Fuel Delivery System
Requirements

• Integrate an ANG delivery system that still allows operation using CNG

• Electrical/Control
  – Ability to operate on a 12V system
  – Recognition of ANG tank operation
  – Operational status feedback to driver indicating operation on CNG or ANG
  – Storage of test data during operation (mileage, tank fill level, etc)
Fuel Delivery System Requirements

- Mechanical
  - Manual fuel delivery shut off
  - Margin of safety of 4 on pressure vessel (i.e. operational pressure of 500 psi, design pressure of 2000 psi)
  - Minimize weight of hardware
  - Tank over-pressurization valves must be installed
  - Integrated fuel delivery system shall be compatible with 2001-2005 Honda Civic
  - A guard bed will be incorporated for filtration of hydrocarbons and heavier gases
Assembly Specifications

- ANG Tank, Guard bed, casing to be made from Al 6061-T6
- ANG Volume = 34 L (9 gal)
- CNG Volume = 100 L (26.4 gal)
- Assuming 150 V/V for ANG, tank is depleted after ~42 miles
- Guard Bed Volume = 0.95 L (0.25 gal), 3 % of ANG volume
- Total added assembly ~150 lbs
Test Fixture

Supply Tank (1,000 psi, 2.25 L)

Pressure Relief Valve

Pressure Transducer and Gauge

ANG Tank (500 psi, 0.5 L)

Pressure Regulator

Thermocouple

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Fuel System Schematic

- CNG Tank
- Pressure Regulator 2
- Fuel Rail and Fuel Injectors
- Engine
- Intake Manifold
- Pressure Regulator 1
Basic Fuel and Electrical System Schematic

Output Data
- Mileage
- Traveled Distance
- ANG Drain Time
- ANG Fill Time

ANG
- Fuel valve
- 3600psi
- 500psi
- 500psi
- 47psi

CPU

ICM

PCM

Fuel Injectors

CNG
- 3600psi
- 193psi
- 47psi

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Fuel and Electrical System Schematic

Reference Supplement page 11-29
For all black lines and green insertions
All insertions in orange are additions of ANG system
Fuel and Electrical System
Schematic contd

- Relief Valve
- Fill Line
- CNG
- ANG
- ICM
- CPU
- PCM
- Fuel temperature Sensor
- Intake Manifold
- Manifold Absolute Pressure (MAP) Sensor
- Fuel Injectors
- On Off fuel tank fuel switch

Reference Supplement page 11-29
For all black lines and green insertions
All insertions in orange are additions of ANG system

Fuel Tank Pressure Sensor
Fuel Tank Temperature Sensor
Fuel Pressure Regulator
Fuel Pressure Sensor
Line Connection with on off valve

Blue includes computers and electrical wiring for current CNG system only
Pink includes computers and electrical wiring for new ANG system only

Injector Control Module (ICM)
Powertrain Control Module (PCM)
Computer Flow Chart

Recognize
On Ignition

Check ANG
Tank

ANG = 100psi
or greater

Yes

Check ANG
tank

Calculate
ANG drain
time and travel
distance

No

Open ANG valve
Close CNG valve

Turn on ANG
Interior LED

Yes

ANG sensor’s
Pressure OK

No

Open CNG valve
Close ANG valve

Check ANG
Sensor’s Pressure

Calculate
ANG fill time

Run CNG
and fill ANG

Store
ANG fill time

Run ANG

Calculate
ANG  drain
time and travel
distance

Run ANG
Tank

Yes

Are
Calculations
Being performed

No

Run CNG
Tank

Yes

Are
Calculations
Being performed

No

Run ANG
Tank

No

Run ANG

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