Propane Autogas Vehicles

A Safe, Economical, and Environmentally Friendly Option for Fleet Vehicles

RAQC Colorado Alt Fuel Vehicle Meeting
Denver, Colorado

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PROPANE education & research COUNCIL

PROPANE EXCEPTIONAL ENERGY

CPGA Colorado Propane Gas Association

Agenda

Propane Autogas: A Smart Vehicle Alternative	Discussion of the Economical, Environmental, and Safety Benefits of Propane-Autogas-Fueled Vehicles
Successful Fleet Initiatives	Propane Autogas Fleet Owners Share Their Stories and Experiences
Resources	Additional Resources to Help You Understand and Evaluate Propane-Autogas-Fueled-Vehicles

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Propane Autogas:
A Smart Vehicle Alternative

Propane Autogas:
The Smarter Vehicle Alternative

- Propane-autogas-fueled vehicles have existed for over 100 years
- Approximately 17 million propane-autogas-fueled vehicles are in operation around the globe
- Propane autogas is the most widely used alternative transportation fuel in the world

Propane Autogas:
The Smarter Vehicle Alternative

Why the increased interest in propane-autogas-fueled vehicles?

Economical

Environmentally Friendly

Domestically Produced

Safety Advantages

Economical

- Costs less per gallon than gasoline or diesel fuel
- Lower maintenance costs
- Incentives available for fleet use

Economical

ThyssenKrupp saved **more than $2,900** per vehicle fueled with propane autogas in 2012.

Fuel Type	Miles Per Year	Gallons	Price Per Gallon	Annual Fuel Cost
Gasoline	25,000	1,852	$3.84	$7,111
Propane Autogas	25,000	2,179	$1.93	$4,205
			Savings:	**$2,906**

This represents a **41% savings** in fuel costs.

Data provided by: ThyssenKrupp Elevator Americas

Environmentally Friendly

Propane-autogas-fueled vehicles emit 17 percent fewer greenhouse gases into the atmosphere than gasoline-fueled vehicles.

