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For Immediate Release  
April 3, 1996, V6-04

## **VOLVO 850 BI-FUEL SOUND ENVIRONMENTAL SOLUTION TO VEHICLE EXHAUST**

New York, NY - Volvo, the acknowledged leader in vehicle safety and for environmental concern, is introducing Bi-fueled 850 sedans and wagons into their employee vehicle test fleet this Spring. The fleet is fueled by compressed natural gas and gasoline - Bi-fuel. Based at their North American headquarters in Rockleigh, New Jersey, the fleet will be used for driver evaluations for the next three years.

This test program will help further Volvo's knowledge in alternative fuel vehicles. Compressed natural gas (CNG) burns cleaner with less environmental pollution than gasoline. According to the American Gas Association (AGA) "vehicles fueled with natural gas can reduce, by 85 to 90 percent, emissions of carbon monoxide and reactive hydrocarbons that contribute to smog. Natural gas vehicles also reduce emissions of carbon dioxide, the principle 'greenhouse' gas, by 32 percent. CNG also "emits virtually no particulate matter, which can harm humans' respiratory and cardiovascular systems and cause 'haze', or visibility impairment." The amount of reductions achieved by Volvo engineers places the CNG powered 850 well within the limits of California's stringent ULEV (Ultra Low Emission Vehicle) standards.

"While this is the first time Volvo has brought a fleet of Bi-fueled vehicles to America, we've been running a test program with the city of Göteborg, Sweden (Volvo's hometown) for quite some time" according to Volvo's Jim Nordmann, Manager Product Development for Volvo Cars of North America, . "The cars exhibit excellent durability and performance. We also have CNG powered Volvo buses and refuse haulers that are operating in the Swedish cities of Göteborg, Malmo, and Lund. While this program is still under test evaluation, all indications are the buses and trucks are meeting the cities expectations."

Worldwide, there are around 1 million CNG powered vehicles, mainly automobiles. Because of their potential for reduced exhaust pollution, most transport analysts believe

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environmental pressures and widespread sources of the fuel will produce sustained growth in this sector. Projections are that by the end of the decade, the United States will likely have 1 million CNG vehicles on the road. Increased use of CNG can help reduce the U.S. dependence on imported crude oil.

Currently, the main obstacle is the availability of CNG refueling stations for private passenger vehicles. "Its like the chicken or egg problem. Vehicle fuel management systems are reliable and practical, yet the infrastructure for "fast fill" refueling stations to accommodate private ownership use are limited" according to Nordmann. "We believe the first mass users of this fuel/technology will be fleet owners who are mandated by law to phase in clean fueled vehicles into their fleets. As a result they will help lay the ground work necessary for wide distribution of CNG product."

Equipment:

Vehicle:	850 Sedan and Wagon
Transmission:	Automatic (three mode - Winter/wet, Sport, and Economy)
Engine:	2.5 ltr. 5 cylinder, 10 valve, all alloy engine
Horsepower:	142 hp (gasoline)
Horsepower:	128 hp (CNG)
Fuel Management:	4.3 Motronic Bosch (gasoline) NECAM (CNG)
CNG Tank:	60 ltr (equal to approx. 4.5 gallons of gasoline)
Gasoline Tank:	19.3 gallons
Driving Range:	150 miles, approx. (CNG)
Driving Range:	350 miles, approx. (gasoline)

Standard safety equipment include the world's first side impact air bags, side impact protection system, dual front Supplemental Restraint System, Daytime Running Lights, and Anti-lock Braking System.

Volvo Cars of North America is a wholly owned subsidiary of Volvo Car Corporation, Göteborg, Sweden. Sales in North America in 1995 were: 88,505 vehicles through 422 Volvo dealerships. Volvo was the first car company to establish manufacturing operations in North America with an assembly plant in Dartmouth, Nova Scotia, Canada in 1963.

