

규격서

COMMODITY DESCRIPTION

세부품명번호 Item No.	품목 및 규격 Description	단 위 Unit	수 량 Quantity
4110341801	자동차 실차 환경시험 챔버 Vehicle Climatic Chamber	System	1

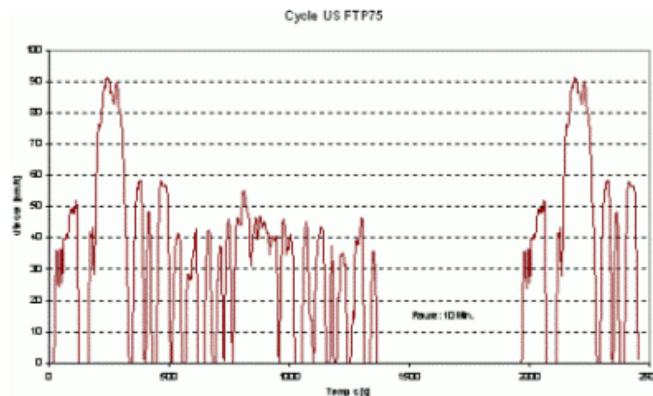
A. Principles and Characteristics of Vehicle Climatic Chamber

The main purpose of Vehicle Climatic Chamber (VCC) is to conduct the driving cycle tests defined by the US Environmental Protection Agency(EPA) and the corresponding Korean regulations for the development of energy saving parts for the future vehicle. The current test procedure has been updated in 2008 and includes four tests: city driving (FTP-75), highway driving (HWFET), aggressive driving (SFTP US06), and optional air conditioning test (SFTP SC03). Therefore, it is required that VCC must be equipped with conditions to conduct the following driving procedure and conditions.

A.1. FTP-75 Mode: EPA Federal Test Procedure

A1.1. City Driving Mode

The "city" driving program or FTP-75 is based on the Urban Dynamometer Driving Schedule or (UDDS) defined in 40 C.F.R. 86 App I. It consists of starting with a cold engine and making 23 stops over a period of 31 minutes for an average speed of 20 mph (32 km/h) and with a top speed of 56 mph (90 km/h). The cycle has of two phases: "cold start" phase of 505 s over a projected distance of 5.78 km at 41.2 km/h average speed, and "transient phase" 864 s. The two phases are separated by stopping the engine for 10 minutes. In the U.S. a weighting factors of 0.43 and 0.57 are applied to the first and second phase, respectively. The cycle simulates an urban route of 12.07 km (7.5 mi) with frequent stops. The maximum speed is 91.2 km/h (56.7 mi/h) and the average speed is 31.5 km/h (19.6 mi/h). A weight average of city (55%) and highway (45%) fuel economies is used to determine the guzzler tax. The procedure has been updated to FTP-75 adding a "hot start" cycle which repeats the "cold start" cycle and moving the 10 pause to the end of "transient" phase.



The following are basic parameters of the FTP-75 cycle:

Distance traveled: 11.04 miles (17.77 km) Duration: 1874s Average speed: 21.2 mph (34.1 km/h).
The weighting factors are 0.43 for the cold start, 1.0 for the transient phase and 0.57 for the hot start phase.

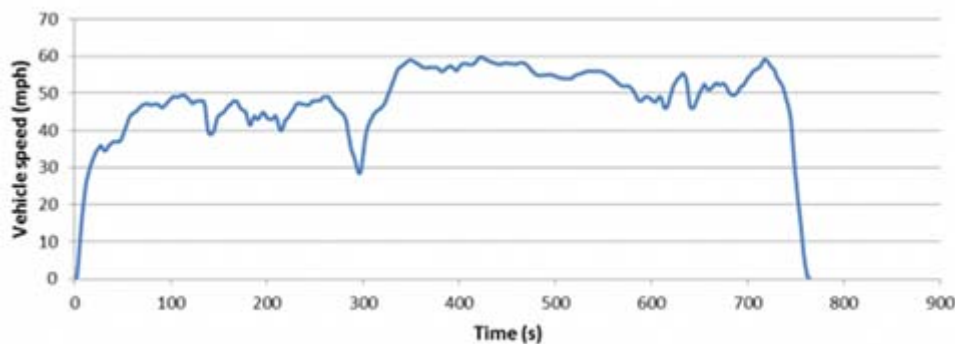
A1.2. Highway Driving Mode

The "highway" program or Highway Fuel Economy Driving Schedule (HWFET) is defined in 40 C.F.R. 600 App I. It uses a warmed-up engine and makes no stops, averaging 48 mph (77 km/h) with a top speed of 60 mph (97 km/h) over a 10-mile (16 km) distance.

