HICEV America

US DOE Advanced Vehicle Testing Activity

2005 Hydrogen ICE[1] Truck

VEHICLE SPECIFICATIONS

CONVERSION VEHICLE
Base Vehicle: 2003 Ford F-150
VIN: 2FTRF07W73CA64601
Seatbelt Positions: Three
Features:
- 5.4L SOHC V8
- Supercharged
- Fuel Injected
- Manual Transmission
- Power Locks and Windows
- Front and Rear Disk Brakes
- Rear Wheel Drive
- Power Steering
- Cruise Control
- AM/FM Stereo w/ CD Player
- Anti-lock Brakes
- Dual Airbags

FUEL TANKS
Manufacturer: Dynetek
Model: W150H200G8
DOT Type 3[2]
Description: Carbon Fiber Wrap over Polymer Bladder
Number of Tanks: 3
Tank Liquid Volume: 150 liters
Total Liquid Volume: 450 liters
Nominal Pressure: 2900 psi
Maximum Pressure: 3625 psi
Fuel Capacity[7]: 6.52 GGE[8]
Fueling Inlet: OPW LW5000

WEIGHTS
Base Design Curb Weight: 4063 lbs
Delivered Curb Weight: 4685 lbs
Distribution F/R: 52/48%
GVWR: 6050 lbs
GAWR F/R: 2800/3500 lbs
Payload: 1365 lbs
Requirement: ≥ 400 lbs

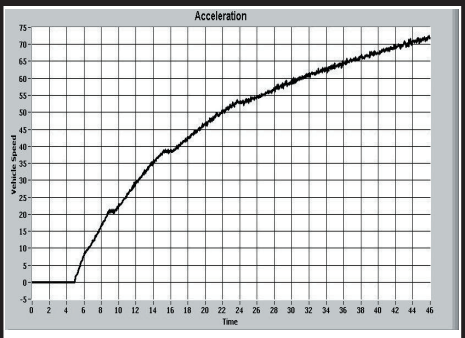
DIMENSIONS
Wheelbase: 120.1 inches
Track F/R: 65.4/65.5 inches
Length: 207.4 inches
Width: 79.9 inches
Height: 72.6 inches
Rear Overhang: 48.6 inches
Ground Clearance: ≥ 5.0 inches
Requirement: ≥ 5.0 inches

TIRES
Tire Mfg: BF Goodrich
Tire Model: Radial Long Trail
Tire Size: P275/60R17
Tire Pressure: 35 psi
Spare Included: Yes

TEST NOTES:
1. Internal Combustion Engine.
2. 49 CFR 571.304
3. Maximum speed was determined from acceleration runs where overdrive was not used.
4. Fuel consumption was determined using the Ideal Gas Law.
5. ICE vehicle tested was a 1992 S-10 pickup with rear wheel drive with a 4.3L V-6 engine.
6. Rough Road testing showed no damage to the fuel system or any other component of the vehicle.
7. At nominal pressure and 25°C.
8. Gasoline Gallons Equivalent, total all tanks.

This vehicle meets all HICEV America Minimum Requirements listed on back.
Values in **red** indicate the Performance Goal was not met.

PERFORMANCE STATISTICS



ACCELERATION 0-50 mph
Acceleration Time: 18.1 seconds
Performance Goal: 13.5 seconds

MAXIMUM SPEED
Speed At One Mile: 80.9[3] mph
Performance Goal: ≥ 70 mph
Speed At Quarter Mile: 57.9 mph

SAE J1634 DRIVING CYCLE FUEL ECONOMY (A/C OFF)
Distance Traveled: 71.2 miles
Fuel Consumed: 3.96[4] GGE[8]
Fuel Economy: 18.0 miles/GGE[8]

SAE J1634 DRIVING CYCLE FUEL ECONOMY (A/C ON)
Distance Traveled: 71.0 miles
Fuel Consumed: 4.9[4] GGE[8]
Fuel Economy: 14.5 miles/GGE[8]

BRAKING FROM 60 mph
Controlled Dry: 229.0 feet

GRADEABILITY (CALCULATED)
Maximum Speed @ 3%: 73.1 mph
Maximum Speed @ 6%: 54.6 mph
Maximum Grade: 34.0%

This vehicle complies with mandatory requirements of HICEV America Vehicle Technical Specification, Revision 0 as follows.

