STATE OF CALIFORNIA
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
CALIFORNIA AIR RESOURCES BOARD

MOBILE SOURCE CERTIFICATION AND COMPLIANCE FEE PAYMENT FORM FOR ON-ROAD MODEL YEAR 2023 APPLICATIONS; CALENDAR YEAR 2022 APPLICATIONS ONLY

ECCD/NVEPB-010 (NEW. 03/2022) WORKSHEET 1 OF 1

CARB USE ONLY

Invoice Name:	MSFI210148
Invoice Date:	June 2, 2022

COMPANY INFORMATION

Company Name:	Ford Motor Company
Street Address:	1 American Road
City, State, Zip:	Dearborn, MI, 48126-2798
Country:	United States
Contact Name:	Tina Oliver
Contact Telephone Number:	1-313-3238938
Contact E-mail:	toliver@ford.com
FI$Cal Account Number:	CCAM000031

PRODUCT INFORMATION

Payment Row Number	Product Description or file name	Model Year/Calendar Year	Unique Application Identifier: Test Group, Engine Family, Trailer Family name, Vehicle Family, ZEP Family, if applicable (ID listed in payment row must match the unique identifier given to the certification application)	Category Type (drop down)	Fee Type (drop down)	Amount
1	OPCARRYOVER_23_CBI_ PFMXT02.34K1_APPIPT1	Model Year 2023	PFMXT02.34K1	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
2	OPCARRYOVER_23_CBI_ PFMXT02.34K2_APPIPT1	Model Year 2023	PFMXT02.34K2	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
3	OPCARRYOVER_23_CBI_ PFMXT03.33U3_APPIPT1	Model Year 2023	PFMXT03.33U3	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
4	OPCARRYOVER_23_CBI_ PFMXT03.33F1_APPIPT1	Model Year 2023	PFMXT03.33F1	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
5	PCARRYOVER_23_CBI_ PFMXV00.0B3R_APPIPT1	Model Year 2023	PFMXV00.0B3R	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Zero-Emission	$11,627
6	PCARRYOVER_23_CBI_ PFMXV00.0B3A_APPIPT1	Model Year 2023	PFMXV00.0B3A	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Zero-Emission	$11,627
7	PCARRYOVER_23_CBI_ PFMXV00.0B4R_APPIPT1	Model Year 2023	PFMXV00.0B4R	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Zero-Emission	$11,627
8	PCARRYOVER_23_CBI_ PFMXV00.0B4A_APPIPT1	Model Year 2023	PFMXV00.0B4A	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Zero-Emission	$11,627
9	PCARRYOVER_23_CBI_ PFMXV00.0G4A_APPIPT1	Model Year 2023	PFMXV00.0G4A	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Zero-Emission	$11,627
10	OPCARRYOVER_23_CBI_ PFMXT02.31EM_APPIPT1	Model Year 2023	PFMXT02.31EM	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
11	OPCARRYOVER_23_CBI_ PFMXT02.72V6_APPIPT1	Model Year 2023	PFMXT02.72V6	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
12	OPCARRYOVER_23_CBI_ PFMXT03.03V7_APPIPT1	Model Year 2023	PFMXT03.03V7	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
13	OPCARRYOVER_23_CBI_ PFMXT02.36HG_APPIPT1	Model Year 2023	PFMXT02.36HG	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
14	OPCARRYOVER_23_CBI_ PFMXT02.33MC_APPIPT1	Model Year 2023	PFMXT02.33MC	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
15	OPCARRYOVER_23_CBI_ PFMXT02.3VJY_APPIPT1	Model Year 2023	PFMXV02.3VJY	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
16						
17	OPCARRYOVER_23_CBI_ PFMXT03.33DU_APPIPT1	Model Year 2023	PFMXT03.33DU	A.1 Light-duty vehicle test group and medium-duty vehicle test group	Partial Carry-Over	$11,627
18						
19						
20						

Total Due	**$186,032**

Invalid signature

I, X Wade Witte , attest that any information provided is true, accurate, and complete.

Responsible Party Signature Here

Signed by: wwitte

APPLICATION FOR CERTIFICATION

PART 1

PFMXV00.0B3A

FORD MOTOR COMPANY

APPLICATION FOR CERTIFICATION – PART 1

2023 Model Year

Test Group: PFMXV00.0B3A
Durability Group: PFMXEEVNNG1D
Evap. Family: N/A

Test Group Description: LDV

Durability Group Description: Battery Electric

Application Standards: Federal: Tier 3 Bin 0
California: ZEV

Car Line Covered Mustang Mach-E AWD
Mustang Mach-E AWD LFP

Vehicle Tested:

PGW1-0.0-J-906 Config. 00 (LFP Testing)	
Charge Depleting UDDS TN:	PFMX10079928
Charge Depleting Highway TN:	PFMX10079929

MGW1-0.0-J-082 Config. 00 (NCM Testing)	
Charge Depleting UDDS TN:	MFMX10066270
Charge Depleting Highway TN:	MFMX10066271

Application Release Date: October 2, 2023

For Questions, Contact:
Avi Friedman, afriedm4@ford.com (313-590-3505)

Part 1. Application Index

8.8 Description of Charger
8.8.1 Power Recharging Procedures
8.8.2 Power Requirements Necessary to Recharge Vehicle
8.9 Accessories Which Draw Energy from the Battery
8.10 Other Unique Features
8.11 Description of Warning Systems for Maintenance / Malfunction
8.11.1 Cut-off Terminal Voltages for Prevention of Battery Damage

9. Reserved

10. Reserved

11. Starting and Shifting Schedules

11.1 Starting Procedure

11.2 Shifting Schedule

12. Description of Vehicles Covered by Certificate

12.1 Calibration Parts List
12.2 Vehicle Description Report

13. Reserved

14. Request for Certification

15. Other Information

15.1 Fee Filing Form

16. Test Results

16.1 EPA Certification Summary Information Report (CSI)

17. California Requirements

17.1 Statement of Compliance
17.1.1 General Statement
17.1.2 Drivability Statement
17.2 Supplemental Data and Certification Review Sheet
17.2.1 Urban Test Results
17.2.2 Highway Test Results
17.2.3 Combined Results
17.2.4 Additional Supplemental Data
17.3 Reserved
17.4 Credits
17.4.1 Description of multi-manufacturer arrangements
17.4.2 Credit Calculation
17.5 Vehicle Safety
17.5.1 All Information for Safe Operation of Vehicle
17.5.2 Information on Safe Handling of Battery System
17.5.3 Description of Emergency Procedures

18. Application Revisions

3. Facilities, Equipment and Test Procedures

The facilities and equipment comply with the related regulations, including 40 CFR Subpart B, §86.108-00(b)(2) [Oct. 22, 1996]

Equipment:	48 inch, single roll electric dynamometer
Regenerative Braking:	Enabled
Vehicle & Battery break in Period:	2600 mile accumulated on this vehicle / battery before test.
Range Test Procedure:	Tested according to “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles, adopted March 22, 2012
Test Procedure Used:	Tested using the Multi Cycle Test (MCT) sequence as stated in SAE International’s “*Surface Vehicle Recommended Practice*” J1634 Oct. 2012.

3.1 Procedure to Determine Mass Emissions of Fuel Fired Heater

Not applicable since Fuel Fired Heater not offered for this vehicle by Ford.

3.2 Battery and Vehicle Pre-Conditioning Procedures

The HV battery and vehicle does not require any pre-conditioning to enable the vehicle system. However, Ford decided to have the test vehicle accumulated 2600 miles on proving ground track prior to testing.

4 Reserved

5 Reserved

6 Maintenance

6.1 Test Vehicle Scheduled Maintenance

Not applicable (same as “Recommended Customer Maintenance Schedule” found in next section).

6.2 Recommended Customer Maintenance Schedule

Ford’s recommended maintenance schedule can be found in the owners guide.

7 Labels

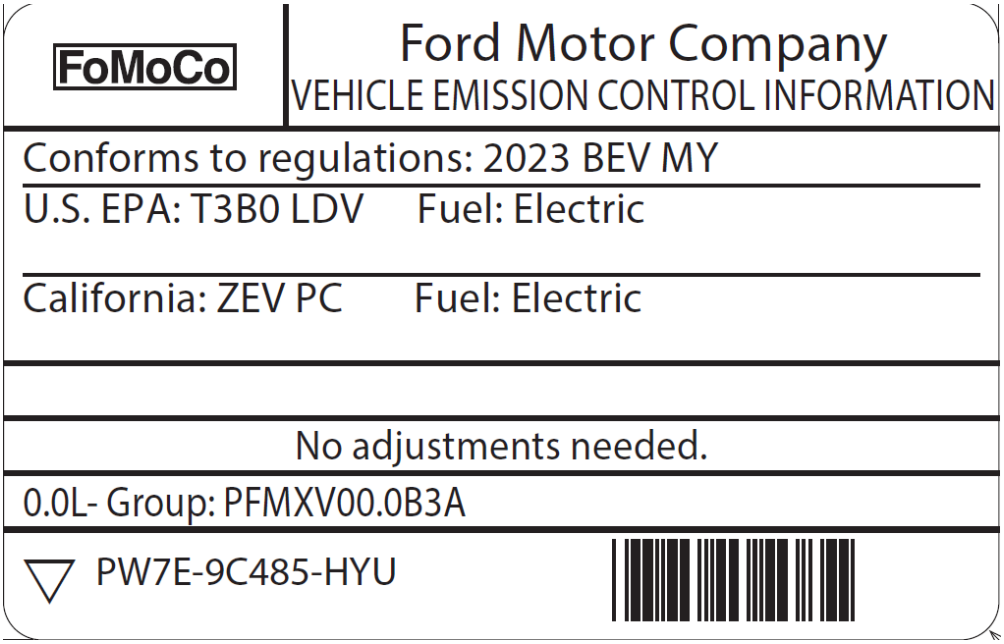
7.1 Label Locations and Labels

The Vehicle Emissions Control Information label (VECI) is located on the underside of the hood. See attachment for this vehicle's VECI label.