Emissions Comparison

- Gasoline-fueled Vehicle emissions
- Propane-autogas-fueled vehicles

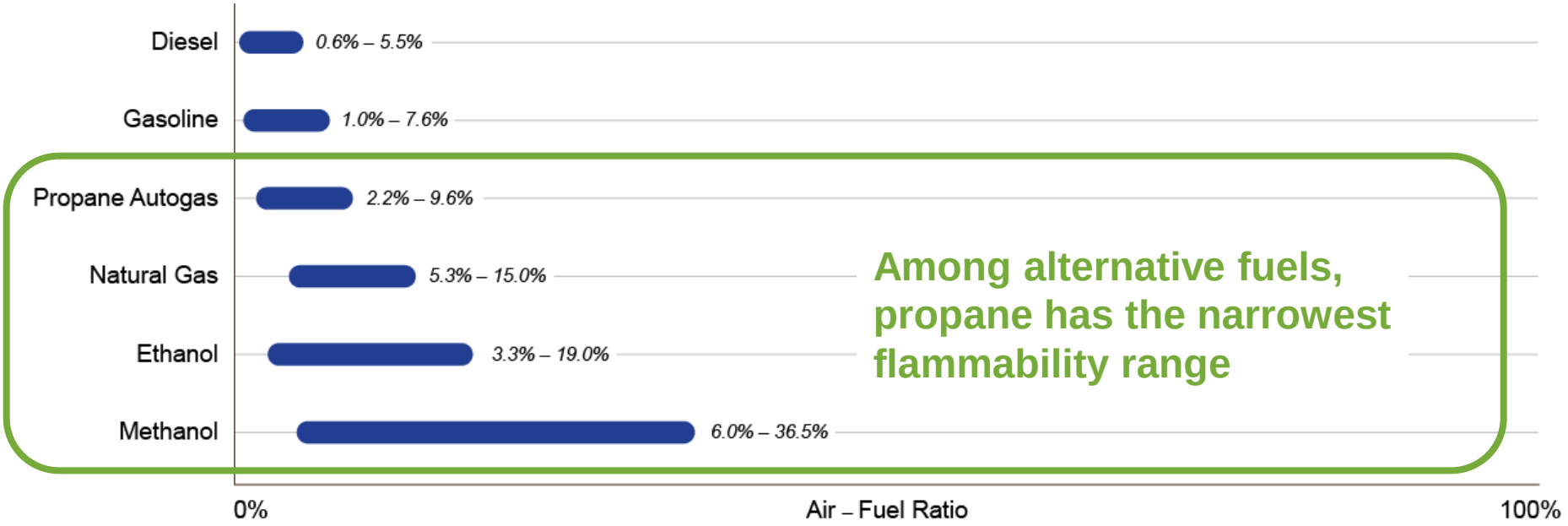
12% fewer carbon dioxide emissions

20% fewer nitrogen oxide emissions

60% fewer carbon monoxide emissions

Safety Advantages of Propane Autogas

Flammability Range



Safety Advantages of Propane Autogas

- Requires a higher temperature to ignite than gasoline or diesel fuel
- Does not puddle – vaporizes and dissipates into the air
- Cannot be accidentally ingested

Safety Advantages of Propane Autogas

- Built-in safety devices and shut-off valves
- Propane tanks are 20 times more puncture-resistant than gasoline tanks

Propane-Autogas-Fueled Vehicles Meet Strict Set of Rules and Requirements

- The Department of Transportation
- National Highway Traffic Safety Administration
- Environmental Protection Agency

Propane-Autogas-Fueled Vehicles Meet Strict Set of Rules and Requirements

- American Society of Mechanical Engineers
- National Fire Protection Association
- Underwriters' Laboratory

Technology Enhancements Changing Perceptions

- Performance level equal or greater than gasoline- and diesel-fueled vehicles
- Better system integration
- Highly trained mechanics

Successful Fleet Initiatives

Successful Fleet Initiatives

Portland (Ore.) School District

Raleigh (N.C.) Police Department

Zion (Utah) National Park

Successful Fleet Initiatives

Portland, Oregon School District

Successful Fleet Initiatives
Portland, Oregon School District

- Portland School District has used propane-autogas-fueled buses for more than 30 years
- Owns and operates about 75 buses
- In addition, *First Student* owns and operates a large fleet for the school district

Successful Fleet Initiatives

Portland, Oregon School District

"As you can imagine, when you operate as many fleet buses as we do in a large city like Portland, occasionally, accidents are going to happen. I've been here for six years and I don't know of any propane autogas safety issues that we've ever encountered as the result of an accident. These buses and their fuel tanks are extremely durable."

Eric Stewart, Fleet Service Coordinator
Portland, Oregon Public School District

Successful Fleet Initiatives

Raleigh, North Carolina Police Department

Image Courtesy of City of Raleigh

Successful Fleet Initiatives

Raleigh, North Carolina Police Department

- Between 2011 and 2012, the Raleigh Police Department purchased 20 bi-fuel vehicles for its fleet
- The police department views propane autogas as a safe, cost-effective fuel that helps them serve and protect their community

Successful Fleet Initiatives

Raleigh, North Carolina Police Department

"When we started looking into replacing our patrol cars, we had certain criteria that needed to be met. First and foremost, they needed to be safe."

Doug Brugger, Police Captain
Raleigh, North Carolina Police Department

Successful Fleet Initiatives

Zion National Park, Utah

Successful Fleet Initiatives
Zion National Park, Utah

- In 2000, Zion National Park instituted a propane-autogas-fueled shuttle bus service
- Fleet of 32 buses and 23 passenger trailers
- The National Park Service uses propane-autogas-fueled vehicles to reduce pollution

Successful Fleet Initiatives

Zion National Park, Utah

"Not only are these buses better for the environment, they're safe. We transport approximately 3.4 million people with them each year and they've proven to be as durable as gasoline- or diesel-fueled busses."