Volvo, being of Swedish origin, has a deep regard for the environment and the impact it places on it. The following chemicals have either been totally or partially eliminated during the vehicle manufacturing process:

- Asbestos (health hazard)
- Cadmium (health hazard)
- Chlorine bleached paper (health and environmentally hazardous)
- Chlorinated paraffin's (toxic, difficult to bio-degrade)
- Dibutyl phthalate ((toxic, bio-accumulating)
- Ethyleneglycols (inhibit reproduction)
- Freon (and all other CFC's. Ozone depleting)
- Halogens (ozone depleting)
- Hexane (nerve damage)
- Lead naphthenes (toxic, difficult to bio-degrade)
- Mercury (nerve damage, non-degrading)
- Nonylphenoloxides (toxic degradable products)
- PVC's
- Trichloroethylene (health hazard)
- 1,1,1-trichloroethane (ozone depleting)



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### **FIRST BI-FUELED VOLVOS IN NORTH AMERICA AN ENVIRONMENTAL STEP FORWARD**

New York, NY - Volvo's 850 Bi-fueled series debuts for the first time in North America at the New York International Automobile Show, April 3, 1996. The 850 on display at the show is the first of 20 specially prepared 850's that will be placed in test service around the New York metro area for the next three years. The fleet will be based at Volvo's North American headquarters in Rockleigh, New Jersey.

Bi-fueled vehicles, when powered by compressed natural gas (CNG) can have emission levels so low that they easily comply with ULEV (Ultra Low Emission Vehicle) in California - presently the most stringent exhaust emission requirement effecting conventional powered passenger vehicles. "CNG fuel is a clean, cost effective alternative to gasoline" according to William Shapiro, P.E., Manager Regulatory, Compliance and Environmental Affairs, for Volvo Cars of North America.

"Vehicles fueled with natural gas can reduce by 85 to 90 percent emissions of carbon monoxide and reactive hydrocarbons that contribute to smog. Natural gas vehicles also reduce emissions of carbon dioxide, the principle 'greenhouse' gas, by 32 percent" according to the American Gas Association (AGA) . CNG also "...emits virtually no particulate matter, which can harm humans' respiratory and cardiovascular systems and cause 'haze', or visibility impairment." The amount of reductions achieved by Volvo engineers places the CNG powered 850 well within the limits of California's stringent ULEV (Ultra Low Emission Vehicle) standards.

This U.S. test fleet, the largest outside of Volvo's home base in Göteborg, Sweden, will be used by Volvo employees as a test of personal use rather than a

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hardware test. "We know the system works because of the long-term joint operational test fleet program in process between Volvo and the City of Göteborg, Sweden. However, we don't know what a driver in America might feel about using this type of system" stated Jim Nordmann, Manager Product Development. Actually, the major issue is refueling. "Right now the refueling infrastructure is the weak link", he said the problem is representative of a classic 'the chicken or egg' syndrome.

"CNG fuel access is a problem for our Rockleigh, NJ test fleet. Of the 10 closest refueling stations the nearest is still 15 miles from our headquarters. Since we needed a site that is convenient, our only option was to build one at our headquarters." according to Nordmann. Expected to be completed this spring, the refueling station will cost approximately \$250,000.

Operation of a 850 Bi-fuel is simple but slightly different than it's gasoline powered counterpart. When the CNG supply is running low, after about 150 miles, a warning indicator lamp, mounted on the floor console, signals the driver to switch over to gasoline. If the warning is ignored, the CNG fuel system computer will automatically switch to gasoline when the CNG is exhausted. During this transition, other than the warning indicator, the driver will not notice the changeover. During CNG operation there is approximately 10% less power than gasoline yet driveability and performance are largely unaffected.

CNG is a cost effective, environmentally beneficial alternative to gasoline. The AGA states, "In addition to paying less for fuel, natural gas vehicle owners save money through a reduction in routine maintenance. Because natural gas does not foul combustion chambers as does gasoline, there are few spark plug and oil changes." Increased consumer use of CNG for automobile applications also lessens the U.S. dependence on imported crude oil.