The following are some characteristic parameters of the cycle:

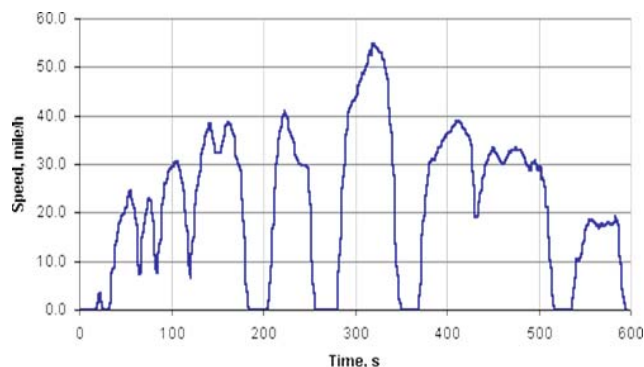
Duration: 765 seconds Total distance: 10.26 miles (16.45 km) Average Speed: 48.3 mi/h (77.7 km/h)

The measurements are adjusted downward by 10% (city) and 22% (highway) to more accurately reflect real-world results.



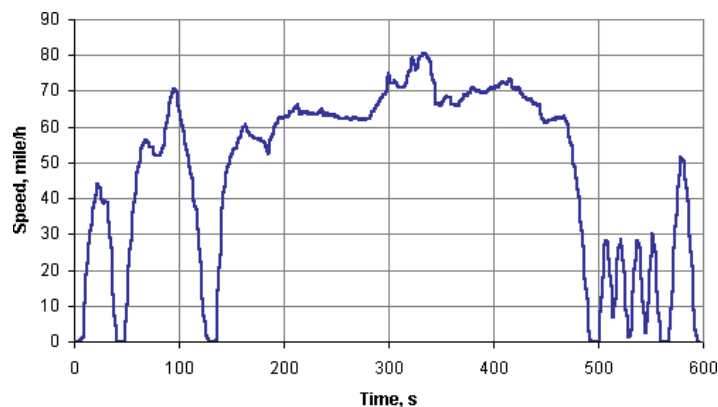
A1.3. SC03 Mode

The SC03 Supplemental Federal Test Procedure (SFTP) has been introduced to represent the engine load and emissions associated with the use of air conditioning units in vehicles certified over the FTP-75 test cycle. SFTO SC03 is the air conditioning test, which raises ambient temperatures to 95 °F (35 °C), and puts the vehicle's climate control system to use. Lasting 9.9 minutes, the 3.6-mile (5.8 km) loop averages 22 mph (35 km/h) and maximizes at a rate of 54.8 mph (88.2 km/h). Five stops are included, idling occurs 19 percent of the time and acceleration of 5.1 mph/sec is achieved. Engine temperatures begin warm. The cycle represents a 3.6 mile (5.8 km) route with an average speed of 21.6 miles/h (34.8 km/h), maximum speed 54.8 miles/h (88.2 km/h), and a duration of 596 seconds.



A1.4. US06 Mode

The US06 Supplemental Federal Test Procedure (SFTP) was developed to address the shortcomings with the FTP-75 test cycle in the representation of aggressive, high speed and/or high acceleration driving behavior, rapid speed fluctuations, and driving behavior following startup. SFTP US06 is a high speed/quick acceleration loop that lasts 10 minutes, covers 8 miles (13 km), averages 48 mph (77 km/h) and reaches a top speed of 80 mph (130 km/h). Four stops are included, and brisk acceleration maximizes at a rate of 8.46 mph (13.62 km/h) per second. The engine begins warm and air conditioning is not used. Ambient temperature varies between 68 °F (20 °C) to 86 °F (30 °C). The cycle represents an 8.01 mile (12.8 km) route with an average speed of 48.4 miles/h (77.9 km/h), maximum speed 80.3 miles/h (129.2 km/h), and a duration of 596 seconds.



