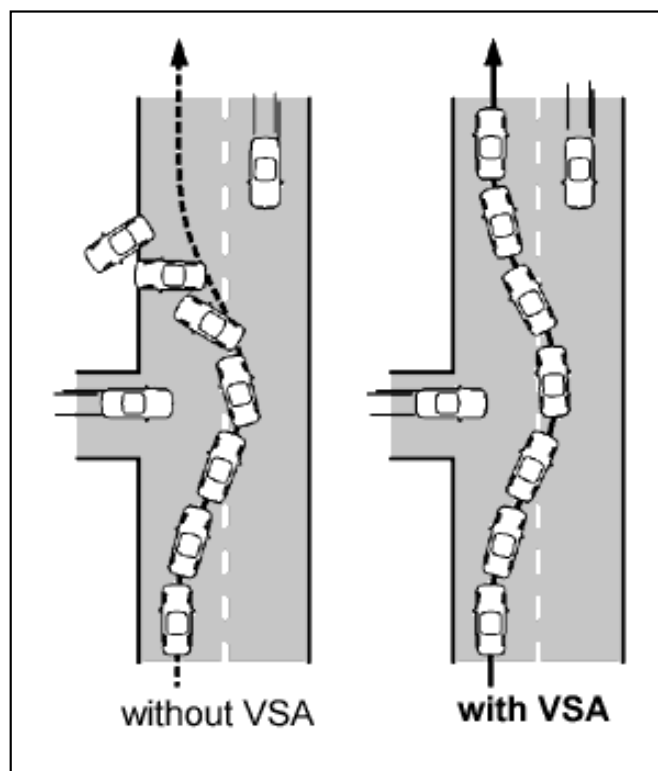
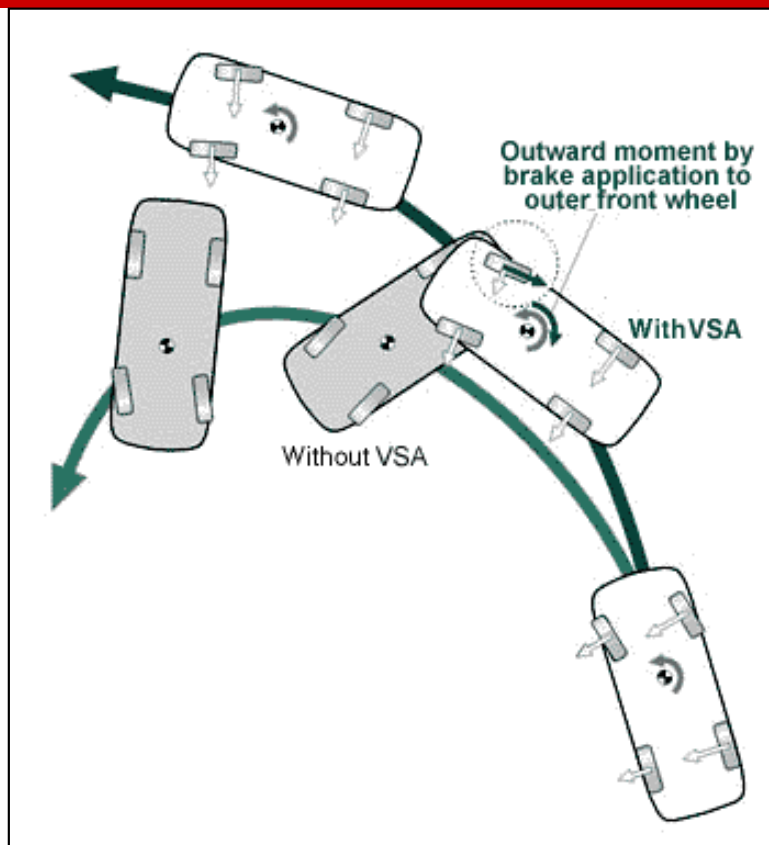


VSA control areas		
Items	purpose	method
oversteer control	spin prevention	brake application to outer front wheel
understeer control during acceleration	improved traceability during cornering under acceleration	brake application to front wheel + engine power control
standing start control	improved starting from standstill on roads with split surface	brake and power control
brake control during cornering	shortened braking distance while cornering (ABS)	fully independent wheel control through 4-channel ABS