The first commercial fleet use for Volvo's Bi-fuel 850's will be in the United Kingdom during the Summer of 1996. As production capacity increases, other Volvo markets will be taking similar equipped 850 models.

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### **COMPRESSED NATURAL GAS - MEGA VOLVO 850 BI-FUEL**

New York, NY - Volvo's 850 Bi-fuel series uses an advanced Compressed Natural Gas regulation system to deliver smooth, responsive engine performance with minimal loss of horsepower and driveability. Developed at Volvo in conjunction with NECAM of Holland, this system uses microprocessor technology to deliver CNG into the engine for clean and efficient operation.

#### **MEGA Multi-Point Electronic Gas Injection**

MEGA is a multi-point gas injection system which has been specially developed for use in modern gasoline injected engines. The system works via a continuous fuel injection principle to inject CNG directly in front of the inlet valves. Using microprocessor technology, the MEGA system combines excellent driveability and power with minimum exhaust emissions.

The CNG operating system uses mechanical pressure regulators and valveing that are controlled by unique software adaptations for specific Volvo engines and applications. The Mega system used in the Volvo 850 Bi-fuel is programmed to be seamlessly switchable between gasoline and CNG thus providing a total driving range of approximately 500 miles. Running on CNG alone, the range is approximately 150 miles.

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## **Gas Regulation Hardware**

The CNG is delivered from a 60 liter, DOT approved fuel tank and passes through a two-stage control regulator which provides a corrected pressure level. A fuel distributor ensures that each engine cylinder receives exactly the correct amount of gas in all circumstances. Pressure adjusted CNG is then injected just in front of the inlet valve of each cylinder via injector piping and an injection valve. In combination with electrical gasoline injectors it is possible to change over smoothly from one type of fuel to the other with out any special routines or mechanical adaptations or noticeable loss of performance.

## **Microprocessor Controlled**

The Mega system is completely microprocessor controlled. All variables which are representative for fuel consumption are measured by the microprocessor and converted into a linear actuator position, which is mounted on top of the gas distributor. The microprocessor acts primarily on the engine speed signal, pressure in the inlet manifold (MAP) and with lambda sensor feed back. The actuator can also make corrections based on the position of the throttle valve and the temperature gauge. The correct CNG dose is calibrated and the data range is stored electronically.

Fuel mixture regulation is monitored by a lambda sensor signal that makes corrections to fuel flow via the microprocessor to the actuator. The software contains an extremely advanced fuel management database which ensures the combustion process is as efficient as possible.

## **Gas regulation**

The gas valve is controlled by the microprocessor. The disconnection of the gasoline injection system is also controlled by the microprocessor, ensuring an intelligent change over from one fuel to another. In this way it is possible to choose a gasoline start-up with an easy change-over to CNG. If the CNG tank is completely