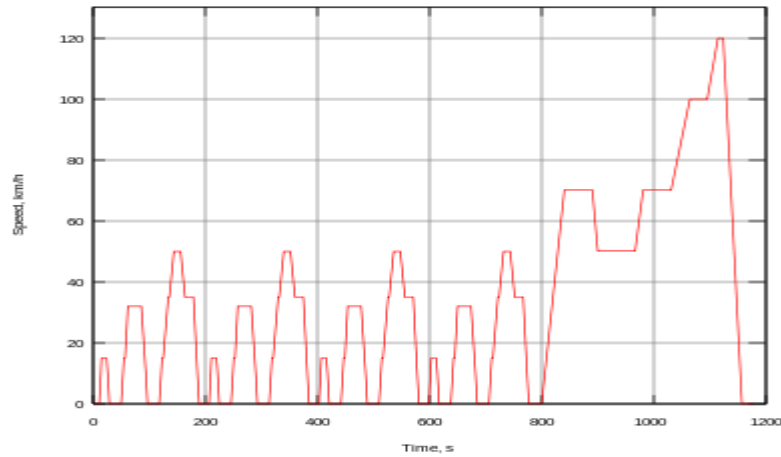
A.2. NEDC(New European Driving Cycle) Mode

The New European Driving Cycle is a driving cycle designed to assess the emission levels of car engines and fuel economy in passenger cars (excluding light trucks and commercial vehicles). It is also referred to as MVEG cycle (Motor Vehicle Emissions Group). The NEDC is supposed to represent the typical usage of a car in Europe. It consists of four repeated ECE-15 Urban Driving Cycles (UDC) and an Extra-Urban driving cycle (EUDC). The test procedure is maintained by UNECE World Forum for Harmonization of Vehicle Regulations.

A2.1. ECE-15 (Urban Driving Mode)

The Urban Driving Cycle, also known as ECE R15 cycle, has been first introduced in 1970 as part of ECE vehicle regulations; the recent version is defined by ECE R83, R84 and R101. The cycle has been designed to represent typical driving conditions of busy European cities, and is characterized by low engine load, low exhaust gas temperature, and a maximum speed of 50 km/h. When the engine starts, the car pauses for 11 s - if equipped with a manual gearbox, 6 s in neutral (with clutch engaged) and 5 s in the 1st gear (with clutch disengaged) - then slowly accelerates to 15 km/h in 4 s, cruises at constant speed for 8 s, brakes to a full stop in 5 s (manual: last 3 s with clutch disengaged), then stops for 21 s (manual: 16 s in neutral, then 5 s in the 1st gear). At 49 s, the car slowly accelerates to 32 km/h in 12 s (manual: 5 s in 1st gear, 2 s gear change, then 5 s in the 2nd gear), cruises for 24 s, slowly brakes to a full stop in 11 s (manual: last 3 s with clutch disengaged), then pauses for another 21 s (manual: 16 s in neutral, 5 s in the 1st gear). At 117 s, the car slowly accelerates to 50 km/h in 26 s (manual: 5 s, 9 s and 8 s in the 1st, 2nd and 3rd gears, with additional 2 × 2 s for gear changes), cruises for 12 s, decelerates to 35 km/h in 8 s,

cruises for another 13 s, brakes to a full stop in 12 s (manual: 2 s change to the 2nd gear, 7 s in the 2nd gear, last 3 s with clutch disengaged), then pauses for 7 s (manual: in neutral with clutch engaged). The cycle ends on 195 s after a theoretical distance of 1017 meters, then it repeats four consecutive times. Total duration is 780 s (13 minutes) over a theoretical distance of 4067 meters, with an average speed of 18.77 km/h.



A2.2. EUDC (Extra Urban Driving Mode)

The EUDC (Extra Urban Driving Cycle), introduced by ECE R101 in 1990, has been designed to represent more aggressive, high speed driving modes. The maximum speed of the EUDC cycle is 120 km/h; low-powered vehicles are limited to 90 km/h. After a 20 s stop - if equipped with manual gearbox, in the 1st gear with clutch disengaged - the car slowly accelerates to 70 km/h in 41 s (manual: 5 s, 9 s, 8 s and 13 s in the 1st, 2nd, 3rd and 4th gears, with additional 3×2 s for gear changes), cruises for 50 s (manual: in the 5th gear [sic]), decelerates to 50 km/h in 8 s (manual: 4 s in the 5th and 4 s in the 4th gear [sic]) and cruises for 69 s, then slowly accelerates to 70 km/h in 13 s. At 201 s, the car cruises at 70 km/h for 50 s (manual: in the 5th gear), then slowly accelerates to 100 km/h in 35 s and cruises for 30 s (manual: in the 5th or 6th gear). Finally, at 316 s the car slowly accelerates to 120 km/h in 20 s, cruises for 10 s, then slowly brakes to a full stop in 34 s (manual: in the 5th or 6th gear, lat 10 s with clutch disengaged), and idles for another 20 s (manual: in neutral). Total duration is 400 s (6 minutes 40 s econds) and theoretical distance is 6956 meters, with an average speed of 62.6 km/h.