How the System Operates

1) Oversteer control:

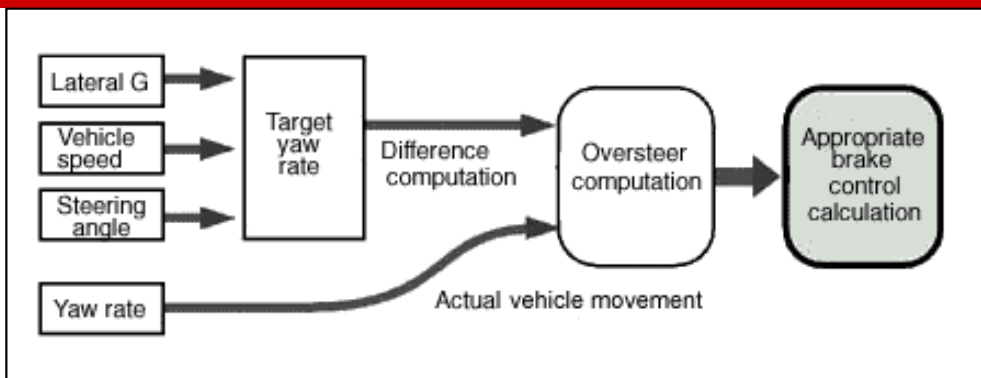
By braking the outer front wheel, an outward moment is generated. The cornering force at the front is thus reduced, decreasing the spin generating moment and stabilizing vehicle behavior.



*** Detection and Control**

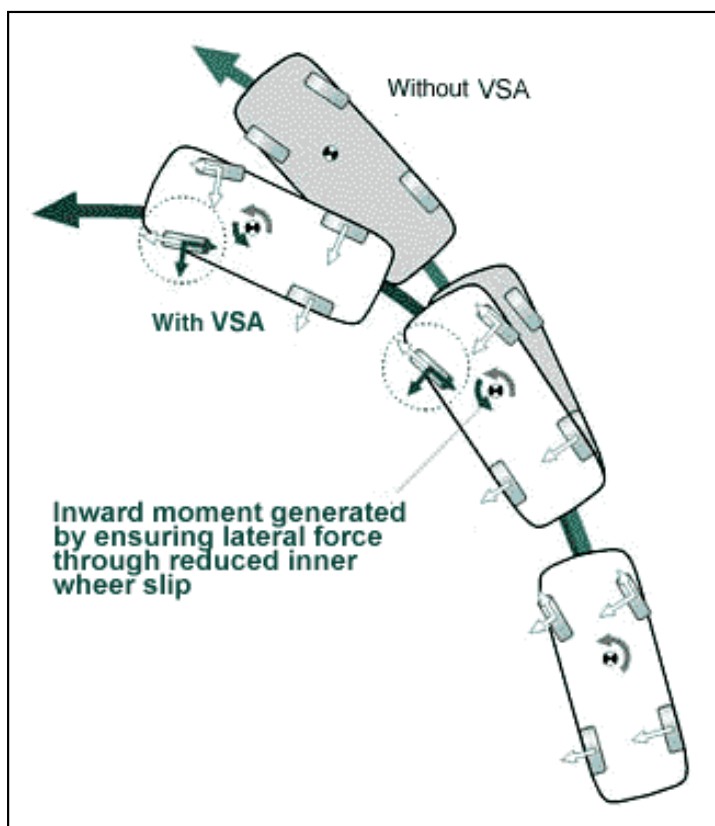
The yaw rate intended by the driver (target yaw rate) is calculated according to lateral acceleration, steering angle and vehicle speed. If the actual yaw rate exceeds the target, the VSA system brakes the outside front wheel to reduce yaw.