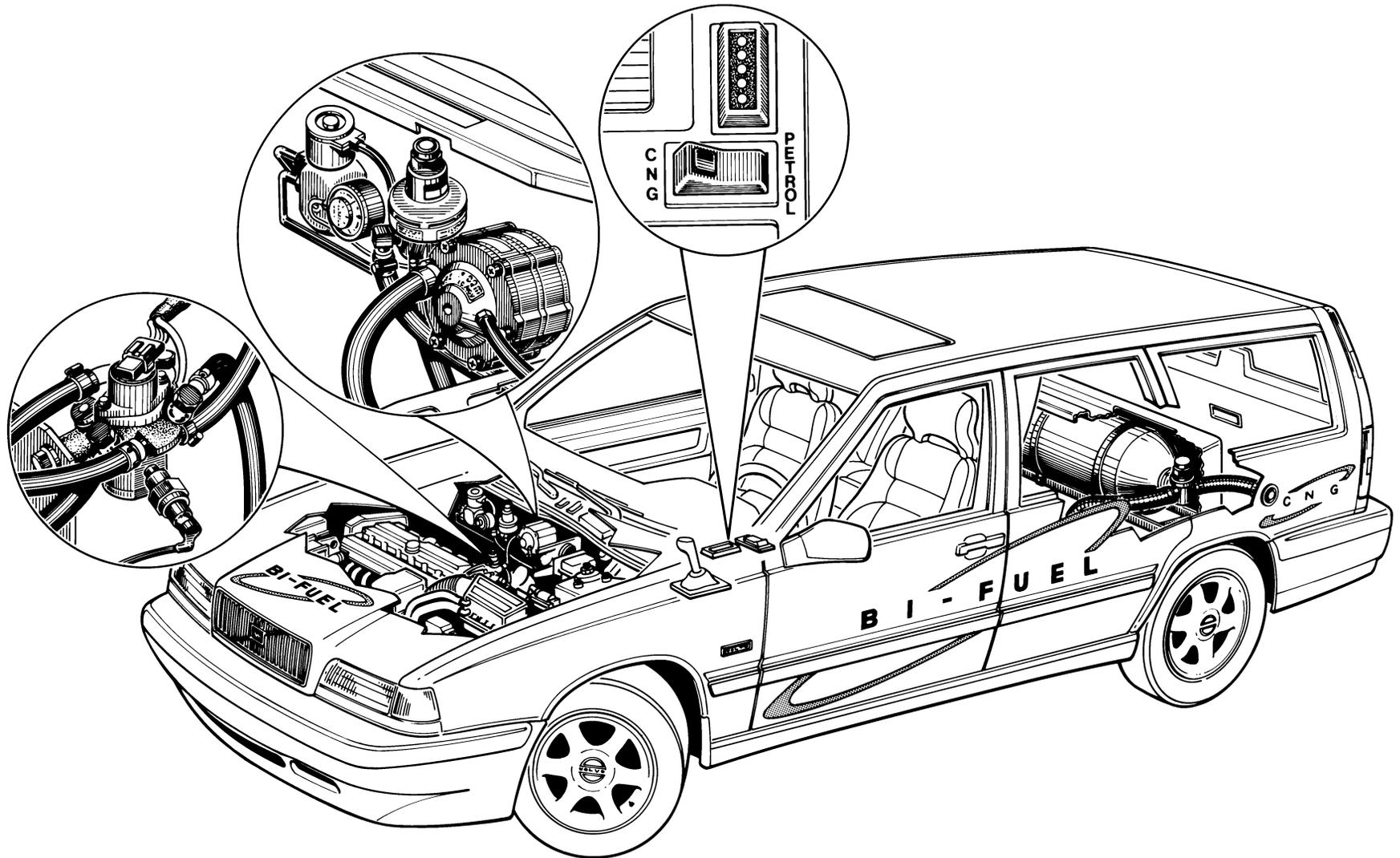
emptied, an imperfect combustion condition could exist which would result in damage to the catalytic converter. This condition is avoided by an automatic switching procedure that changes over the CNG operation to gasoline without driver intervention.

### **The Diagnostic System**

Built into the microprocessor is an integrated diagnostic system to detect possible operational defects. A dashboard warning lamp alerts the driver to "Check Engine" and a fault code is stored in the microprocessor memory. This fault code is readable by a trained technician.

### **Summary of Volvo's CNG System Advantages.**

- Application as a multi-point CNG injection system.
- The installation does not restrict the inlet system of the engine thereby providing optimum filling in the intake system which creates a perfect mixture distribution, resulting in maximum power.
- Minimum exhaust emission is achieved with an extremely advanced regulation system.
- Reduced risk of backfiring as there is no combustible mixture in the inlet manifold.
- No separate engine idling system, and transference between systems is seamless.
- Correct gas dosage is calibrated and monitored by the software.
- Gas dosage and gas distribution to each engine cylinder are not sensitive to:
  - high/low air speeds in the inlet manifold
  - pulsation's in the inlet manifold