(1) Vehicles shall comply with Federal Motor Vehicle Safety Standards applicable on the date of manufacture and such compliance shall be certified by the manufacturer in accordance with 49 CFR 567. Suppliers shall provide a completed copy of Appendix A and Appendix B with their proposal, providing vehicle specifications and the method of compliance with each required section of 49 CFR 571. If certification includes exemption, the exemption number issued by the National Highway Transportation Safety Administration (NHTSA), the date of it's publication in the Federal Register and the page number(s) of the Federal Register acknowledging issuance of the exemption shall be provided along with Appendix B.
Exemptions for any reason other than non-applicability shall not be allowed.
(2) Suppliers shall provide Material Safety Data Sheets (MSDS) for all unique hazardous materials provided with the vehicle.
(3) Compressed gas storage tanks shall comply with the requirements of 49CFR571.304 and ANSI/NGV2-2000.
(4) Suppliers shall provide recycling plans for vehicle hazardous materials including how the plan has been implemented.
(5) Vehicles shall have a minimum payload capability of at least 400 lbs. Payload is to include the driver, any passengers and any items not considered a permanent component of the vehicle whose weight is carried completely by the vehicle.
(6) For conversions of vehicles not manufactured by the HICEV Supplier, OEM gross vehicle weight rating (GVWR) shall not be increased.
For conversion vehicles, Suppliers shall specify the OEM's gross vehicle weight rating (GVWR).
(7) For conversions of vehicles not manufactured by the HICEV Supplier, OEM Gross Vehicle Axle Weight Ratings (GAWR) shall not be increased. Suppliers shall provide axle weights for the vehicle as delivered, and at full rated payload.
(8) A speedometer and an odometer shall be provided.
(9) Tires shall be subject to the following requirements:
- Tires provided with the vehicle shall be the standard tire offered by the HICE Supplier for the vehicle being proposed.
- Tires shall correspond to the requirements of the placard installed in accordance with 49 CFR 571.109, 110, 119 and 120, as applicable.
- Suppliers shall specify manufacturer, model and size of the standard tire.
- Tires sizes and in ation pressures shall be in accordance with the requirements of the placard.
- At no time shall the tire's in ation pressure exceed the maximum pressure imprinted upon that tire's sidewall.
- The tire shall be operable across the entire operation/load range of that vehicle.
- Replacement tires shall be commercially available to the end user in sufficient quantities to support the purchaser's needs.
- If the vehicle may be equipped with more than one standard tire, the afore-mentioned information shall be provided for each type/manufacturer of each standard tire.