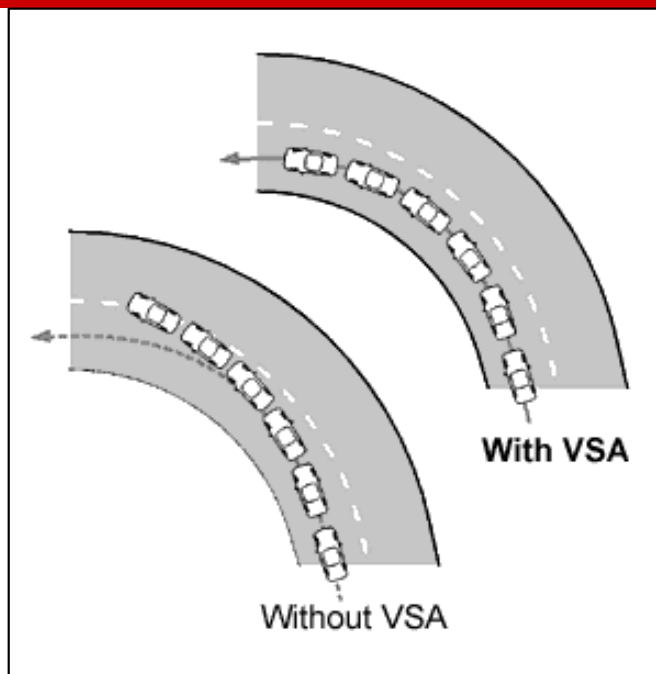
Brake Application to Outer Front Wheel = Oversteer Control



2) Understeer control when cornering under power

When the car's cornering line widens under excessive throttle application, the system intervenes by reducing engine torque and, if necessary, by braking the inside front wheel. This creates an inward moment helping the car trace the line originally intended by the driver.



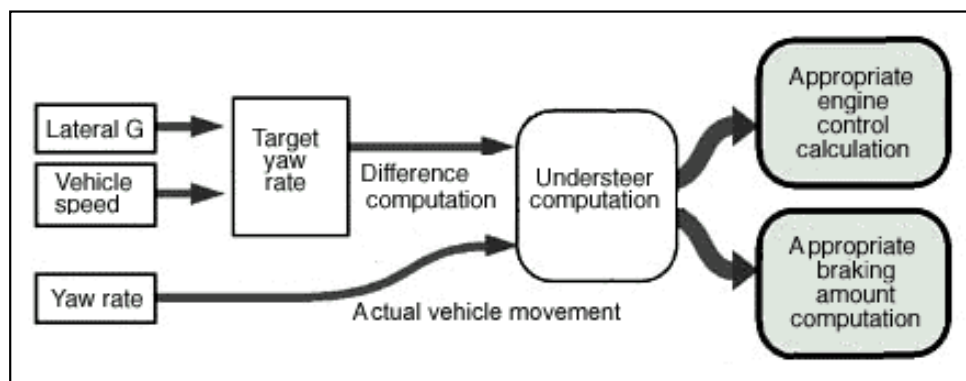


*** Detection and Control**

The yaw rate intended by the driver (target yaw rate) is calculated using steering angle and vehicle speed. If the actual yaw rate is below target, the system intervenes to reduce engine power and increase yaw rate. If necessary, the system will also brake the inner front wheel.