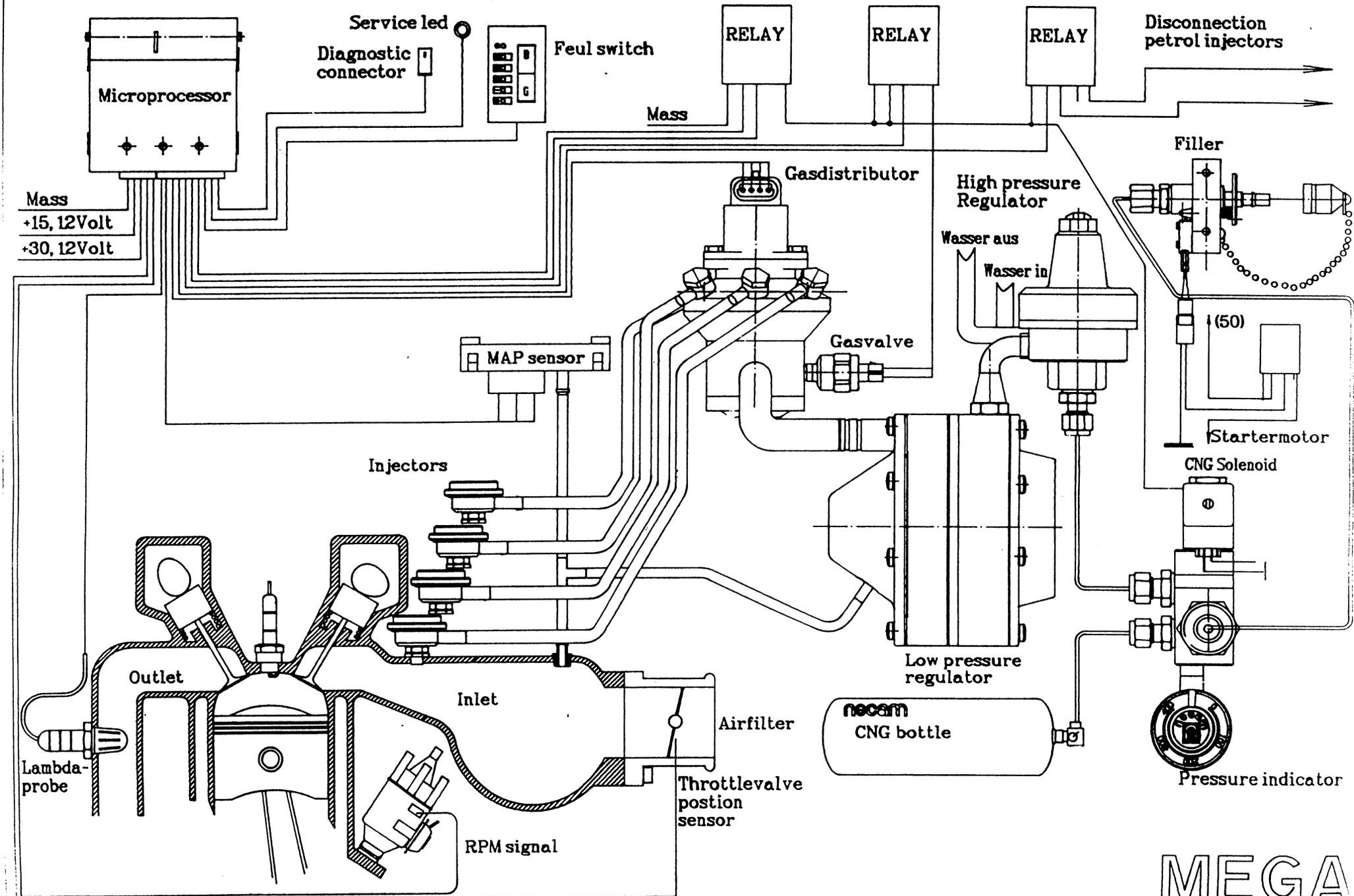


Picture of cut-a-way:

Volvo's 850 Bi-fuel series. Utilizing compressed natural gas, this Volvo delivers clean, efficient performance that can have emissions levels so low that they easily comply with future ULEV standards in California.

# VOLVO

## necam NATURAL GAS MULTIPONT ELECTRONIC GAS INJECTION



MEGA