Jack Burns, Concessions Management Chief
Zion National Park, Utah

Propane Properties

- Tasteless, colorless, and naturally odorless
- Propane manufacturers add odorant (ethyl mercaptan)
- Capable of being either liquid or gas; in ambient conditions, it is a gas
- Flammability range of 2.2 percent to 9.6 percent
- Approximate ignition temperature of 920 degrees Fahrenheit
- If liquid propane leaks, it will vaporize and dissipate into the air (will not puddle)

Vehicle Identification

- Propane identification decals are mounted on the lower right rear of the vehicle (above the bumper)
- Decal is black, diamond shaped with a luminous light silver or white border, and with the word “PROPANE”

Vehicle Components

- Fuel tank
- Fuel tank mounting and bracket system
- Fuel system and line

Fuel Tanks

- Built in several shapes and sizes
- Installed in a variety of locations (depending on the type of vehicle)
- Vehicles may have more than one tank
- Tanks rated for 312 psig
- Pressure-relief valves vent to outside of vehicle
- 20 times more puncture-resistant than a gas tank
- Equipped with manual shutoff, excess flow, and automatic closure features

Fuel Tank Durability

"Propane tanks are more durable than gasoline or diesel tanks. If in the rare instance a tank were to get punctured as the result of an accident, it doesn't mean that the vehicle would explode like you might see in a Hollywood movie."

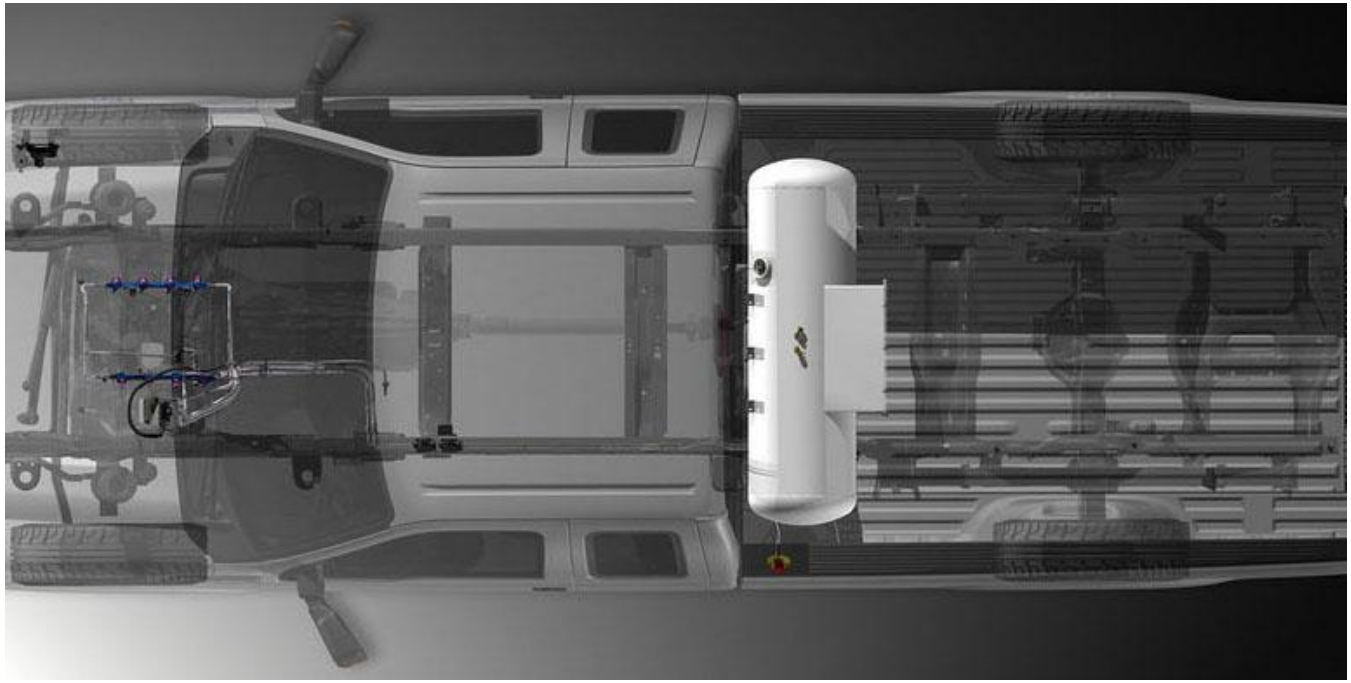
James Mays, Jr., Vice President and Interior Firefighter
Sheridan Fire Department, New York