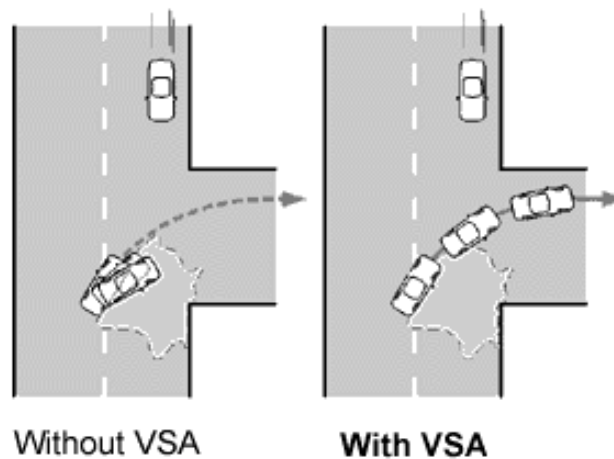
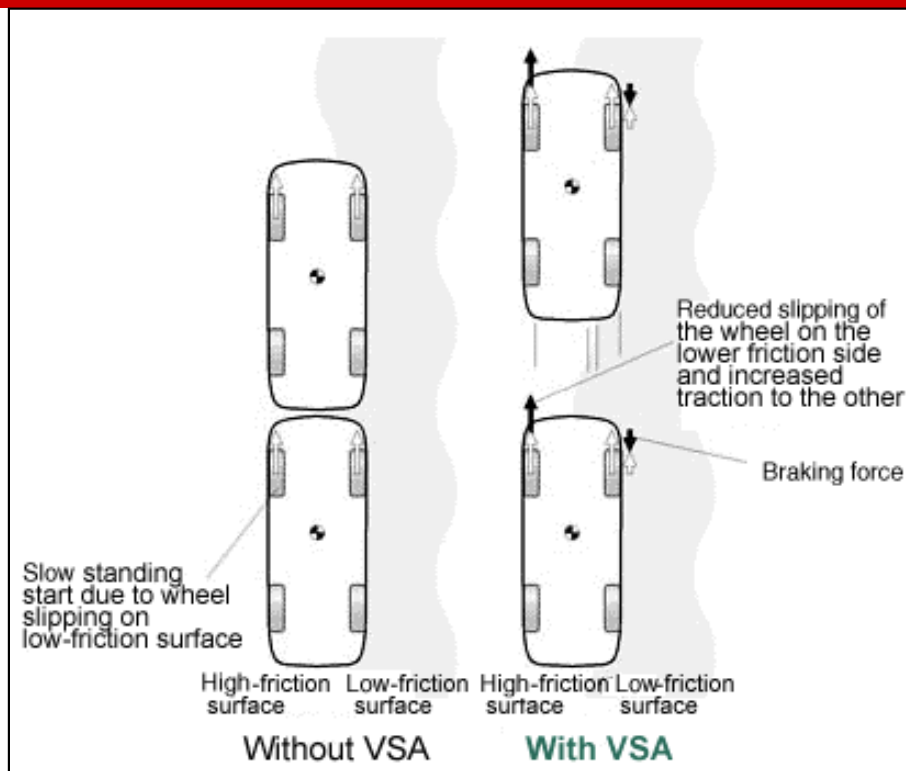


Engine Torque Reduction + Inner Front Wheel Braking = Understeer Control When Cornering Under Power



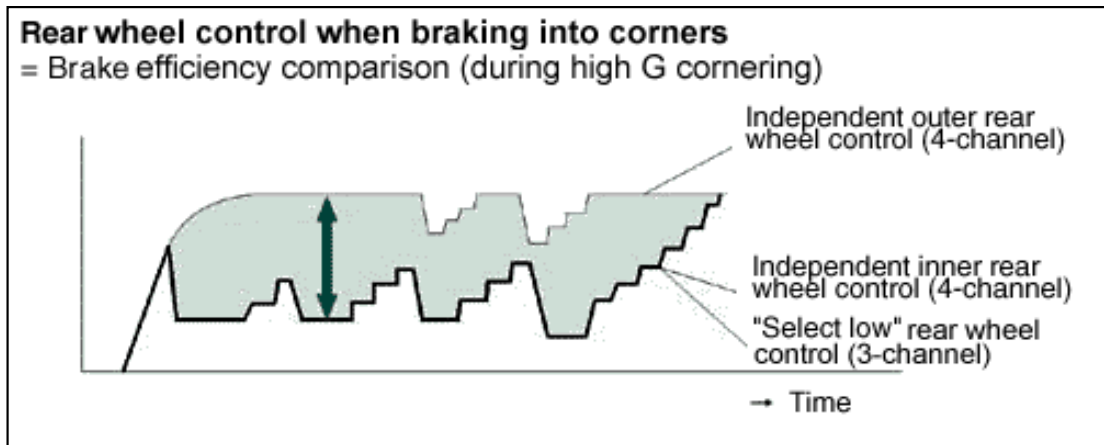
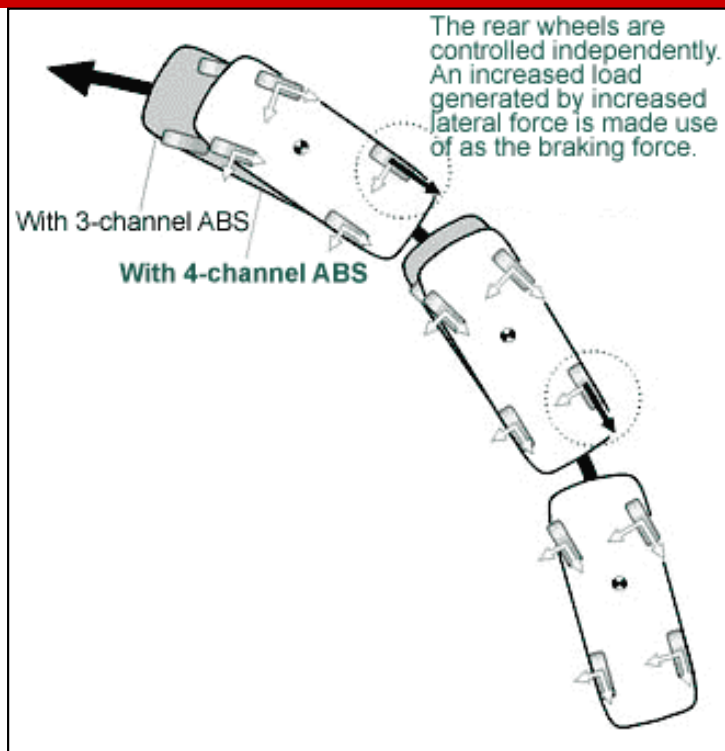
3) Standing Start Slip Control