The Fuel Economy Label is installed on the passenger side front door. The Monroney Label now includes the EPA/DOT Fuel Economy and Environment Section (GHG, Smog Rating) based on the template published by EPA in May 2011. See attachment for label template to be used for this vehicle (The real FE label for this vehicle is not available at this time). The California Environmental Performance Label will be included on the vehicle. Please see section 17.2.3 for values.

7.2 Statement of Compliance

This vehicle conforms to US EPA Tier 3 Bin 0 vehicle regulations applicable to 2023 model year new motor vehicles and to California regulations applicable to 2023 model year new ZEV light-duty vehicles.


FoMoCo
Ford Motor Company
VEHICLE EMISSION CONTROL INFORMATION
Conforms to regulations: 2023 BEV MY
U.S. EPA: T3B0 LDV Fuel: Electric
California: ZEV PC Fuel: Electric
No adjustments needed.
0.0L- Group: PFMXV00.0B3A
PW7E-9C485-HYU

9 Reserved

10 Reserved

11 Starting and Shifting Schedules

11.1 Starting Procedure

Please refer to Owner's Guide for starting procedure.

11.2 Shifting Schedule

This vehicle uses a rotary dial to select transmission direction (choose "D" for Drive or "R" for Reverse) and since the vehicle uses a single ratio gearbox, there is no shift schedule.

12 Description of Vehicles Covered by Certificate

12.1 Calibration Parts List

Cert. Level	Calibrations	PCM -12A650-	HPCM -7P120-	BECM -10B687-	BCCM -10B689-	ABS -2D335-	AWD_CH -7S008-
Initial Application	PCGWC2NA07	PPJ98-BC	PPJ98-BC	NJ98-AE	PLJ98-AV	LK9C-CH	PPJ98-DC
	PCGWC2NA08	PPJ98-BD	PPJ98-BD	NJ98-AF	PLJ98-AX	LK9C-CJ	PPJ98-DD
B3A-001	PCGWC2NA09	PPJ98-BE	PPJ98-BE	NJ98-AF	PLJ98-AX	LK9C-CK	PPJ98-DE
B3A-002	PCGWC2NA10	PPJ98-BF	PPJ98-BF	NJ98-AF	PLJ98-AY	LK9C-CK	PPJ98-DF
B3A-003	PCGWC2NA11	PPJ98-BF	PPJ98-BF	NJ98-AF	PLJ98-AY	LK9C-CK	PPJ98-DF
B3A-004 (Initial LFP)	PCGWENNE05	PJ98-ALC	PPJ98-RC	PZ98-KD	PPJ98-FG	LK9C-CK	PPJ98-GA
B3A-004 (Initial LFP)	PCGWENNE06	PJ98-ALD	PPJ98-RD	PZ98-KE	PPJ98-FH	LK9C-CK	PPJ98-GB

Battery Assembly: MNJ98-10B759-DF

MNJ98-10B759-DE (Alt)

PZ98-10B759- BC (Alt)

PZ98-10B759- BD (Alt)

Primary Drive Unit (PDU): LJ9P-7P500-AF

Secondary Drive Unit (SDU): LJ9P-7B000-AC

LJ9P-7B000-AE (Alt)

LJ9P-7B000-BA (Alt)

Note:

12.2 Vehicle Description Report

See page attached.

Vehicle Description Report

Application: 50ST

Test Group: PFMXV00.0B3A

ID Number	5102407	5102416	5102425	5102434	5119022
Displacement	0.0	0.0	0.0	0.0	0.0
Cert Code	PCGWC2NA07	PCGWC2NA08	PCGWC2NA09	PCGWC2NA10	PCGWC2NA11
Fuel Tank(s)					
Carline	MUSTANG MACH-E AWD	MUSTANG MACH-E AWD	MUSTANG MACH-E AWD	MUSTANG MACH-E AWD	MUSTANG MACH-E AWD
Wheel Configuration	Standard	Standard	Standard	Standard	Standard
Body Style	Sport Utility Vehicle	Sport Utility Vehicle	Sport Utility Vehicle	Sport Utility Vehicle	Sport Utility Vehicle
Wheelbase	117.5	117.5	117.5	117.5	117.5
Transcode Combo	WA	WA	WA	WA	WA
Curb Weight	4583	4583	4583	4583	4583
ETW	5000	5000	5000	5000	5000
Loaded Weight LVW	4883	4883	4883	4883	4883
ALVW-ETW	5000	5000	5000	5000	5000
Adj. Loaded Weight	5042	5042	5042	5042	5042
GVWR	5500	5500	5500	5500	5500
Min Axle Ratio	9.05	9.05	9.05	9.05	9.05
Max Axle Ratio	9.05	9.05	9.05	9.05	9.05
Min N/V Ratio	109.4	109.4	109.4	109.4	109.4
Max N/V Ratio	109.8	109.8	109.8	109.8	109.8
Emission Vehicle Class	LDV	LDV	LDV	LDV	LDV
Drive Code	All Wheel Drive	All Wheel Drive	All Wheel Drive	All Wheel Drive	All Wheel Drive
Trans Type	Automatic	Automatic	Automatic	Automatic	Automatic
Calibration Application	50ST	50ST	50ST	50ST	50ST
Min Tire Size	225/60R18 - 109.8	225/60R18 - 109.8	225/60R18 - 109.8	225/60R18 - 109.8	225/60R18 - 109.8
Max Tire Size	225/55R19 - 109.4	225/55R19 - 109.4	225/55R19 - 109.4	225/55R19 - 109.4	225/55R19 - 109.4
Alt Tire 1					
Alt Tire 2					
Alt Tire 3					
Alt Tire 4					
Alt Tire 5					
Alt Tire 6					
Alt Tire 7					
DAW Full Tank	2306	2306	2306	2306	2306
DAW Empty Tank	2306	2306	2306	2306	2306

Vehicle Description Report

Application: 50ST

Test Group: PFMXV00.0B3A

ID Number	5102460
Displacement	0.0
Cert Code	PCGWENNE0002
Fuel Tank(s)	
Carline	MUSTANG MACH-E AWD LFP
Wheel Configuration	Standard
Body Style	Sport Utility Vehicle
Wheelbase	117.5
Transcode Combo	WA
Curb Weight	4874
ETW	5250
Loaded Weight LVW	5174
ALVW-ETW	5250
Adj. Loaded Weight	5337
GVWR	5800
Min Axle Ratio	9.05
Max Axle Ratio	9.05
Min N/V Ratio	109.4
Max N/V Ratio	109.8
Emission Vehicle Class	LDV
Drive Code	All Wheel Drive
Trans Type	Automatic
Calibration Application	50ST
Min Tire Size	225/60R18 - 109.8
Max Tire Size	225/55R19 - 109.4
Alt Tire 1	
Alt Tire 2	
Alt Tire 3	
Alt Tire 4	
Alt Tire 5	
Alt Tire 6	
Alt Tire 7	
DAW Full Tank	2519
DAW Empty Tank	2519

Vehicle Description Report

Application: 50ST

Test Group: PFMXV00.0B3A

ID Number	5119266
Displacement	0.0
Cert Code	PCGWENNE0003
Fuel Tank(s)	
Carline	MUSTANG MACH-E AWD LFP
Wheel Configuration	Standard
Body Style	Sport Utility Vehicle
Wheelbase	117.5
Transcode Combo	WA
Curb Weight	4874
ETW	5250
Loaded Weight LVW	5174
ALVW-ETW	5250
Adj. Loaded Weight	5337
GVWR	5800
Min Axle Ratio	9.05
Max Axle Ratio	9.05
Min N/V Ratio	109.4
Max N/V Ratio	109.8
Emission Vehicle Class	LDV
Drive Code	All Wheel Drive
Trans Type	Automatic
Calibration Application	50ST
Min Tire Size	225/60R18 - 109.8
Max Tire Size	225/55R19 - 109.4
Alt Tire 1	
Alt Tire 2	
Alt Tire 3	
Alt Tire 4	
Alt Tire 5	
Alt Tire 6	
Alt Tire 7	
DAW Full Tank	2519
DAW Empty Tank	2519

13 Reserved

14 Request for Certificate

Emissions Certification,
Homologation, & Compliance

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, Michigan 48101-2053

August 29, 2022

Mr. Robert Peavyhouse
Certification Division
Mobile Source Pollution Control
U. S. Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, Michigan 48105

Dear Mr. Peavyhouse:

Ford Motor Company (Ford) herewith submits its Part I Application for Certification for 2023 model year battery electric powered light-duty vehicles (LDVs) contained in Ford's 50 states test group PFMXV00.0B3A.

This Test Group complies with EPA final Tier 3 Bin 0 certification and in-use exhaust emission standards. Evaporative emission is not applicable to BEV program.

Based on Ford Motor Company's good engineering judgment, all the vehicles described in this application are designed to comply with the applicable intermediate and full useful life standards.