Click link below to play video
http://www.youtube.com/watch?v=jAI12LtFkjw

Fuel Tank Mounting & Bracket Systems

- Fuel tanks can be mounted inside or outside of a vehicle
  - Typical exterior mounts include:
    - Pickup truck bed
    - Under a flat or stake bed of a truck
    - Along the frame rails of a truck or bus
  - Typical interior mounts include:
    - Trunk of a passenger car (e.g., taxi and police car)
    - Rear of a van, minivan, or SUV
    - Must be installed with protective enclosure to prevent leaks to passenger compartment
- All tanks must be protected to prevent damage from objects encountered on roadways

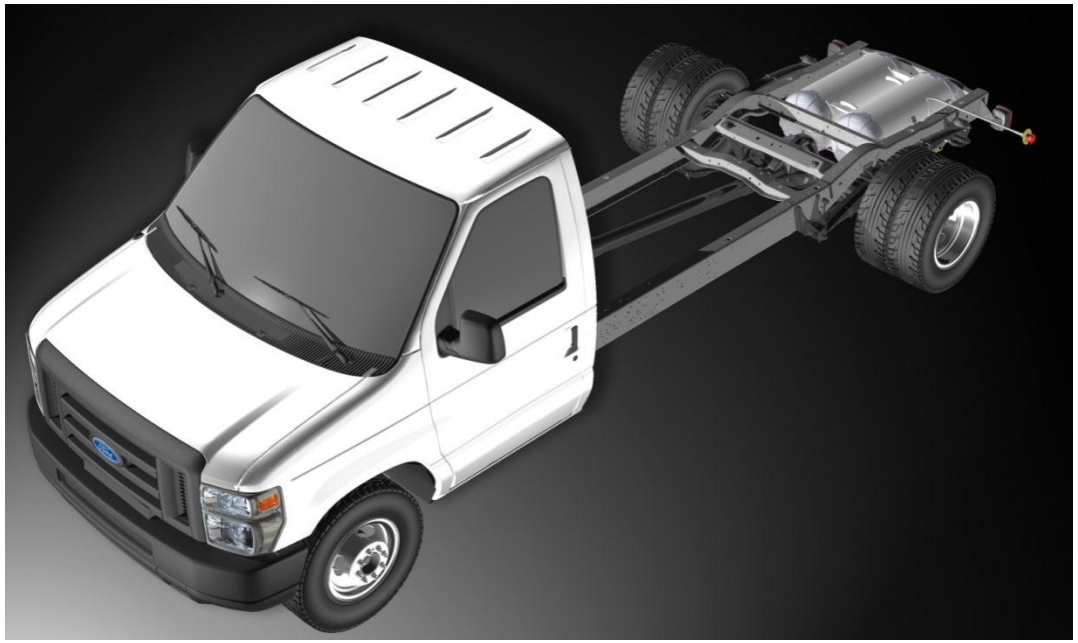
Fuel Tank Mounting & Bracket Systems

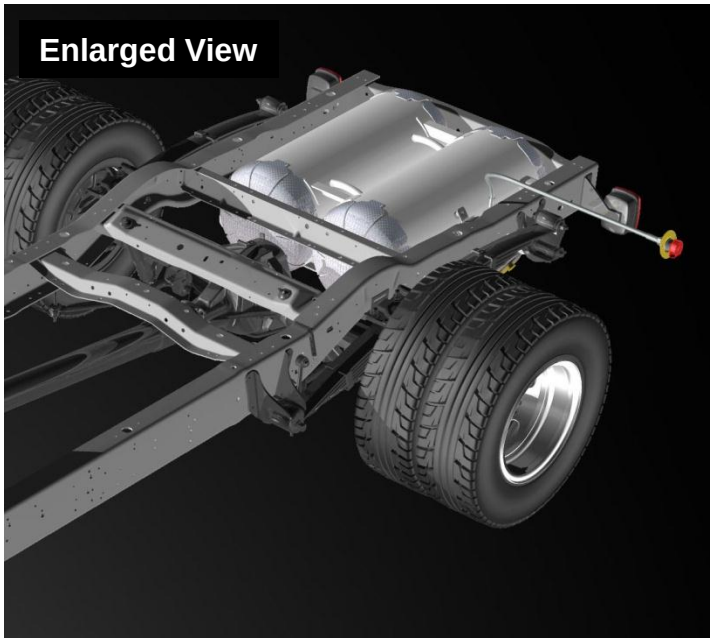


Images courtesy of Roush CleanTech

- Exterior mount on pickup truck bed

Fuel Tank Mounting & Bracket Systems

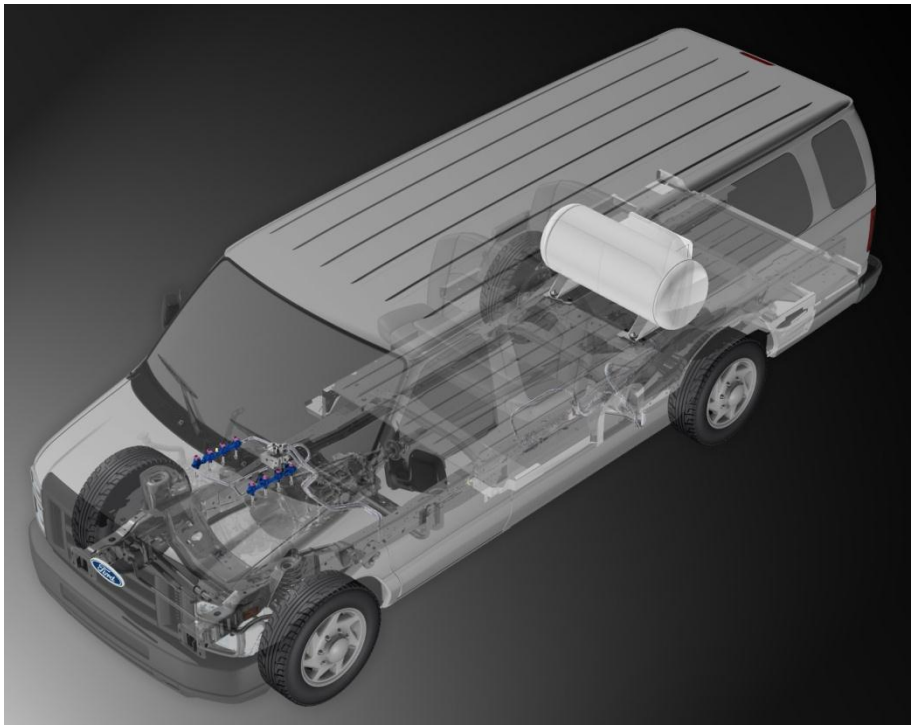


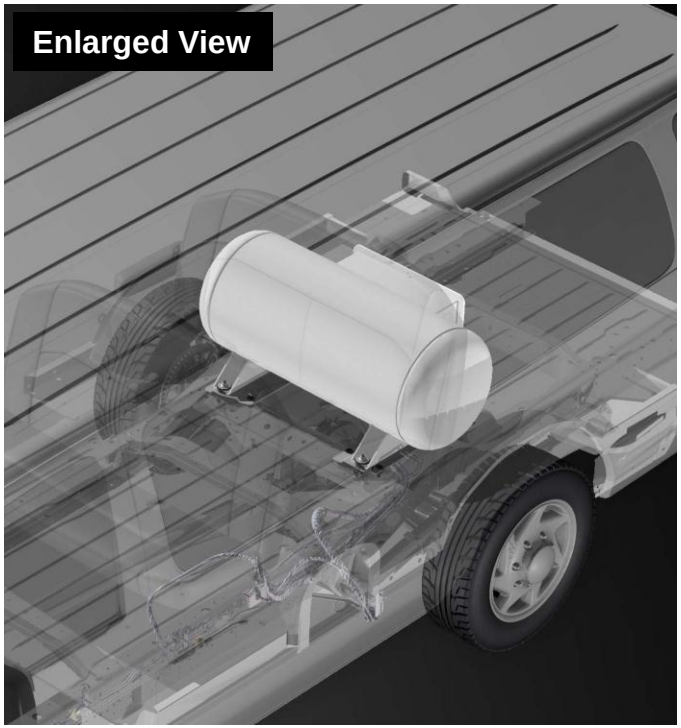


Images courtesy of Roush CleanTech

- Exterior mount on DRW cabin chassis

Fuel Tank Mounting & Bracket Systems



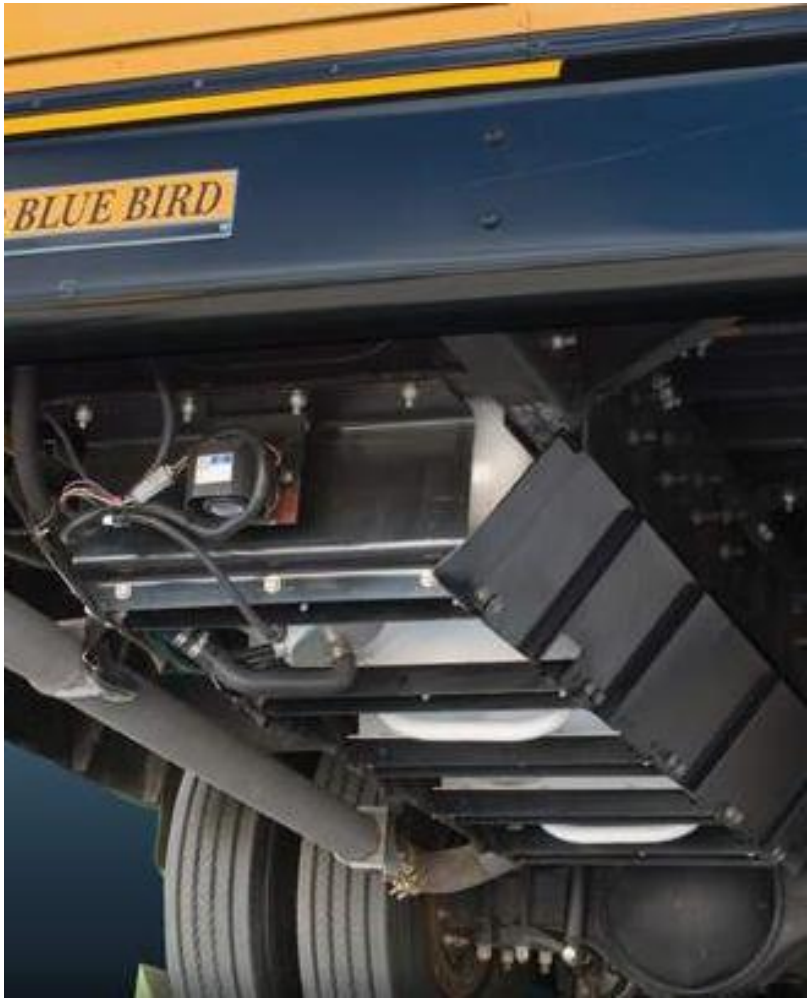


Images courtesy of Roush CleanTech

- Interior mount in van

Fuel Tank Mounting & Bracket Systems

- Larger vehicles and buses may have bracket systems
  - Buses utilize a bracket system that provides added protection
  - Tanks located between bus frame rails



Fuel Systems and Lines

- Two types of fuel systems
  1. Vapor fuel injection system
     - Stored in tank in liquid form at low pressure
     - Passes through fuel line to engine, converted to vapor by a regulator
     - Vapor mixes with air and enters combustion chamber
     - Similar to a traditional vehicle carburetor system

Fuel Systems and Lines

2. Liquid fuel injection system
   - New and popular technology
   - Liquid propane is directly injected into the combustion chamber
   - Improves engine durability and power output