When accelerating on a split surface with different grip coefficients, engine torque is usually transmitted to the wheel with the lowest grip level, resulting in traction loss. By braking the wheel with the lowest grip, greater torque is provided to the wheel on the other side, ensuring quick, powerful acceleration.



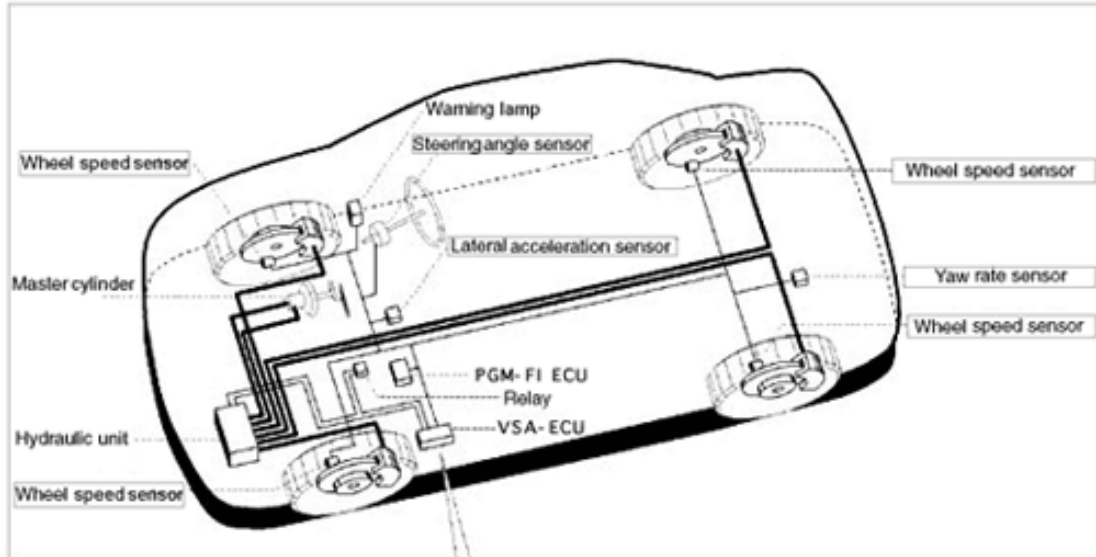
4) Braking control under cornering

When high cornering forces are detected, ABS automatically switches to the 4-channel mode (3-channel mode when in a straight line or when cornering at lower speeds). Taking advantage of the weight transfer during cornering, the system applies a higher brake pressure on the outer rear wheel, improving braking performance.