This Part I application for certification has been prepared in accordance with the standardized format recommended by EPA via its mail out # CD-14-19 (LDV/LDT/ICI/LIMO), subject: "Certification Application Reporting Guidance", dated November 24, 2014. Therefore, in accordance with the provisions of 40 CFR 86.1844-01(d)(14) including the provisions of 40 CFR Parts 85, 86 and 600, Ford requests that a Certificate of Conformity be issued for the LDV test group listed in this Application for Certification.

Please contact Avi Friedman at 313-590-3505, if you have any questions regarding this submission.

Sincerely,

DocuSigned by:
Glen Heiser
324454DCB23E436...

Glen Heiser
Manager, Emissions Certification, Homologation & Compliance
Vehicle Homologation & Compliance, SE&SE

Emissions Certification,
Homologation, & Compliance

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W200
Allen Park, Michigan 48101- 2053

August 29, 2022

Ms. Robin U. Lang, Chief
Emissions Compliance, Automotive Regulations and Science Division
Air Resources Board
4001 Iowa Ave.
Riverside, CA 92507

Dear Ms. Lang:

Ford Motor Company (Ford) herewith submits its Part I Application for Certification for 2023 model year battery electric powered light-duty vehicles (LDVs) contained in Ford's 50 states test group PFMXV00.0B3A.

This Test Group complies with ARB ZEV emission standards. Evaporative emission is not applicable to BEV program.

Based on Ford Motor Company's good engineering judgment, all the vehicles described in this application are designed to comply with the applicable intermediate and full useful life standards.

This Part I application for certification has been prepared in accordance with the standardized format recommended by EPA via its mail out # CD-14-19 (LDV/LDT/ICI/LIMO), subject: "Certification Application Reporting Guidance", dated November 24, 2014. This Application has also been prepared in accordance with the California Air Resources Board, Final Regulation Order, Amendments to Sections 1960.1, 1960.5, 1961, and 1962 Title 13, California Code of Regulations (As Amended August 4, 2005). Therefore, in accordance with the provisions of 40 CFR 86.1844-01(d)(14) including the provisions of 40 CFR Parts 85, 86 and 600, Ford requests that an Executive Order be issued for the PC test group listed in this Application for Certification.

Please contact Avi Friedman on 313-590-3505, if you have any questions regarding this submission.

Sincerely,

DocuSigned by:
Glen Heiser
324454DCB23E436...

Glen Heiser
Manager, Emissions Certification, Homologation & Compliance
Vehicle Homologation & Compliance, SE&SE

Cc: M. Ahmed
M. Desai

15 Other Information

15.1 Fee Filing Form

CCAPS Manual Payment Request

(North America)

REF NO: 306147

NAME AND ADDRESS OF PAYEE	Employee	Ex-Employee / Board of Director	Mail Attachments	Separate Check	Special Handling
Environmental Protection Agency-MVECP U.S. Bank - Government Lockbox 979032 1005 Convention Plaza SL-MO-C2-GL St. Louis, MI 63101 The requestor is responsible to ensure the supplier code has correct company name, remit to and/or banking information whether the payment is going by check or electronically by ACH.				Y	
	Supplier Code	**CCAPS Plant Code**	**Due Date**	**Currency**	**Amount**
	GXHSA	10	ASAP		312,895.00

REASON FOR DISBURSEMENT

CERTIFICATION FEES - EPA STANDARD ENGINE FAMILY, EXHAUST EMISSION CONTROL SYSTEM

COMMENTS (Shown on Remittance Advice/Not to include PII)

2023 CERTIFICATION FEES - PFMXT02.52F1, PFMXT02.73JK, PFMXT02.34K1, PFMXT02.34K2, PFMXV00.0B34, PFMXT02.33MC, PFMXT02.02Y1, PFMXT02.52B2, PFMXT00.0BG1, PFMXT05.2AHS, PFMXT02.72V6 (FORMS ATTACHED)

LOC CODE	GEN. LED.	SUB. ACCT.	SUB. DIV.	DEPT	PROD. CODE	BALANCE REFERENCE	MISC. REFERENCE	INVOICE #	INVOICE DATE	AMOUNT (Bracket Credits)	1099 Tax Type
5100	25A	00217		5100S910		F102A	EPA			312,895.00	N
									TOTAL	312,895.00	

Pre-requisites for Payment :

1. Requestors or Approvers to ensure the following
   - Receipt of Service
   - Price Validation
   - Supported by invoice or other documentation
2. Check if payment item is on Uses of Manual Payment Requests
3. For Finance Approval follow Corporate Approval Authorities - Method of Payment

TYPE OF INVOICE:

MANUAL PAYMENT REQUEST CATEGORY (use drop down with Alt+down arrow key): Legal Matters- Environmental Fees

Requestor

Preparer/Requestor	CDS ID	Sign	Date
	LTOLIVER		5/5/2022

Operations Approval - Receipt of Service

DocuSigned by:

Approver	CDS ID	Sign	Date
	GHEISER	Glen Heiser 324454DCB23E436...	5/5/2022

Approvals per Corporate Approval Authorities - Method of Payment

Payment Item is on Uses of Manual Payment Requests

DocuSigned by:

	CDS ID	Sign	Date
Finance LL5+ or Plant Controller (LL6) Unlimited	PBLANCAS	Patricia Blancas 98D37B2D5DA0498...	5/5/2022
Finance LL6 < $250,000			

Payment Item is not on Uses of Manual Payment Requests

	CDS ID	Sign	Date
Finance LL4+ Unlimited			
Finance LL5 < $25,000			

It is important to protect personal data when retaining and forwarding this Payment Authorization Form and attachments, if any. Every effort must be made to prevent exposure.

The space below may be used for additional local requirements

306147

EPA_MVECP_v1

US EPA Fee Form

Help and EPA Instructions

Tracking Information

Pay.gov Tracking ID: 26VVGD80

Agency Tracking ID: 76235176896

* Required Field

General Information

Date: 05/02/2022

Process Code *

Submit New Fee Filing Form

Manufacturer Code *

FMX

Manufacturer Name *

Ford Motor Company

Contact Name *

Tina Oliver

Contact Email Address *

toliver@ford.com

Contact Phone *

3133238938

Calendar Year complete application submitted to EPA *

2022

PLEASE NOTE: These fees apply to complete certification applications received by EPA from January 1, 2022, through December 31, 2022. The applicable fee is determined by the calendar year in which the complete certification application is received, not the model year.

Engine Family / Evaporative Family / Test Group *

PFMXV00.0B3A

Certificate Request Type (Industry Sector Code)

Certificate Request Type *

- On-Highway LDV, LTD, MDVPV, HDV Chassis Cert (Federal) (A, B, D, J, T, V)
- On-Highway HDE Dyno Cert (Federal) (E, H)
- On-Highway LD ICI, MDPV ICI, HDV ICI (A, B, D, J, T, V)
- On-Highway Motorcycle (C)
- On-Highway HDV Evap (F)
- On-Highway LDV, LTD, MDVPV, HDV Chassis Cert (California Only) (A, B, D, J, T, V)
- On-Highway HDE Dyno Cert - California Only (E, H)
- Nonroad CI (J)
- Nonroad SI (B, S)
- Locomotive (G, R)
- All Nonroad Recreational excluding Marine Engines (A, V)
- All Marine (including IMO) (M, N, V)
- Component Certification for Evaporative Families (F)

IMO Name (Required for dual US/IMO Marine Only)

ICI VIN Number (Required for ICIs Only)

Do you qualify for a Reduced Fee? *

No

Payment Information

Amount Owed

$28,445.00

Payment Type

Offline ACH

Comments

APRIL SMAN

EPA Form Number 3520-29
OMB Control No. 2060-0545
Approval expires 12/31/2022
The public reporting and recordkeeping burden for this collection of information is estimated to average 12 minutes per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed forms to this address.

16 Test Results

16.1 EPA Certification Summary Information Report (CSI)

Certification Summary Information Report

Manufacturer	Ford Motor Company	**Manufacturer Code**	FMX
Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--
Certificate Number	--	**CARB Executive Order #**	--
Certificate Issue Date	--	**Certificate Revision Date**	--
Certificate Effective Date	--	**Conditional Certificate**	--
CSI Revision #	--	**CSI Submission/Revision Date**	05/17/2023 11:26:22 PM
Model Year	2023		

Test Group Information

CSI Type	Running Change	**Running Change Reference Number**	004
GHG Exempt Status	Not Exempt		

Drive Sources and Fuel(s)

Drive Source #1: Electric Motor

Fuel	Basic Fuel Metering System	Lean Burn Strategy Indicator
Electricity	--	No

Hybrid Indicator	No		
Multiple Fuel Storage	--	**Rechargeable Energy Storage System Indicator**	Yes
Multiple Fuel Combustion	--	**Off-board Charge Capable Indicator**	Yes
Fuel Cell Indicator	No	**EPA Vehicle Class**	LDV
Federal Clean Fuel Vehicle	No	**Federal Clean Fuel Vehicle Standard**	--
Federal Clean Fuel Vehicle ILEV	--	**California Partial Zero Emissions Vehicle Indicator**	--
Durability Group Name	PFMXEEVNNG1D	**Durability Group Equivalency Factor**	1.0
Reduced Fee Test Group	No	**Certification Region Code(s)**	FA, CA
Complies with HD GHG 2b/3 regulations?	No		
Introduction into Commerce Date	12/12/2022	**CAP2000 Conditional Certificate?**	N/A
Independent Commercial Importer?	--	**Alternative Fuel Converter Certificate?**	--
SFTP Federal Composite Compliance Identifier	Not Applicable	**SFTP Tier 2 Composite CO Option**	--
SFTP LEV-III Composite Compliance Indicator	No		
OBD Compliance Type	CARB	**OBD Demonstration Vehicle Test Group**	PFMXV02.5H3V
Test Group OBD Compliance Level	Full - no deficiencies	**Number of Test Group OBD Deficiencies**	0
OBD Deficiencies Comments	This BEV program does not have OBD compliance requirements. Items filled in for the purpose of passing system validation because they are required fields.		
Mfr Test Group Comments	2023 MY Mach-E AWD BEV - Standard Range		
Mfr Exhaust / Evap Standards Comments	--		