B. Construction

The essential parts (both S/W & H/W) of VCC is followed below. However all of parts will not be constructed simultaneously. The time frame described by the project fiscal year is shown in the following table.

Contents	Fiscal Year	Notes
B.1 Test section	2	Year 1 2012.08.01.~2013.07.31.
B.2 Temperature control equipment	2	
B.3. Humidity control equipment	2	
B.4. Wind control equipment	2	Year 2 (current) 2013.08.01.~2014.07.31.
B.5. Axillary air system	2	
B.6. Solar simulation equipment	2	Year 3 2014.08.01.~2015.07.31.
B.7. Chassis Dynamometer	3	
B.8. Emission Analyzer	4	
B9. Climatic chamber control software	2	Year 4 2012.05.01.~2016.07.31.
B10. Data Acquisition system	2	
B11. Safety and Auxiliary system	2	
B12. Engineering Support	2	
B13. Miscellaneous Items	2	

B.1 Test section

- Test chamber
- Control room
- Window between test chamber and control room
- Vehicle Access Door(Double Wing Type)
- Personnel Access Door

B.2 Temperature control equipment

- Temperature control system
- Heat exchanger
- Main cooling system
- Electric line heater

B.3. Humidity control equipment

- Humidity control system
- Standard cooling system for make-up air unit
- Steam generator
- Dehumidify control system (Make-up air unit)

B.4. Wind control equipment

- Wind is necessary for cooling of a running engine
- Nozzle to satisfy the SC03 driving mode
- Air circuit structure
- A fan for wind generation
- Wind speed control system

B.5. Axillary Air System

- Make-up Air
- Purge System

B6. Solar simulation system

- Full spectrum Metal Halide Lamp
- Structure to equip the lamps
- Solar simulation control system
- Moving structure(Up & Down)

B.7. Chassis Dynamometer

B.8. Emission Analyzer

B9. Climatic chamber control software

- Specialized software to operate Vehicle Climate Chamber

B10. Data Acquisition system for

- Thermocouple 200 channels
- Analog Input/Output 40 channels
- Accelerometer Input 10 channels
- Current Input 10 channels
- PC 5set(CPU, Monitors)
- Printers 1set

B11. Safety and Auxiliary system

- CCTV 2 Points
- Wireless Communication System (2EA)
- DVR
- Monitors
- Anti-Vibration System for Support
- Exhaust gas extraction system
- CO, HC, H gas detection
- Fire Protection System

B12. Engineering Support

- Basic, Detail Engineering
- Project Management
- Operator Training
- Documentation (Operation manual)
- 2 years equipment warranty

B13. Miscellaneous Items

- Explosion proof facility for hydrogen vehicle test
- 3 additional years maintenance warranty
- 128 channel acoustic camera

C. Required Specification

C.1. Chamber specification

- Must be feasible to conduct driving mode test described on Section A.1. & A.2.
- Explosion proof for hydrogen vehicle test.
- Feasible for 4WD chassis dynamometer installation
- Feasible(space) for later installation of Falling Snow & Raining system
- Inside Light: Min 500lux, Metal Halide Type Lamp min. 12EA

C.2. Chamber Size

- Minimum 15m(L) x 8m(W) x 5.5m(H)
- Vehicle Entrance Door: Double Wing 1 set (Minimum size 3.0m(W) x 3.0m(H))
- Personnel Entrance Door: Sing Wing 1 set (Minimum size 0.9m(W) x 2.0m(H))

C.3. Control Room

- Explosion proof Observation window, Minimum size 2.0m(W) x 1.5m(H)
- Explosion proof structure between a chamber and a control room

C.4. Temperature Control : General

- Required Range : $-40^{\circ}\text{C}\sim 60^{\circ}\text{C}$
- Control stability : $\pm 0.5^{\circ}\text{C}$
- Control distribution : $\pm 0.5^{\circ}\text{C}$
- Linear control : $1.0^{\circ}\text{C}/\text{min}(@50\text{kph}, -25^{\circ}\text{C}\sim 10^{\circ}\text{C})$