(10) Seating capacity shall be a minimum of 1 driver and 1 passenger. Suppliers shall specify seating capacity (available seat belt positions) for their vehicle. For conversion vehicles, if the seating capacity is changed from that specified by the OEM on their FMVSS placard, the seat(s) being added or abandoned shall be modified as required by 49 CFR 571.207, et al, and a new FMVSS placard installed as required by 49 CFR 567, 568 or 571, as applicable.
(11) For conversion vehicles, the OEM passenger space shall not be intruded upon by the Hydrogen Fuel Storage System (HFSS) or other conversion components.
(12) The vehicle shall have a parking mechanism as per 49CFR571.102.
(13) The engine shall utilize hydrogen fuel injection with the injectors located to inject fuel at either the throttle body, intake port or directly into the cylinder.
(14) For conversions of vehicles not originally manufactured by the HICE vehicle Supplier, OEM engine modifications shall not require body modifications, which either intrude upon interior passenger space, reduce over hood visibility or impact vehicle crashworthiness.
(15) Vehicles shall comply with the requirements of 49 CFR 571.105.S5.2.1, or alternatively, 49 CFR 571.105.S5.2.2 for parking mechanisms.
(16) Vehicles shall be capable of completing the HICEV America Rough Road Test (ETA-HITP-005) including (1) driving through standing water without damage, and (2) standing for extended periods in extreme temperatures without damage to or failure of the vehicle or its systems. Vehicles should be capable of completing the HEV America Rough Road Test (ETA-HITP-005) without becoming inoperable. Vehicle shall be capable of completing all HICEV America tests without repairs exceeding a cumulative total of 72 hours.
(17) Fuel shall be stored onboard the vehicle in gaseous form.
(18) Fuel storage tanks shall be installed as per the requirements of section 5.3 of NFPA 52-2002, Section 5.3.
(19) Connection to the fuel storage tank shall utilize the fuel storage tank manufacturer's specified fittings.
(20) Each fuel cylinder or assembly shall be protected by a pressure relief device(s) complying with ANSI PRD1-1998 (with 1999 addendum) - *Basic Requirements for Pressure Releif Devices for Natural Gas Vehicle) Fuel Containers* and/or CGA-S-1.1, *Pressure Relief Device Standards—Part 1—Cylinders for Compressed Gases, 2003 edition*. Such pressure relief device shall be either temperature activated or pressure activated.
(21) The pressure relieving device(s) shall be rated for hydrogen use by its manufacturer and acceptable for use by the cylinder manufacturer.
(22) The pressure relief device shall be directly connected to the fuel cylinder or assembly or integral with the body of the isolation valve joined to the fuel cylinder or assembly.
(23) A valve shall not be installed between the pressure relief device and the fuel cylinder.
(24) The pressure relief device(s) vent shall be designed such that the vent system can withstand the pressures that result from venting and such that no gas will accumulate within or under any vehicle structure.
(25) Fuel storage tank piping shall be rigid stainless steel and shall comply with the requirements of ASTM A269-2001 *Standard Specification for Seamless and Welded Austenitic Steel Tubing for General Service* or, A213/A213M *Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes*.
(26) Fuel storage tank piping shall be installed as per the requirements of Section 5.5 of NFPA 52-2002.
(27) Fuel piping shall be secured to the vehicle at least every 24 inches.
(28) Flexible fuel piping shall only be used to connect two sections of fuel or vent pipe where relative motion between the two can reasonably be expected (e.g., between frame and engine). Any one section of exible piping shall be limited to 16" in length.
(29) Flexible piping or hose shall only be installed downstream of the first pressure regulator.
(30) Flexible piping shall be certified by its manufacturer for use with hydrogen. Such certification shall be provided with the vehicle submittal.
(31) Each fuel storage tank shall be provided with an isolation valve mounted either inside the tank or affixed to the tank manufacturer's outlet.
(32) The isolation valve shall either be a manually operated or normally closed, remotely actuated valve and shall be connected directly to the fuel cylinder so that it shuts off the supply of gas when closed. Connection to the fuel storage tank shall utilize the fuel storage tank manufacturer's specified fittings.
(33) The fuel system shall be equipped with a manual or automatic shutoff valve. The shutoff valve shall isolate the fuel storage system from the remainder of the fuel system including the Fueling Connection Device.
(34) Manual shutoff valves shall require no more than 90º of handle rotation to close the valve.
(35) The shutoff valve shall be securely mounted to the vehicle and shall not be supported in any way by the fuel piping.
(36) The location of the shutoff valve shall be clearly labeled and shall be accessible from outside the vehicle.
(37) Fuel pressure regulator(s) shall be located as close as practical to the shutoff valve.
(38) A pressure relief valve shall be fitted on the regulated side of the first stage of the regulator with a relief pressure setting designed to protect all components downstream of the regulator.
(39) The pressure relief valve vent shall be designed to withstand the pressures developed during venting and such that vented gasses cannot accumulate within or under any vehicle structure.
(40) An automatic valve shall be installed in the fueling system that prevents the ow of hydrogen gas to the engine when the engine is not running, even if the ignition switch is in the "ON", "RUN", or "ACC" position.
(41) The Fueling Connection Device shall be mechanically keyed for the nominal storage pressure using the SAE 2600-2002: *Compressed Hydrogen Vehicle Fueling Connection Devices* standard to avoid connection to a higher than allowable pressure dispenser.
(42) The Fueling Connection Device shall be matched to the nominal design pressure of the fuel storage cylinder(s).
(43) The Fueling Connection Device shall include dual check valves to prevent fuel leakage from the inlet.
(44) The Fueling Connection Device shall be securely mounted to the vehicle and shall not be supported in any way by the inlet piping.
(45) Fueling Connection Device piping shall be rigid stainless steel and shall comply with the requirements of ASTM A269-2001 *Standard Specification for Seamless and Welded Austenitic Steel Tubing for General Service* or, A213/A213M *Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes*.
(46) Fueling Connection Device piping shall be secured to the body and/or frame at least every 24 inches.
(47) Piping connection to the Fueling Connection Device shall utilize the manufacturer's recommended fittings.
(48) The fuel system shall be equipped with a fuel quantity indicating device. This device shall indicate either actual pressure (gauge pressure in pounds-per-square-inch) within the storage tank(s) or an indication of Full to Empty based on, at a minimum, actual pressure within the storage tank(s).
(49) A fuel gauge installed in the passenger compartment shall be electrically operated with the pressurized sending unit installed in the fuel system outside of any passenger spaces.
(50) The Supplier shall provide recommended fuel system maintenance requirements, including requirements, if any, for periodic fuel system integrity checks.
(51) Suppliers shall specify all optional equipment required to meet the requirements of this Vehicle Specification.
The installation of options shall not relieve Suppliers of meeting other "shall" requirements.
(52) Non-proprietary manuals for parts, service, operation and maintenance, interconnection wiring diagrams and schematics shall accompany all vehicles submitted for testing.

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