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Models Covered by this Certificate

Carline Manufacturer	Division	Carline	Certification Region Code(s)	Drive System	Trans - Type	- # of Gears	Trans - Lockup
Ford Motor Company	1 - Ford	21 - MUSTANG MACH-E AWD	California + CAA Section 177 states	All Wheel Drive	Automatic	1	No
Ford Motor Company	1 - Ford	21 - MUSTANG MACH-E AWD	Federal	All Wheel Drive	Automatic	1	No
Ford Motor Company	1 - Ford	2 - MUSTANG MACH-E AWD LFP	California + CAA Section 177 states	All Wheel Drive	Automatic	1	No
Ford Motor Company	1 - Ford	2 - MUSTANG MACH-E AWD LFP	Federal	All Wheel Drive	Automatic	1	No

Engine Description

Hybrid Type	--	**Hybrid Description**	--
Engine Type	--	**Mfr Engine Description**	--
Engine Block Arrangement	--	**Mfr Engine Block Arrangement Description**	--
Camless Valvetrain Indicator	--	**Oil Viscosity/Classification**	
Number of Cylinders/Rotors	--	**Mechanically Variable Compression Ratio Indicator**	--

After Treatment Device(s) (ATD)

Mfr After Treatment Device (ATD) Comments	--
Direct Ozone Reduction (DOR) Device	--
Mfr Emission Control Device Comments	--

Official Test Numbers

Test Group Fuel	FTP	US06	SC03	Cold CO	Highway	EPA City Litmus Value	EPA City Litmus Threshold	EPA Highway Litmus Value	EPA Highway Litmus Threshold	CREE Weighting Factor
Electricity	--	--	--	--	--	--	--	--	--	--

Official Charge Depleting Test Numbers

Test Group Fuel	UDDS	Highway
Electricity	MFMX10066270	MFMX10066271
Electricity	PFMX10079928	PFMX10079929

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Hybrid Electric Vehicle And Fuel Cell Information

Rechargable Energy Storage System	Battery(s)	**Rechargable Energy Storage System, if Other**	--
Battery Type	Lithium Ion	**Number of Battery Packs**	1
Total Voltage of Battery Packs	410	**Battery Energy Capacity**	223
Battery Specific Energy	130	**Battery Charger Type**	On-Board
Number of Capacitors	--	**Capacitor Rating (In Farads)**	--
Mfr Capacitor Comments	--		
Hydraulic System Description	--		
Regenerative Braking Type	Electrical Regen Brake		
Regenerative Braking Source	Both	**Driver Controlled Regenerative Braking**	No
Mfr Regenerative Braking Description	--		
Drive Motor(s)/Generator(s)	2		
Motor/Generator Type 1	AC permanent magnet synchronou	**Rated Motor/Generator Power**	198
Motor/Generator Type 2	AC permanent magnet synchronou	**Rated Motor/Generator Power**	1
Mfr Fuel Cell Description	--		
Fuel Cell On-Board H2 Storage Capacity (kg)	--	**Usable H2 Fill Capacity (kg)**	--
Mfr Hybrid Electric/ Electric Vehicle Comments	This is a pure BEV vehicle. The Drive Motors are both AC permanent magnet synchronous machines. The Primary Drive Motor peak output is rated at 198kW. The Secondary Drive Motor peak output is 0kW, but is labeled as 1kW for processing needs of VERIFY.		

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Emission Data Vehicle Information

Vehicle ID / Configuration	MGW1-0.0-J-082 / 0	**Manufacturer Vehicle Configuration Number**	0
Original Test Group Name	MFMXV00.0B3A	**Original Evaporative/Refueling Family**	--
Original Test Vehicle Model Year	2021		

Vehicle Model

Represented Test Vehicle Make	Ford	**Represented Test Vehicle Model**	Mack-E

Leak Family Details

Leak Family Identifier	--	**Leak Family Name**	--

Drive Sources and Fuel System Details

Drive Source and Fuel#	Drive Source	Fuel
1	Electric Motor	Electricity

Hybrid Indicator	No		
Multiple Fuel Storage	--	**Multiple Fuel Combustion**	--
Fuel Cell Indicator	No	**Rechargeable Energy Storage System Indicator**	Yes
Rechargeable Energy Storage System	Battery(s)	**Rechargeable Energy Storage System, if 'Other'**	--
Off-board charge Capable Indicator	Yes		
Odometer Correction -- Initial	0	**Odometer Correction Factor**	1.03
Odometer Correction Sign	+ = System Miles is equal to (Test odometer reading * Correction factor) + Initial system miles		
Odometer Correction Units	Miles		
Engine Code	MCGWC2NA08	**Rated Horsepower**	266
Displacement (liters)	0.001		
Air Aspiration Method	Naturally Aspirated	**Air Aspiration Method, if 'Other'**	
Number of Air Aspiration Devices	0	**Air Aspiration Device Configuration**	--
Charge Air Cooler Type	--	**Drive Mode While Testing**	All Wheel Drive
Shift Indicator Light Usage	Not eqipped	**Aged Emission Components**	4,000 (mi)
Curb Weight (lbs)	4508	**Equivalent Test Weight (pounds)**	4750
GVWR (lbs)	5500	**N/V Ratio**	0
Axle Ratio	9.05		
Transmission Type	BEV	**# of Transmission Gears**	1
Transmission Lockup	No	**Creeper Gear**	No

Dynamometer Coefficients:

	Target Coefficients			Set Coefficients			
Coefficient Category	**A (lbf)**	**B (lbf/mph)**	**C (lbf/mph**2)**	**A (lbf)**	**B (lbf/mph)**	**C (lbf/mph**2)**	**EPA Calculated Total Road Load Horse Power for City/Highway/Evap Coefficients**
City/Highway/Evap	43.72	0.2458	0.02095	1.91	-0.0345	0.02125	14.5

Emission Control Device Comments ZEV vehicle, T3B0/ZEV

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--
Manufacturer Test Vehicle Comments	2021 MY Mach-E BEV		

Test #	**MFMX10066270**	**Test Procedure**	**81 - Charge Depleting UDDS**
Exhaust Test # for this Evap Test	--	**Test Fuel Type**	62 - Electricity
Test Date	07/31/2020	**Fuel**	Electricity
Fuel Batch ID	--	**Fuel Calibration Number**	--
Vehicle Class	LDV/Passenger Car	**DF Type**	Mfr. Assigned
Verify Test Lab ID	APTL		
E10 Evaporative Test Measurement Method	--		
Test Start Odometer Reading	2724	**Odometer Units**	M
4WD Test Dyno	Yes	**Diesel Adjustment Factor Usage**	--
State of Charge Delta	Yes		
Drive Cycle Speed Tolerance Criteria	Used Part 1066 (+/- 2.0 mph, +/- 1.0 sec)	**Road Speed Fan Usage**	Yes

PHEV/EV Charge Depleting Test Information

Recharge Event Voltage	240	**Recharge Event Energy (kiloWatt-hours)**	77.7
Charge Depleting Range (Calculated miles)	295.3	**Charge Depleting Range (Actual miles)**	295.3
All Electric Range Unadjusted (miles)	--	**Derived 5-Cycle Coefficient Model Year**	--
Equivalent All Electric Range (miles)	295.3		
Number of Charge Depleting Bags/Phases Conducted	1	**Transition Bag/Phase Number**	--

Charge Depleting Bag/Phase

Charge Depleting Bag/Phase #	Test Result/Emission Name	Unrounded Test Result
1	Carbon-Related Exhaust Emissions	0
2	Drive Trace Absolute Speed Change Rating	0.22
3	Drive Trace Energy Economy Rating	-0.14
4	Drive Trace Inertia Work Ratio Rating	0.49
5	Manufacturer Fuel Economy	128

Manufacturer Test Comments --

Certification Region	Useful Life	Standard Level	Emission Name	Rounded Result	RAF	NMOG/NM HC Ratio	Diesel Adjustment Factor	Add DF	Mult DF	Certification Level	Standard	Pass/Fail
Fed	150,000 miles	Federal Tier 3 Bin 0	CREE	0	--	--	--	0	--	0	--	--
CA	150,000 miles	California ZEV	CREE	0	--	--	--	0	--	0	--	--

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Test #	**MFMX10066271**	**Test Procedure**	**84 - Charge Depleting Highway**
Exhaust Test # for this Evap Test	--	**Test Fuel Type**	62 - Electricity
Test Date	07/31/2020	**Fuel**	Electricity
Fuel Batch ID	--	**Fuel Calibration Number**	--
Vehicle Class	LDV/Passenger Car	**DF Type**	Mfr. Assigned
Verify Test Lab ID	APTL		
E10 Evaporative Test Measurement Method	--		
Test Start Odometer Reading	2724	**Odometer Units**	M
4WD Test Dyno	Yes	**Diesel Adjustment Factor Usage**	--
State of Charge Delta	Yes		
Drive Cycle Speed Tolerance Criteria	Used Part 1066 (+/- 2.0 mph, +/- 1.0 sec)	**Road Speed Fan Usage**	Yes