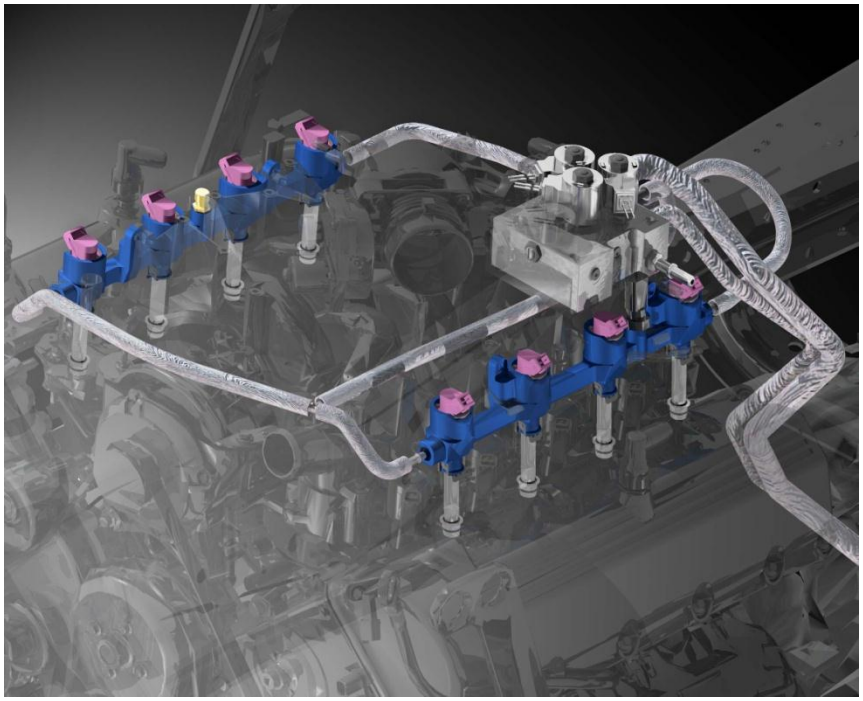


Image courtesy of Roush CleanTech

Fuel Systems and Lines

- Propane autogas fuel lines are typically routed through the vehicle in the same location as the original factory fuel lines
- Fuel lines are typically made of stainless steel to handle the varying temperatures and pressures of liquid propane
- An automatic shutoff valve prevents the flow of fuel to the engine when it is not running, even if the ignition switch is in the “on” position

Vehicle Refueling

- Distinct differences in propane autogas dispensing systems
  - Sealed systems
  - Operate under higher pressure
- Above-ground storage
- Tanks filled to 80% to allow expansion
- Pump/dispenser uses standard 110/220V electrical

Resources

Propane Autogas Resources

http://www.autogasusa.org

This Propane Education & Research Council (PERC)-sponsored website provides information on the several different types of propane-autogas-fueled vehicles (and other types of propane equipment), fueling with propane autogas, adoption incentives, and propane autogas webinars.

http://www.propanesafety.com

This PERC website provides information and training dates for the Propane Emergencies program.

http://www.afdc.energy.gov/vehicles/propane.html

The U.S. Department of Energy's Alternative Fuels Data Center website delivers information on various alternative-fueled vehicles, including those fueled by propane autogas.

Propane Vehicle ROI Savings Calculation

- US DOE Alternative Fuels Data Center
  Vehicle Cost Calculator
  http://www.afdc.energy.gov/calc/
- Roush CleanTech Propane
  Autogas Vehicle Calculator
  http://www.roushcleantech.com/popup/CleanTechSavingsCalc.htm
- AmeriGas Autogas
  Propane ROI Calculator
  http://www.amerigas.com/autogas/calculator.html

Propane Autogas Vehicle Resources

http://www.collinsbus.com
The Collins Bus Corporation website provides information about the many buses it manufactures, including the first developed Type A NEXBUS school bus fueled by propane autogas.

http://www.roushcleantech.com
Calculate your emissions savings with propane autogas, view products, and learn why propane autogas is the fuel choice for progressive companies such as ROUSH.

http://www.blue-bird.com
The Blue Bird website contains information about the different types of buses it manufactures and the affordable green solutions its propane-autogas-fueled buses offer.

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Please contact us with any further questions or comments:

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