C.5. Temperature Control : Cooling

- Type: indirect Cooling system
- 1hrs ($+60^{\circ}\text{C}\rightarrow 0^{\circ}\text{C}$) @50kph w/o a car
- 3hrs ($0^{\circ}\text{C}\rightarrow -40^{\circ}\text{C}$) @50kph w/o a car
- Main cooling system: Open Screw Compressor
- Axillary cooling system: Needed
- refrigerant : 1st R507, 2nd Dynalene or Syltherm XLT (Environment Friendly Material)
- Condenser type : Evaporative condenser
- Compressor type : Open screw compressor

C.6. Temperature Control : Heating

- Type: Electric Line Heater
- 1hr ($-40^{\circ}\text{C}\rightarrow 0^{\circ}\text{C}$) @50kph with a car
- 1hr ($0^{\circ}\text{C}\rightarrow 60^{\circ}\text{C}$) @50kph with a car

C.7. Humidity Control

- Range : 5%~95% RH@Constant Speed
- 5%~95% RH@ 40°C
- 5%~95% RH@ 20°C
- 5%~95% RH@ 10°C

- Dew Point Control Stability: $\pm 2\%RH@+35^{\circ}C$, 40%RH, 40~160kph
- Humidity Transition: 80%RH \leftrightarrow 40%RH(@25°C within 30minutes)

C.8. Solar simulation system

- Spectrum Range : Full Spectrum of day light
- Light Type : Metal Halide
- Light Capacity: 600~1,200W/m²
- Light life cycle: Min 1,500hrs
- Effective area: Min. 3.0m x 6.0m
- Controllability : $\pm 45W/m^2$
- Moving structure: Up-down movement

C.9. Wind simulation

- Nozzle size: Minimum size 1.3m(W) x 1.3m(H) feasible for SC03
- Wind speed: Minimum 150kph
- Capability tracking the vehicle driving speed
- Air Circuit Structure : Insulation panel air circuit
- Wind speed controllability : less than 10% for SC03
- Wind speed uniformity : less than 20% for SC03

D. Axillary system

D.1. Control System

- Specialized for Vehicle Climatic Chamber with Chassis Dynamometer
- Both automatic and manual control for a given test condition.
- Synchronization with Chassis Dynamometer and Emission Analyzer
- Remote control capable.
- Real time display and alarm function of operating status
- Sampling Rate: min. 2Hz
- Real time data saving
- Data Format: MS Excel, MS Word Exportable
- Independent Electrical Panel (with Emergency Stop Function)
- UPS for 30minutes

D.2. Data Acquisition System

- Thermocouple 200 channels
- Analog Input/Output 40 channels
- Accelerometer Input 10 channels
- Current Input 10 channels
- PC 5set(CPU, Monitors): Memory 4GB \uparrow , Hard Disk 1TB(SATA3) \uparrow
- Printers 1set : Color Laser, USB Interface, 16PPM \uparrow , 2400x600dpi \uparrow

D.3. Safety

- Independent and automatic air ventilation system.

- Exhaust gas extraction system during vehicle running: Min. Φ 150mm hose
- Gas detection for HC & CO : Range 300ppm, Accuracy : \pm 1.5% below, Real time LCD Panel
- Emergency Stop needed: 1EA in chamber, 1EA in control room

D.4. CCTV

- Camera : Min. 2EA, Panning Angle: 360° Tilting: -5°~180°
- Monitor : 24inch LED, 1920 x 1080
- DVR : 16 channel, 480fps / 704x480, 250GB

D.5. Purge System

D.6 Acoustic camera

- 128 microphones array, Mapping frequency: 316Hz~15kHz
- Focal Length: 0.5m to infinity
- Sampling rate: 44.1kHz, Resolution 16bit/sample
- Max sound level: 110dB
- Portable, Weight 2.5kg below, Embedded interface.

E. Remark

E1. Installation should be completed within 10 months

E.2 Warranty

1. Initial two years maintenance for equipment and engineering support
2. Additional three years maintenance for equipment and engineering support

E.3 The company is preferred who has ;

1. Climatic Chamber supply experiences of similar (or larger) to the requirements described in 'Section C' for completed vehicle manufacturers and R&D institute of government and other industrial companies
2. Supply experience of climatic chamber with explosion proof facility for hydrogen vehicle test
3. Regular maintenance service contract for the supplied vehicle climatic chambers.