PHEV/EV Charge Depleting Test Information

Recharge Event Voltage	240	**Recharge Event Energy (kiloWatt-hours)**	77.7
Charge Depleting Range (Calculated miles)	262.2	**Charge Depleting Range (Actual miles)**	262.2
All Electric Range Unadjusted (miles)	--	**Derived 5-Cycle Coefficient Model Year**	--
Equivalent All Electric Range (miles)	262.2		
Number of Charge Depleting Bags/Phases Conducted	1	**Transition Bag/Phase Number**	--

Charge Depleting Bag/Phase

Charge Depleting Bag/Phase #	Test Result/Emission Name	Unrounded Test Result
1	Carbon-Related Exhaust Emissions	0
2	Drive Trace Absolute Speed Change Rating	0.22
3	Drive Trace Energy Economy Rating	-0.14
4	Drive Trace Inertia Work Ratio Rating	0.49
5	Manufacturer Fuel Economy	113.7

Manufacturer Test Comments --

Certification Region	Useful Life	Standard Level	Emission Name	Rounded Result	RAF	NMOG/NM HC Ratio	Diesel Adjustment Factor	Add DF	Mult DF	Certification Level	Standard	Pass/Fail
Fed	150,000 miles	Federal Tier 3 Bin 0	CREE	0	--	--	--	0	--	0	--	--
CA	150,000 miles	California ZEV	CREE	0	--	--	--	0	--	0	--	--

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Emission Data Vehicle Information

Vehicle ID / Configuration	PGW1-0.0-J-906 / 0	**Manufacturer Vehicle Configuration Number**	0
Original Test Group Name	PFMXV00.0B3A	**Original Evaporative/Refueling Family**	--
Original Test Vehicle Model Year	2023		

Vehicle Model

Represented Test Vehicle Make	Ford	**Represented Test Vehicle Model**	Mach-E

Leak Family Details

Leak Family Identifier	--	**Leak Family Name**	--

Drive Sources and Fuel System Details

Drive Source and Fuel#	Drive Source	Fuel
1	Electric Motor	Electricity

Hybrid Indicator	No		
Multiple Fuel Storage	--	**Multiple Fuel Combustion**	--
Fuel Cell Indicator	No	**Rechargeable Energy Storage System Indicator**	Yes
Rechargeable Energy Storage System	Battery(s)	**Rechargeable Energy Storage System, if 'Other'**	--
Off-board charge Capable Indicator	Yes		
Odometer Correction -- Initial	0	**Odometer Correction Factor**	1.03
Odometer Correction Sign	+ = System Miles is equal to (Test odometer reading * Correction factor) + Initial system miles		
Odometer Correction Units	Miles		
Engine Code	PCGWENNE05	**Rated Horsepower**	311
Displacement (liters)	0.001		
Air Aspiration Method	Naturally Aspirated	**Air Aspiration Method, if 'Other'**	N/A - BEV
Number of Air Aspiration Devices	--	**Air Aspiration Device Configuration**	--
Charge Air Cooler Type	N/A	**Drive Mode While Testing**	All Wheel Drive
Shift Indicator Light Usage	Not eqipped	**Aged Emission Components**	4,000 (mi)
Curb Weight (lbs)	4874	**Equivalent Test Weight (pounds)**	5250
GVWR (lbs)	5800	**N/V Ratio**	109.4
Axle Ratio	9.05		
Transmission Type	Electric Vehicle	**# of Transmission Gears**	1
Transmission Lockup	No	**Creeper Gear**	No

Dynamometer Coefficients:

	Target Coefficients			Set Coefficients			
Coefficient Category	**A (lbf)**	**B (lbf/mph)**	**C (lbf/mph**2)**	**A (lbf)**	**B (lbf/mph)**	**C (lbf/mph**2)**	**EPA Calculated Total Road Load Horse Power for City/Highway/Evap Coefficients**
City/Highway/Evap	34.5	0.2353	0.02125	-10.71	0.1917	0.01922	13.3

Emission Control Device Comments --

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Manufacturer Test Vehicle Comments --

Test #	**PFMX10079928**	**Test Procedure**	**81 - Charge Depleting UDDS**
Exhaust Test # for this Evap Test	--	**Test Fuel Type**	62 - Electricity
Test Date	04/06/2023	**Fuel**	Electricity
Fuel Batch ID	--	**Fuel Calibration Number**	--
Vehicle Class	LDV/Passenger Car	**DF Type**	Mfr. Assigned
Verify Test Lab ID	APTL		
E10 Evaporative Test Measurement Method	--		
Test Start Odometer Reading	2741	**Odometer Units**	M
4WD Test Dyno	Yes	**Diesel Adjustment Factor Usage**	--
State of Charge Delta	Yes		
Drive Cycle Speed Tolerance Criteria	Used Part 1066 (+/- 2.0 mph, +/- 1.0 sec)	**Road Speed Fan Usage**	Yes

PHEV/EV Charge Depleting Test Information

Recharge Event Voltage	240	**Recharge Event Energy (kiloWatt-hours)**	83.7
Charge Depleting Range (Calculated miles)	345.9	**Charge Depleting Range (Actual miles)**	345.9
All Electric Range Unadjusted (miles)	--	**Derived 5-Cycle Coefficient Model Year**	--
Equivalent All Electric Range (miles)	345.9		
Number of Charge Depleting Bags/Phases Conducted	1	**Transition Bag/Phase Number**	--

Charge Depleting Bag/Phase

Charge Depleting Bag/Phase #	Test Result/Emission Name	Unrounded Test Result
1	Carbon-Related Exhaust Emissions	0
2	Drive Trace Absolute Speed Change Rating	0.46
3	Drive Trace Energy Economy Rating	-0.47
4	Drive Trace Inertia Work Ratio Rating	0.74
5	Manufacturer Fuel Economy	139.3

Manufacturer Test Comments --

Certification Region	Useful Life	Standard Level	Emission Name	Rounded Result	RAF	NMOG/NM HC Ratio	Diesel Adjustment Factor	Add DF	Mult DF	Certification Level	Standard	Pass/Fail
Fed	150,000 miles	Federal Tier 3 Bin 0	CREE	0	--	--	--	0	--	0	--	--
CA	150,000 miles	California ZEV	CREE	0	--	--	--	0	--	0	--	--

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Test #	**PFMX10079929**	**Test Procedure**	**84 - Charge Depleting Highway**
Exhaust Test # for this Evap Test	--	**Test Fuel Type**	62 - Electricity
Test Date	04/06/2023	**Fuel**	Electricity
Fuel Batch ID	--	**Fuel Calibration Number**	--
Vehicle Class	LDV/Passenger Car	**DF Type**	Mfr. Assigned
Verify Test Lab ID	APTL		
E10 Evaporative Test Measurement Method	--		
Test Start Odometer Reading	2741	**Odometer Units**	M
4WD Test Dyno	Yes	**Diesel Adjustment Factor Usage**	--
State of Charge Delta	Yes		
Drive Cycle Speed Tolerance Criteria	Used Part 1066 (+/- 2.0 mph, +/- 1.0 sec)	**Road Speed Fan Usage**	Yes

PHEV/EV Charge Depleting Test Information

Recharge Event Voltage	240	**Recharge Event Energy (kiloWatt-hours)**	83.7
Charge Depleting Range (Calculated miles)	309.2	**Charge Depleting Range (Actual miles)**	309.2
All Electric Range Unadjusted (miles)	--	**Derived 5-Cycle Coefficient Model Year**	--
Equivalent All Electric Range (miles)	309.2		
Number of Charge Depleting Bags/Phases Conducted	1	**Transition Bag/Phase Number**	--

Charge Depleting Bag/Phase

Charge Depleting Bag/Phase #	Test Result/Emission Name	Unrounded Test Result
1	Carbon-Related Exhaust Emissions	0
2	Drive Trace Absolute Speed Change Rating	0.46
3	Drive Trace Energy Economy Rating	-0.47
4	Drive Trace Inertia Work Ratio Rating	0.74
5	Manufacturer Fuel Economy	124.5

Manufacturer Test Comments --

Certification Region	Useful Life	Standard Level	Emission Name	Rounded Result	RAF	NMOG/NM HC Ratio	Diesel Adjustment Factor	Add DF	Mult DF	Certification Level	Standard	Pass/Fail
Fed	150,000 miles	Federal Tier 3 Bin 0	CREE	0	--	--	--	0	--	0	--	--
CA	150,000 miles	California ZEV	CREE	0	--	--	--	0	--	0	--	--

Fuel Properties

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Consolidated List of Standards

Exhaust Standards

Cert Region	California + CAA Section 177 states	**Cert/In-Use Code**	Both
Vehicle Class	LDV/Passenger Car	**Standard Level**	California ZEV
Fuel	Electricity	**Test Procedure**	Charge Depleting Highway

Useful Life	Emission Name	Rounded Result	RAF	NMOG / NMHC	Upward Diesel Adjustment Factor	Downward Diesel Adjustment Factor	Mult DF	Add DF	Std
150,000 miles	CREE	--	--	--	--	--	--	0	0

Cert Region	Federal	**Cert/In-Use Code**	Both
Vehicle Class	LDV/Passenger Car	**Standard Level**	Federal Tier 3 Bin 0
Fuel	Electricity	**Test Procedure**	Charge Depleting UDDS

Useful Life	Emission Name	Rounded Result	RAF	NMOG / NMHC	Upward Diesel Adjustment Factor	Downward Diesel Adjustment Factor	Mult DF	Add DF	Std
150,000 miles	CREE	--	--	--	--	--	--	0	0

