2013 Ford Focus Electric

Advanced Vehicle Testing – Baseline Testing Results

VEHICLE SPECIFICATIONS[1]

Vehicle Features

VIN: 1FADP3R42DL268207
Class: Compact Car
Seatbelt Positions: 5
Type: BEV
CARB[2]: Type II ZEV
EPA Fuel Economy: 310 Wh/mi, 110 MPGe/340 Wh/mi, 99 MPGe/320 Wh/mi, 105 MPGe (City/Highway/Combined)
EPA Range: 76 miles
On-Board Charger: 6.6 kW

Motor

Type: AC Induction
Maximum Power: 107 kW
Maximum Torque: 245 Nm

Transmission

Type: Automatic Fixed Gear
Final Drive Ratio: 7.82

Battery

Manufacturer: LG Chem
Type: Lithium-Ion (LMO)
Number of Cells: 430
Cell Config.: 5 Parallel Strings of 86 Cells in Series
Cell Voltage Max/Min: 4.2/3.0 V
Nominal Cell Voltage: 3.7 V
Nominal System Voltage: 318.2 V
Rated Pack Capacity: 75 Ah
Rated Pack Energy: 23 kWh
Weight of Pack: 667 lb
Pack Location: Split into Two Sections: (1) Behind Rear Seats and (2) Under Rear Seats
Cooling: Active – Liquid Cooling

Weights

Design Curb Weight: 3,691 lb
Delivered Curb Weight: 3,616 lb
Distribution F/R (%): 49/51
GVWR: 4,597 lb
GAWR F/R: 2,060 lb/2,646 lb
Maximum Payload: 906 lb

Dimensions

Wheelbase: 104.3 in
Track F/R: 60.5 in/59.6 in
Length/Width: 171.3 in/73.3 in
Height: 58.6 in
Ground Clearance: 6.3 in

Tires

Manufacturer: Michelin
Model: Energy
Size: P225/50R17 93V
Pressure F/R: 38 psi/38 psi
Spare: Sealant and Inflator Installed

PERFORMANCE STATISTICS[3]

TRACK TESTING[4]

Acceleration 0-60 mph[5]

Measured Time: 10.9 s

Performance Goal: ≤13.5 s

Peak Power from Battery: 117.2 kW

Maximum Speed

At ¼ Mile: 80.1 mph

At 1 Mile[6]: 85.1 mph

Performance Goal: ≥90 mph at 1-mile mark

Braking at 50% SOC from 60-0 mph[7]

Measured Time: 3.6 s

Distance: 137.0 ft

Peak Power into Battery: 52.9 kW

Braking at 100% SOC from 60-0 mph[7]

Measured Time: 3.6 s

Distance: 139 ft

Peak Power into Battery: 54.0 kW

Deceleration 60-10 mph[8]

Measured Time: 61.4 s

Distance: 2,688 ft

Peak Power into Battery: 13.7 kW

Total Energy into Battery: 102.0 Wh

DYNAMOMETER TESTING[9]

Cycle Results[10]

	72 °F	20 °F	95 °F + 850 W/m^2
UDDS (Cold Start)	243.9 Wh/mi	582.6 Wh/mi	312.8 Wh/mi
UDDS	235.3 Wh/mi	479.1 Wh/mi	301.5 Wh/mi
HWFET	261.5 Wh/mi	411.5 Wh/mi	298.1 Wh/mi
US06	355.0 Wh/mi	476.1 Wh/mi	400.1 Wh/mi
SC03			315.6 Wh/mi

City Range	110.9 miles	US06 Range	74.1 miles
Highway Range	100.7 miles		

Energy Consumption at Steady-State Speed, 0% Grade

10 mph	149.9 Wh/mi		50 mph	253.6 Wh/mi
20 mph	151.4 Wh/mi		60 mph	306.8 Wh/mi
30 mph	174.1 Wh/mi		70 mph	356.6 Wh/mi
40 mph	194.5 Wh/mi		80 mph	433.8 Wh/mi

Duration of Passing Maneuver at Grade[11]

	0% Grade	3% Grade	6% Grade
35-55 mph	4.1 s	4.7 s	5.7 s
55-65 mph	3.0 s	3.6 s	4.9 s
35-70 mph	8.6 s	10.5 s	14.0 s
55-80 mph	9.0 s	12.3 s	20.8 s
Maximum Speed at 25% Grade from Stop: 41.4 mph			

NOTES (also from previous page):