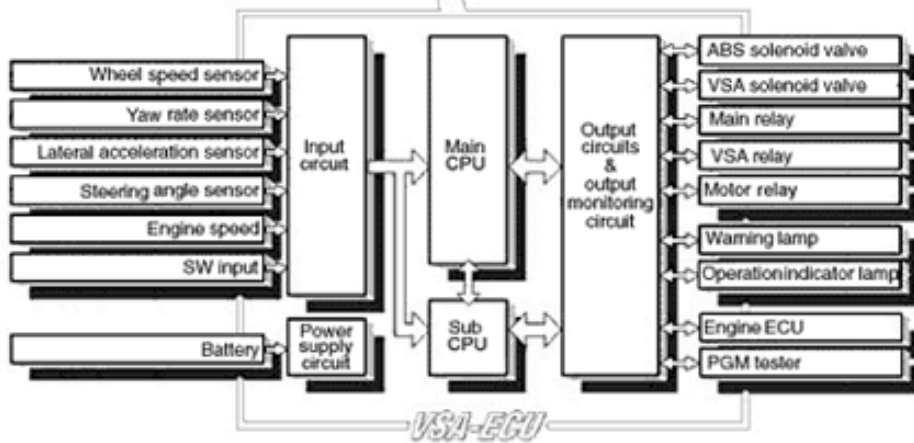


System Configuration and Principal of Operation

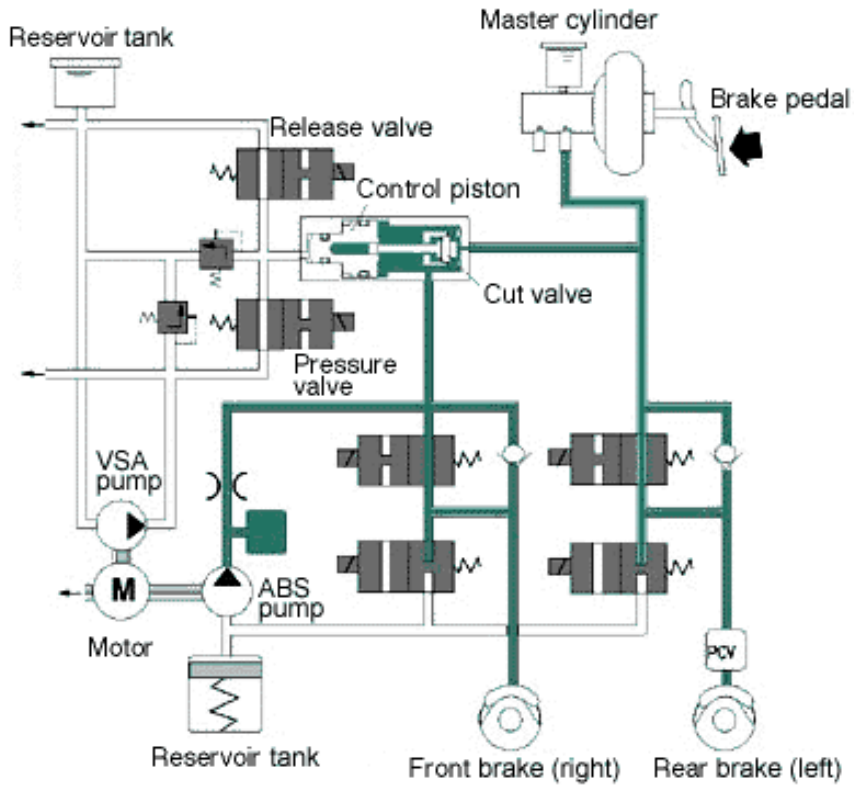
System Configuration



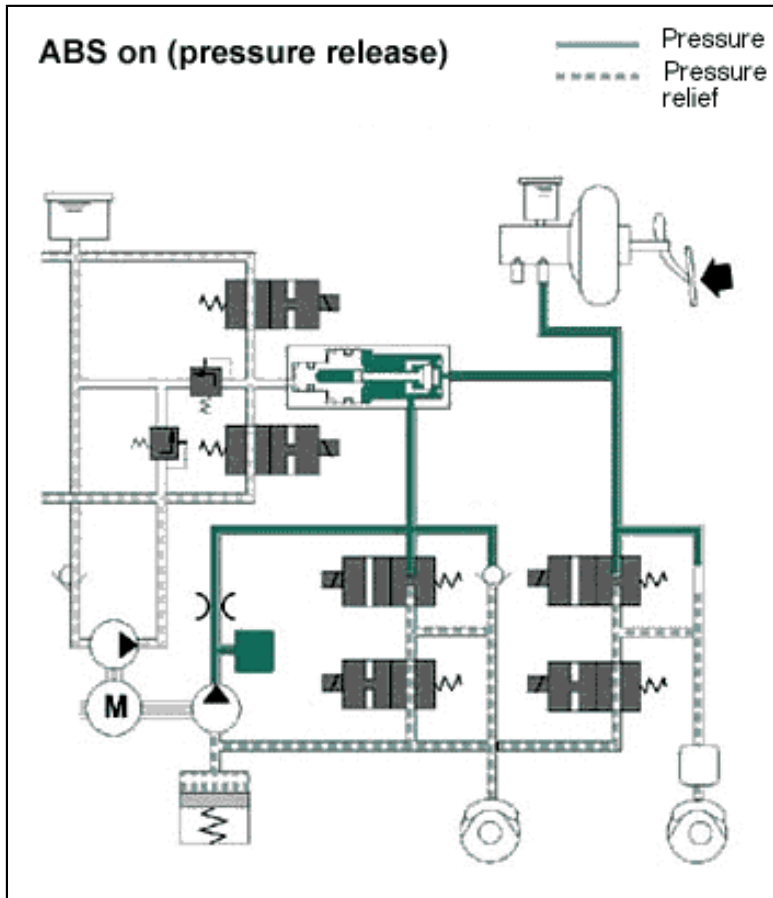
ECU circuit diagram



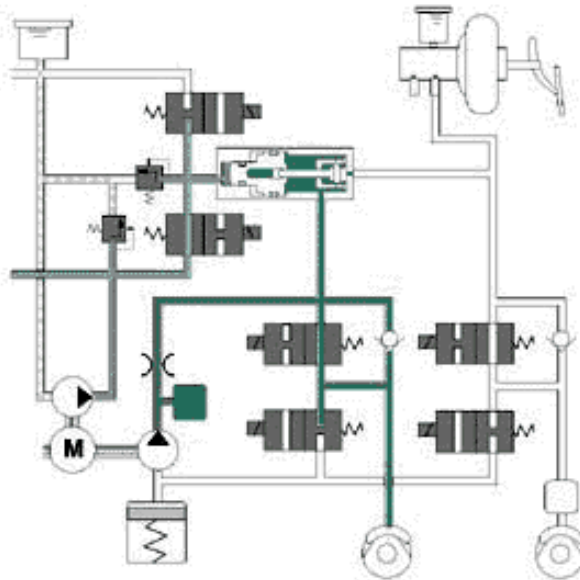
Normal braking



ABS on (pressure release)

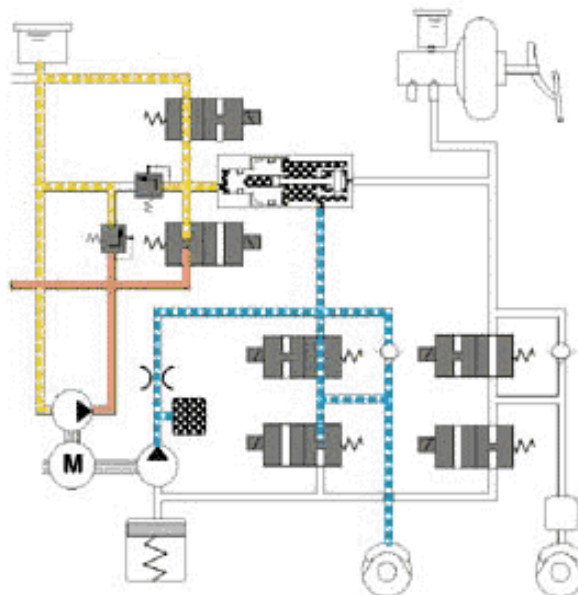


VSA intervention (pressure increase)



1. The release valve is closed and the motor is switched on to activate the pump.
2. The brake fluid flowing from the pump moves the control piston to the right.
3. The cut valve shuts down the fluid path from the master cylinder.
4. The pressure generated by the pump moves the control piston, reducing chamber volume, and increasing pressure to the front caliper.

VSA intervention (pressure release)



1. The pressure valve is closed and the release valve opened. Pressure accumulated inside the back pressure chamber is released into the reservoir tank.
2. Pressure inside the control chamber moves the control piston to the left.
3. Chamber volume increases, reducing pressure to the front caliper.

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