Cert Region	Federal	**Cert/In-Use Code**	Both
Vehicle Class	LDV/Passenger Car	**Standard Level**	Federal Tier 3 Bin 0
Fuel	Electricity	**Test Procedure**	Cold CO

Useful Life	Emission Name	Rounded Result	RAF	NMOG / NMHC	Upward Diesel Adjustment Factor	Downward Diesel Adjustment Factor	Mult DF	Add DF	Std
150,000 miles	CO	--	--	--	--	--	--	0	0

Cert Region	California + CAA Section 177 states	**Cert/In-Use Code**	Both
Vehicle Class	LDV/Passenger Car	**Standard Level**	California ZEV
Fuel	Electricity	**Test Procedure**	Cold CO

Useful Life	Emission Name	Rounded Result	RAF	NMOG / NMHC	Upward Diesel Adjustment Factor	Downward Diesel Adjustment Factor	Mult DF	Add DF	Std
150,000 miles	CO	--	--	--	--	--	--	0	0

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Cert Region	Federal	**Cert/In-Use Code**	Both
Vehicle Class	LDV/Passenger Car	**Standard Level**	Federal Tier 3 Bin 0
Fuel	Electricity	**Test Procedure**	Charge Depleting Highway

Useful Life	Emission Name	Rounded Result	RAF	NMOG / NMHC	Upward Diesel Adjustment Factor	Downward Diesel Adjustment Factor	Mult DF	Add DF	Std
150,000 miles	CREE	--	--	--	--	--	--	0	0

Cert Region	California + CAA Section 177 states	**Cert/In-Use Code**	Both
Vehicle Class	LDV/Passenger Car	**Standard Level**	California ZEV
Fuel	Electricity	**Test Procedure**	Charge Depleting UDDS

Useful Life	Emission Name	Rounded Result	RAF	NMOG / NMHC	Upward Diesel Adjustment Factor	Downward Diesel Adjustment Factor	Mult DF	Add DF	Std
150,000 miles	CREE	--	--	--	--	--	--	0	0

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Glossary

Useful Life			
4	4,000 miles	120	120,000 miles
50	50,000 miles	150	150,000 miles
100	100,000 miles		

Emission Name			
HC-TOTAL	Total Hydrocarbon	METHANOL	CH3OH - Methanol
CO	Carbon Monoxide	N2O	Nitrous Oxide
CO2	Carbon dioxide	SPITBACK	Spitback Hydrocarbon in grams
CREE	Carbon-Related Exhaust Emissions	AMP-HRS	Integrated Amp-hours
OPT-CREE	Optional Carbon-Related Exhaust Emissions	START-SOC	System Start State of Charge Watt-hours
NOX	Nitrogen Oxide	END-SOC	System End State of Charge Watt-hours
PM	Particulate Matter	ACT-DISTANCE	Actual Distance Driven (miles)
PM-COMP	SFTP Composite Particulate Matter	AS-VOLT	Average System Voltage
HC-NM	Non-methane Hydrocarbon	CO2 BAG 1	Bag 1 Carbon Dioxide
OMHCE	Organic material Hydrocarbon Equivalent	CO2 BAG 2	Bag 2 Carbon Dioxide
OMNMHCE	Organic material non-methane HC equivalent	CO2 BAG 3	Bag 3 Carbon Dioxide
NMOG	Non-methane organic gases	CO2 BAG 4	Bag 4 Carbon Dioxide
HCHO	Formaldehyde	NMOG+NOX	Non-methane organic gases plus Nitrogen Oxides
H3C2HO	Acetaldehyde	NMOG+NOX-COMP	SFTP Composite Non-methane Organic Gases + Nitrogen Oxides
HC-NM+NOX	SFTP Non-methane Hydrocarbon + Nitrogen Oxides for US06 or SC03	DT-IWRR	Drive Trace Inertia Work Ratio Rating
HC-NM+NOX-COMP	SFTP Composite Non-methane Hydrocarbon + Nitrogen Oxides	DT-ASCR	Drive Trace Absolute Speed Change Rating
CO-COMP	SFTP Composite Carbon Monoxide	DT-EER	Drive Trace Energy Economy Rating
ETHANOL	C2H5OH - Ethanol	COMB-CREE	Combined Carbon-Related Exhaust Emissions
FE BAG 1	Bag 1 Fuel Economy	COMB-OPT-CREE	Combined Optional Carbon-Related Exhaust Emissions
FE BAG 2	Bag 2 Fuel Economy	HC-TOTAL-EQUIV	Total Hydrocarbon equivalent - Evap only
FE BAG 3	Bag 3 Fuel Economy	METHANE-COMB	Combined CH4 for HD 2b/3 vehicles only
FE BAG 4	Bag 4 Fuel Economy	N2O-COMB	Combined Nitrous Oxide for HD 2b/3 vehicles only
MFR FE	Manufacturer Fuel Economy	LEAK-DIA	Effective Leak Diameter (inches)
HC	Hydrocarbon for Running Loss and ORVR	LEAK-GAS CAP	Gas Cap Leakage (cc/min)
METHANE	CH4 - Methane	CO2-COMB	Combined Carbon Dioxide for HD 2b/3 Vehicles Only

Certification Region			
CA	California + CAA Section 177 states	FA	Federal

Exhaust Emission Standard Level			
B1	Federal Tier 2 Bin 1	L3ULEV340	California LEV-III ULEV340
B2	Federal Tier 2 Bin 2	L3ULEV250	California LEV-III ULEV250
B3	Federal Tier 2 Bin 3	L3ULEV200	California LEV-III ULEV200
B4	Federal Tier 2 Bin 4	L3SULEV170	California LEV-III SULEV170
B5	Federal Tier 2 Bin 5	L3SULEV150	California LEV-III SULEV150

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--
B6	Federal Tier 2 Bin 6	L3LEV630	California LEV-III LEV630
B7	Federal Tier 2 Bin 7	L3ULEV570	California LEV-III ULEV570
B8	Federal Tier 2 Bin 8	L3ULEV400	California LEV-III ULEV400
B9	Federal Tier 2 Bin 9	L3ULEV270	California LEV-III ULEV270
B10	Federal Tier 2 Bin 10	L3SULEV230	California LEV-III SULEV230
B11	Federal Tier 2 Bin 11	L3SULEV200	California LEV-III SULEV200
HDV1	HDV1 (Federal HD chassis Class 2b GVW 8501-10000)	T3B160	Federal Tier 3 Bin 160
HDV2	HDV2 (Federal HD chassis Class 3 GVW 10001-14000)	T3B125	Federal Tier 3 Bin 125
L2	California LEV-II LEV	T3B110	Federal Tier 3 Transitional Bin 110
L2OP	California LEV-II LEV Optional	T3B85	Federal Tier 3 Transitional Bin 85
U2	California LEV-II ULEV	T3SULEV30	Federal Tier 3 Transitional LEV-II SULEV30 Carryover
S2	California LEV-II SULEV	T3B70	Federal Tier 3 Bin 70
ZEV	California ZEV	T3B50	Federal Tier 3 Bin 50
OT	Other	T3B30	Federal Tier 3 Bin 30
T1	Federal Tier 1	T3B20	Federal Tier 3 Bin 20
PZEV	California PZEV	T3B0	Federal Tier 3 Bin 0
L2LEV160	California LEV-II LEV160	HDV2B395	Federal Tier 3 HD Class 2b Transitional Bin 395
L2ULEV125	California LEV-II ULEV125	HDV2B340	Federal Tier 3 HD Class 2b Transitional Bin 340
L2SULEV30	California LEV-II SULEV30	HDV2B250	Federal Tier 3 HD Class 2b Bin 250
L2LEV395	California LEV-II LEV395	HDV2B200	Federal Tier 3 HD Class 2b Bin 200
L2ULEV340	California LEV-II ULEV340	HDV2B170	Federal Tier 3 HD Class 2b Bin 170
L2LEV630	California LEV-II LEV630	HDV2B150	Federal Tier 3 HD Class 2b Bin 150
L2ULEV570	California LEV-II ULEV570	HDV2B0	Federal Tier 3 HD Class 2b Bin 0
L3LEV160	California LEV-III LEV160	HDV3B630	Federal Tier 3 HD Class 3 Transitional Bin 630
L3ULEV125	California LEV-III ULEV125	HDV3B570	Federal Tier 3 HD Class 3 Transitional Bin 570
L3ULEV70	California LEV-III ULEV70	HDV3B400	Federal Tier 3 HD Class 3 Bin 400
L3ULEV50	California LEV-III ULEV50	HDV3B270	Federal Tier 3 HD Class 3 Bin 270
L3SULEV30	California LEV-III SULEV30	HDV3B230	Federal Tier 3 HD Class 3 Bin 230
L3SULEV20	California LEV-III SULEV20	HDV3B200	Federal Tier 3 HD Class 3 Bin 200
L3LEV395	California LEV-III LEV395	HDV3B0	Federal Tier 3 HD Class 3 Bin 0

Transmission Type Code			
AMS	Automated Manual- Selectable (e.g. Automated Manual with paddles)	M	Manual
A	Automatic	OT	Other
AM	Automated Manual	SA	Semi-Automatic
CVT	Continuously Variable	SCV	Selectable Continuously Variable (e.g. CVT with paddles)

Drive System Code			
4	4-Wheel Drive	P	Part-time 4-Wheel Drive
F	2-Wheel Drive, Front	A	All Wheel Drive
R	2-Wheel Drive, Rear		

Certification Summary Information Report

Test Group	PFMXV00.0B3A	**Evaporative/Refueling Family**	--

Additional Terms and Acronyms

AFC	Alternative Fuel Converter	ICI	Independent Commercial Importer
CSI	Certificate Summary Information	ORVR	Onboard Refueling Vapor Recovery
DF	Deterioration Factor	SIL	Shift Indicator Light
Evap	Evaporation, Evaporative	Trans	Transmission

17 California Requirements

17.1 Statement of Compliance

17.1.1 General Statement

Ford Motor Company states that in regard to the vehicle control systems and all related parameters the production vehicles will be identical to the test vehicles which are used for certification testing.