1. Vehicle specifications were supplied by the manufacturer, measured, or derived from a literature review.
2. The vehicle was classified as a Type II ZEV by the California Air Resources Board (CARB). The range on consecutive UDDS cycles is over 100 miles (less than 200 miles), but the vehicle does not meet the charging requirements for the Type III classification.
3. Performance numbers based on "Normal" vehicle mode. Performance numbers are averages from multiple tests.
4. Vehicle track testing occurs when the vehicle has achieved its "break-in mileage" of between 4,000 to 6,000 miles, and at the delivered curb weight plus 332 ± 10 lb (including driver and test equipment), distributed in a manner similar to the original curb loading of the vehicle. Track testing took place between July 2 and July 11, 2014 with a beginning vehicle odometer reading of 4,055 miles. The ambient temperatures ranged from 81 °F to 97 °F. No accessories were used except for headlights as required by track regulation.
5. The acceleration is measured from the point at which the vehicle begins to move. The acceleration and maximum speed results were averaged from 13 runs. The peak power value was taken from a single run.
6. The maximum speed was reached before the one-mile mark.
7. Controlled braking on dry surface. Brake testing was performed when the battery was at 50% state of charge (SOC) and also at 100% SOC. The peak power into the battery value was taken from a single run.
8. Coasting in drive on dry surface. Test run data were cut off when the vehicle reached 10 mph, as vehicle creep speeds are typically below this threshold. The time and distance results were averaged from 12 runs. The peak power into the battery value and total energy into the battery value were both taken from a single (but different) run.
9. Dynamometer testing occurs after the track testing is complete. Dynamometer testing began on August 8, 2014, with the vehicle odometer reading 4,524 miles. A comprehensive explanation of the dynamometer facility and methodology can be found at http://www.transportation.anl.gov/D3/, titled "Chassis Dynamometer Testing Reference Document". The ABC coefficients derived from track coastdown testing and matched on the dynamometer were A: 36.4265 lb, B: 0.51941 lb/mph, and C: 0.015143 lb/mph2. All electrical consumption values are given in AC Wh/mi.
10. The Cycle Results table presents the fuel economy achieved by the vehicle on five EPA drive cycles at three different ambient temperatures: (1) 72 °F with vehicle climate-control off, (2) 20 °F with vehicle climate-control set to 72 °F Auto, and (3) 95 °F with vehicle climate-control set to 72 °F Auto. For (3), the vehicle is also subjected to 850 W/m2 of solar load at 95 °F to simulate direct sunlight. The drive cycles include a hot start unless otherwise indicated. The ranges are calculated using SAE J1634, and are for a temperature of 72 °F.
11. The passing maneuver value indicates the amount of time required for the vehicle to transition from the first to the second speed, at the specified grade.

Values in red indicate that the Performance Goal was not met.

CONSTANT-SPEED RANGE AND CHARGE TESTING IN CHARGE-DEPLETING MODE[1]

	45 mph Test[2]	60 mph Test[3]	70 mph Test[4]
Average DC power out of battery at speed (kW):	9.0	16.3	22.7
(A) DC energy out of battery at set speed (kWh)[5,7,9]:	19.2	19.3	18.7
(A+) Total DC energy out of battery (kWh)[5,7,9]:	19.5	19.7	19.4
Battery capacity discharge at set speed (Ah):	59.5	60.2	58.5
(B) Range at set speed (mi)[6,8,10]:	97.1	71.7	57.6
(C) Post-test charge AC energy from EVSE @ 240 V to onboard charger (kWh):	25.4	25.0	24.8
(D) Post-test charge DC energy into battery from onboard charger (kWh):	20.5	20.5	20.3
Post-test charge duration (HH:MM):	04:15	04:28	04:25
AC electricity consumption rate (Wh/mi)[11]:	258	342	415
DC electricity consumption rate (Wh/mi)[12]:	198	269	325
(A+/D) Battery Roundtrip Efficiency[13]:	95%	96%	96%
(D/C) On-Board Charger Efficiency[14]:	81%	82%	82%
(A+/C) Overall Trip Efficiency[15]:	77%	79%	78%

NOTES:

1. See Note 3 and Note 4 on page 2. The vehicle is accelerated to the desired speed and then cruise control is used to maintain the speed. Range is considered reached when the vehicle is no longer capable of maintaining a speed that is 2 mph lower than the set speed.
2. During the 45 mph range test, the maximum battery temperature was 34 °C and the average ambient temperature was 28 °C. During the post-test charge, the maximum battery temperature was 37 °C, and the average ambient temperature was 31 °C.
3. During the 60 mph range test, the maximum battery temperature was 36 °C and the average ambient temperature was 29 °C. During the post-test charge, the maximum battery temperature was 38 °C, and the average ambient temperature was 36 °C.
4. During the 70 mph range test, the maximum battery temperature was 33 °C and the average ambient temperature was 29 °C. During the post-test charge, the maximum battery temperature was 38 °C, and the average ambient temperature was 34 °C.
5. In addition to the energy discharged from the battery during the 45 mph test, energy was discharged during the drive from test prep area to point at which vehicle test speed is achieved and maintained. After the range at 45 mph was completed, there is still ESS energy throughput during the drive to return the vehicle to the test prep area and the EVSE unit for the post-test charge. The pre-test drive required 0.31 kWh while the post-test drive returned 0.06 kWh, and these energy inputs can be added to the energy consumed during the range test **(A)** to obtain the total output from the battery (19.5 kWh, denoted as **(A+)**) that is used in the calculations discussed in Notes 13-15.
6. In addition to the range measured for the 45 mph test, the pre-test drive required 1.02 miles from test prep area to point at which vehicle test speed is achieved and maintained. After the range at 45 mph was completed, the post-test drive required an additional drive of 0.80 miles to return to the test prep area and the EVSE unit for the post-test charge. These distances can be added to the distance traveled during the range test **(B)** to obtain the total distance traveled (98.9 miles). However, the energy consumption values consider only the distance traveled during the test itself, or value **(B)**.
7. In addition to the energy discharged from the battery during the 60 mph test, energy was discharged during the drive from test prep area to point at which vehicle test speed is achieved and maintained. After the range at 60 mph was completed, there is still ESS energy throughput during the drive to return the vehicle to the test prep area and the EVSE unit for the post-test charge. The pre-test drive required 0.46 kWh while the post-test drive returned 0.02 kWh, and these energy inputs can be added to the energy consumed during the range test **(A)** to obtain the total output from the battery (19.7 kWh, denoted as **(A+)**) that is used in the calculations discussed in Notes 13-15.
8. In addition to the range measured for the 60 mph test, the pre-test drive required 1.17 miles from test prep area to point at which vehicle test speed is achieved and maintained. After the range at 60 mph was completed, the post-test drive required an additional drive of 2.53 miles to return to the test prep area and the EVSE unit for the post-test charge. These distances can be added to the distance traveled during the range test **(B)** to obtain the total distance traveled (75.4 miles). However, the energy consumption values consider only the distance traveled during the test itself, or value **(B)**.
9. In addition to the energy discharged from the battery during the 70 mph test, energy was discharged during the drive from test prep area to point at which vehicle test speed is achieved and maintained. After the range at 70 mph was completed, there is still ESS energy throughput during the drive to return the vehicle to the test prep area and the EVSE unit for the post-test charge. The pre-test drive required 0.71 kWh while the post-test drive returned 0.02 kWh, and these energy inputs can be added to the energy consumed during the range test **(A)** to obtain the total output from the battery (19.4 kWh, denoted as **(A+)**) that is used in the calculations discussed in Notes 13-15.
10. In addition to the range measured for the 70 mph test, the pre-test drive required 1.73 miles from test prep area to point at which vehicle test speed is achieved and maintained. After the range at 70 mph was completed, the post-test drive required an additional drive of 1.09 miles to return to the test prep area and the EVSE unit for the post-test charge. These distances can be added to the distance traveled during the range test **(B)** to obtain the total distance traveled (60.4 miles). However, the energy consumption values consider only the distance traveled during the test itself, or value **(B)**.
11. The AC electricity consumption rate is calculated by dividing the DC electricity consumption rate (in Wh/mi) by the Overall Trip Efficiency for that particular speed.
12. The DC electricity consumption rate is calculated by dividing the DC energy from the battery as the set speed **(A)** by the range at the set speed **(B)**.
13. Battery Roundtrip Efficiency is calculated by dividing the DC energy out of the battery **(A+)** by the DC energy from the on-board charger into the battery **(D).**
14. On-Board Charger Efficiency is calculated by dividing the DC energy from the on-board charger into the battery **(D)** by the AC energy from the EVSE **(C).**
15. Overall Vehicle Efficiency is calculated by dividing the DC energy out of the battery **(A+)** by the AC energy from the EVSE **(C)**.

As a production vehicle, this vehicle is assumed to meet all Federal Motor Vehicle Safety Standards (FMVSS) for Battery Electric Vehicles.

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