17.1.2 Drivability Statement

The 2023 model year Ford Mach-E vehicles meet the typical drivability requirements that the United States market expects, including acceleration rates, braking performance and stability performance. Furthermore, this vehicle meets all applicable FMVSS standards.

17.2 Supplemental Data and Certification Review Sheet

17.2.1 Certification Review Sheet

See Attachment.

E.O.#.

2023 MY MODEL-YEAR AIR RESOURCES BOARD CERTIFICATION REVIEW SHEET ZEV-PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

Manufacturer: Ford Motor Company Test Group: PFMXV00.0B3A

Range Test Results								
		(check one)	(check one)			System	System	Vehicle
Vehicle ID	Trans	TW _____	DPA _____		Unadjusted Range	AC (Wh/mi)	DC (Wh/mi)	DC (Wh/mi)
		ETW / GVWR _X____	RLHP _____					
			dyno coeff. X					
MGW1-0.0-J-082	Auto Single Speed	4750	F0 = 43.72	Ford UDDS Original Test	295.37	263.19	246.85	229.16
			F1 = 0.2458				232.39	
			F2 = 0.02095				222.9	
							230.71	
				Ford HWY Original Test	262.23	296.45	261.91	258.12
							254.33	

Battery Test Results: Specific Energy (Whr/kg) _162.9

Vehicle Models	Trans type	Calibration	ETW (lb)	Tires	TRLHP
Mach-E AWD BEV	Auto (single speed)	MCGWC2NA08	4750	225/55R19	14.5

Range Test Results								
		(check one)	(check one)			System	System	Vehicle
Vehicle ID	Trans	TW _____	DPA _____		Unadjusted Range	AC (Wh/mi)	DC (Wh/mi)	DC (Wh/mi)
		ETW / GVWR _X____	RLHP _____					
			dyno coeff. X					
PGW1-0.0-J-906	Auto Single Speed	5250	F0 = 34.50	Ford UDDS Original Test	345.9	241.96	247.40	211.05
			F1 = 0.2353				211.36	
			F2 = 0.02125				207.66	
							211.31	
				Ford HWY Original Test	309.2	270.62	237.78	236.05
							234.32	

Battery Test Results: Specific Energy (Whr/kg) _121.7

Vehicle Models	Trans type	Calibration	ETW (lb)	Tires	TRLHP
Mach-E AWD LFP	Auto (single speed)	PCGWENNE05	5250	225/55R19	13.3

Fuel Fired Heater Test Results (emission results in grams/mile): NA

NMHC
CO
NOx

Remarks:

----------ARB USE ONLY ----------

Application Processed By: _____ Date:_____

17.3 Reserved

17.4 Credits

17.4.1 Description of multi-manufacturer arrangements

Not applicable to this program. Ford is the sole manufacturer of this product.

17.4.2 Credit Calculation

As per the California EPA ARB document: “California Exhaust Emissions Standards … for 2018 and Subsequent Model Zero-Emission Vehicles…”, which was adopted in California on Mar 22, 2012, the 2023 model year Mach-E AWD Standard Range will receive 3.45 ZEV Credits for each vehicle sold, according to the following formula:
ZEV Credit =
(0.01)*(UDDS Range)+0.50 = (0.01)*(295.37)+0.50 = 3.45 Credits (Rounded to nearest 1/100th).

The 2023 model year Mustang Mach-E AWD LFP model will receive 3.95 ZEV Credits for each vehicle sold, according to the following formula:
ZEV Credit =
(0.01)*(UDDS Range)+0.50 = (0.01)*(345.9)+0.50 = 3.95 Credits (Rounded to nearest 1/100th).

17.5 Vehicle Safety

17.5.1 All Information for Safe Operation of Vehicle

Details on how to operate the vehicle can be found in the owners guide.

Note that the vehicle is started and driven in the same manner as a conventional I.C.E. vehicle.

17.5.2 Information on Safe Handling of Battery System

The battery is to be serviced only by technicians that are authorized to do so by Ford. The detail will be available prior to production

17.5.3 Description of Emergency Procedures

Emergency procedures are described in Owner’s guide. Please refer to owner’s guide for details.

SECTION 18

Revisions

18.00.00.00 – Revisions – PFMXV00.0B3A

NO.	DATE	PAGE(S)	DESCRIPTION
ARC-341	10/13/2022	Section 12 Section 18	ARC 341: Running change ARC-341 introduces a new calibration level R09 into production across the Mustang Mach-E program. Reference whitepaper: 03.14.01-11931
ARC-347	11/22/2022	Section 12 Section 18	ARC 347: Running change ARC-347 introduces a new calibration level R10 into production across the Mustang Mach-E program. Reference whitepaper: 03.14.01-11952
ARC-361	4/13/2023	Section 12 Section 18	ARC 361: Running change ARC-361 introduces a new calibration level R11 into production across the Mustang Mach-E program. Reference whitepaper: 03.14.01-11952
B3A-004	6/1/2023	Section 2 Section 8 Section 12 Section 16 Section 17 Section 18	B3A-004: This running change introduces the LFP battery pack and associated calibrations into production. Reference Whitepaper: 03.14.01-12701, 03.14.01-12764, 03.14.01-12858

Application for Certification

Part 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2023 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Ford Motor Company**
(U.S. Manufacturer or Importer)

Certificate Number: PFMXV00.0B3A-039

Effective Date: 08/31/2022

Expiration Date: 12/31/2023

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 08/31/2022

Revision Date: N/A

Test Group Name: PFMXV00.0B3A
Evaporative/Refueling Family Name:
Applicable Exhaust Emission Standards: Federal Tier 3 Bin 0
Applicable Evaporative/Refueling Standards:

Engine Displacement: N/A
Exhaust Emission Test Fuel Type: Electricity
Full Useful Life Miles: Exhaust Emissions: 150,000 miles
Full Useful Life Miles: Evaporative/Refueling Emissions: N/A

Models Covered: Ford: MUSTANG MACH-E AWD
All electric EV

Pursuant to section 206 of the Clean Air Act (42 U.S.C.7525) and 40 CFR Parts 85, 86, 88, 600, 1037, 1065, and 1066 as applicable, this certificate of conformity is hereby issued with respect to test vehicles which have been found to conform to the requirements of the regulations on Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines (40 CFR Parts 85, 86, 88, 600, 1037, 1065, and 1066 as applicable) and which represent the new motor vehicle models listed above by test group and evaporative/refueling emission family, more fully described in the application of the above named manufacturer. Vehicles covered by this certificate have demonstrated compliance with the applicable emission standards as more fully described in the manufacturer's application. This certificate covers the above models, which are designed to meet the applicable emission standards specified in 40 CFR Parts 85, 86, 88, 600, 1037, 1065, and 1066 as applicable at both high and low altitude as applicable.

EPA is issuing this certificate subject to the conditions and provisions of 40 CFR 86.1848(c), and 40 CFR 1037 as applicable.

This certificate covers only those new motor vehicles or vehicle engines which conform, in all material respects, to the design specifications that apply to those vehicles or engines described in the documentation required by 40 CFR Parts 85, 86, 88, 600, 1037, 1065, and 1066 as applicable and which are produced during the 2023 model year production period stated on this certificate of the said manufacturer, as defined in 40 CFR Parts 85, 86, 88, 600, 1037, 1065, and 1066 as applicable. The manufacturer shall obtain the approval of the California Air Resources Board (in the form of an executive order issued by the California Air Resources Board) prior to introducing any vehicle covered by this certificate into commerce 1) in the State of California, or 2) in a State that, under the authority of Section 177 of the Clean Air Act, has adopted and placed into effect the California standards to which this test group has been certified.

In the case of completely assembled vehicles, this certificate of conformity covers only vehicles which are completely manufactured prior to January 1, 2024. Normally incompletely assembled vehicles (such as cab chassis) may be completed after this date, provided that the basic manufacturing (including installation of the emission control system) was completed prior to January 1, 2024. This certificate does not cover vehicles sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

CALIFORNIA AIR RESOURCES BOARD	FORD MOTOR COMPANY	Executive Order: A-010-2429 New Zero-Emission Vehicles in the Passenger Car, Light-Duty Truck, and Medium Duty Vehicle Classifications Page 1 of 2

Pursuant to the authority vested in California Air Resources Board by Health and Safety Code, Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by Health and Safety Code Sections 39515 and 39516 and Executive Order G-19-095;

IT IS ORDERED: The following vehicles produced by the manufacturer are certified as zero-emission vehicles pursuant to Title 13, California Code of Regulations (13 CCR) 1962.2 and the incorporated test procedures. Production vehicles shall be in all material respects the same as those for which certification is granted.

TEST GROUP INFORMATION				
MODEL YEAR	**TEST GROUP**	**VEHICLE TYPE (1)**	**ZEV TYPE (2)**	**ZEV FUEL TYPE (3)**
2023	PFMXV00.0B3A	PC	ZEV	LI+

VEHICLE MODEL INFORMATION						
MAKE	**MODEL**	**VEHICLE TYPE (1)**	**ZEV TYPE (2)**	**ZEV FUEL TYPE (3)**	**UDDS AER (4) (MILES)**	**ZEV CREDIT**
FORD	MUSTANG MACH-E AWD	PC	ZEV	LI+	295.4	3.45

13 CCR abc = Title 13, California Code of Regulations, Section abc; HSC xyz = Health and Safety Code Section xyz; * = not applicable

(1) PC: passenger car; LDT: light-duty truck; MDV: medium-duty vehicle; HDV: heavy-duty vehicle; #: pounds; LVW: loaded vehicle weight; ALVW: adjusted loaded vehicle weight, alternately called TW: test weight; GVWR: gross vehicle weight rating
(2) ZEV: zero-emission vehicle; NEV: neighborhood electric vehicle; NEV+: neighborhood electric vehicle meeting 13 CCR 1962.2(d)(5)(F) specifications and requirements
(3) Pb-A: lead-acid battery; NiCd: nickel-cadmium battery; NiMH: nickel-metal hydride battery; Li+: lithium ion battery; FCH2: fuel cell consuming on-board stored hydrogen
(4) UDDS: urban dynamometer driving schedule; AER: all electric range

BE IT FURTHER RESOLVED: The listed vehicle models shall not be equipped with any fuel-fired auxiliary power sources or heaters.

BE IT FURTHER RESOLVED: The listed vehicle models shall comply with 13 CCR 1965 (labeling).

BE IT FURTHER RESOLVED: The listed vehicle models shall be clearly labeled as "low-emission motor vehicle" pursuant to the requirements of HSC 43802(a).

BE IT FURTHER RESOLVED: Because the vehicles certified by this Executive Order have no parts that affect emissions for which there is an applicable emission requirement, the manufacturer is not required to provide an emission control system warranty pursuant to HSC 43205 or 13 CCR 2035 et seq. Notwithstanding the above, the drive train, including battery packs, of the listed vehicle models certified under 13 CCR 1962.2(d)(5)(F) [i.e., NEV+] shall be covered under warranty in compliance with the requirement in 13 CCR 1962.2(d)(5)(F)3.

BE IT FURTHER RESOLVED: Any debit in the manufacturer's fleet average compliance requirement for NMOG+NOx or Vehicle Equivalent Credit (13 CCR Sections 1961.2(b)(1), 1961.2(b)(3), or 1961.2(c)(3), and the incorporated test procedures, as applicable), or Greenhouse Gas Emissions (13 CCR Section 1961.3, or 17 CCR Section 95663, and the incorporated test procedures, as applicable), for PC, LDT, MDPV or MDV shall be equalized as required.

BE IT FURTHER RESOLVED: As applicable, heavy-duty vehicles (HDV) over 14,000 pounds in GVWR listed in this Executive Order are certified to the requirements in 13 CCR Section 1961.2 applicable to MDV pursuant to 13 CCR Section 1956.8(c)(3) or 13 CCR Section 1956.8(h)(5), as applicable.

Quarterly production reports shall be submitted to the Executive Order no later than 45 days after the end of each quarter.

Vehicles certified under this Executive Order shall conform to all applicable California emission regulations.

The Bureau of Automotive Repair will be notified by copy of this Executive Order.

Executed on this 5th day of October 2022.

Robin U. Lang, Chief
Emissions Certification and Compliance Division

Vehicle Homologation and Compliance
Sustainability, Environment and Safety Engineering
Ford Motor Company

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, MI 48101

October 13, 2022

Mr. Robert Peavyhouse
Certification Division
Mobile Source Pollution Control
U. S. Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, Michigan 48105

Dear Mr. Peavyhouse:

Subject: **2023MY Ford All Running Change ARC – 341**

Ford Motor Company is hereby notifying the EPA of its intention to introduce into production a 2023MY running change covering the test groups listed below under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes."

This running change introduces the following Ford Mach-E calibration levels and changes:

Test Group	New Calibration
PFMXV00.0B3A	PCGWC2NA09
PFMXV00.0B3R	PCGWC1NB09
PFMXV00.0B4A	PCGWEJNC09
PFMXV00.0B4R	PCGWEHND09
PFMXV00.0G4A	PCGWEKNB09
	PCGWELNA09

Electric Vehicle Control Module Strategy Changes:

- New Strategy Name: HBVS2

Electric Vehicle Control Module Calibration Changes:

- Updated unused (not applicable to BEVs) FUEL parameters to conform with new Ford rule (APR).

Electric Vehicle Control Module OBD Changes:

- General Diagnostics: Turned off DTC P162F for all BEVs as starter motor hardware is not present (Starter Motor Disabled - Engine Crank Time Too Long).

Primary Drive Control Module Strategy Changes:

- New Strategy Name: PHGS0

Primary Drive Control Module Calibration Changes:

- Thermal
  - Commonized software with P702, bringing in unused calibrations for: Pro power on board, radiator cooling, cloud based cooling threat assessment, and power brake torque assist.
  - Commonized software with P702, bringing in transparent controls for: battery power request, battery coolant communication diagnostics, PTC heater diagnostics, torque de-rate tables based on drive modes, and HV battery chiller operation.

  - Renamed calibrations for high voltage component protection strategy, transparent with the previous calibration release.
  - Enabled battery heating strategy during extreme cold temperatures that will share the cabin heater capability with the battery, to prevent low battery discharge limits that cause drivability complaints. No effect to homologated range tests.
  - New strategy for heating the battery while driving to a DC fast charge station during extreme cold temperatures. Allows the customer to charge the battery faster due to improved charging ability of a warmer pack.
  - New, unused parameters to accommodate new battery thermal control being introduced on 23.5MY+ CX727. Not enabled for 21-23MY CX727.
- Drivability:
  - Shortened the timer to engage the electronic parking brake after drivers door is closed while in 1 pedal drive.
  - Allow regen on the front axle in Reverse to prevent torque split logic from clipping total torque, which results in rolling, rather than stopping, in 1PD. Only applies to base CX727 AWD and aligns cal with CX727 RWD, GT, and P702.
- Bi-Directional Power:
  - Commonized software with P702, test switch to emulate an active bi-directional power transfer, not applicable to CX727.
- HMI:
  - Activating new distance to empty (DTE) history reset function for improved customer experience.
  - Reduced the number of execution loops HMI message "Vehicle not in Park" is sent to conform with new Ford rule (APR).

Primary Drive Control Module OBD Changes:

- General Diagnostics:
  - Increased the fault timer for DTC P07E4_00 (unable to engage park) and P07E6_00 (stuck in park) to avoid false (positive) epark faults.
  - Increased the fault counter threshold for DTCs P073D (unable to engage neutral), P07E6 (stuck in park), and P07E4 (unable to engage park) to avoid false (positive) epark faults.
  - Updated park motor inputs to avoid false (positive) epark DTCs P073D (unable to engage neutral), P07E6 (stuck in park), and P07E4 (unable to engage park).

Secondary Drive Control Module Strategy Changes:

- New Strategy Names: MMHS0 / MHGS0

Secondary Drive Control Module Calibration Changes (Base and GT):

- Thermal:
  - Renamed calibrations for high voltage component protection strategy, transparent with the previous calibration release.
  - Commonized software with P702 SDCM, software includes new parameters for functionality in the PDCM that have no effect in the SDCM.
  - Added new parameters to de-rate motor torque based on drive mode, no change to calibration.

- Motor Generator Control Unit (MGCU):
  - Enabled the calibratable that ensures the TRID utilizes the measured generator resolver offset, and not from the resolver offset determination feature (feature that is disabled). No effect to customer, just a robustness action.

- Torque Monitor:
  - Updated level 1 torque fault thresholds to better coincide with level 2 fault thresholds and avoid any false detections.

Anti-Lock Braking System Software Changes:

- New Software Version: LK9C-2D053-CK
- The new feature Hold&Apply retains the brake pressure from the driver until the park pawl is engaged. Then the pressure is released. This brake pressure release is noticeable due to brakes foundation noise. This noise can be tuned to some extent. The new ABS software is decreasing the time of the brake pressure release, that means the brake pressure reliefs faster and the brake noise is less noticeable. As the parameters to do this change are hard coded, a new application software is required.

Anti-Lock Braking System Calibration Changes:

- Only up-suffix is changing due to the new application software. The parameters itself remain the same.

Because this change affects multiple test groups, the updated revision pages will be documented in each application and included in the Part 2 submissions, but not included with this letter.

In accordance with 40 CFR 86.1842-01 (b)(ii), Ford has determined that this change does not affect emissions, fuel economy, range, or OBD based on engineering evaluation.

Please contact Tom Beierschmitt (tbeiers1@ford.com / 313-407-7886) if you have any questions concerning this submittal.

Sincerely,

DocuSigned by:
Craig A. Smith
ACF3C468B1A24EF...

Wade Witte,
Supervisor – Car/LDT/MDPV Emissions Certification & Durability

Vehicle Homologation and Compliance
Sustainability, Environment and Safety Engineering
Ford Motor Company

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, MI 48101

October 13, 2022

Ms. Robin U. Lang, Chief
Emissions Compliance, Automotive Regulations and Science Division
Air Resources Board
4001 Iowa Ave.
Riverside, CA 92507

Dear Ms. Lang:

Subject: **2023MY Ford All Running Change ARC – 341**

Ford Motor Company is hereby notifying the ARB of its intention to introduce into production a 2023MY running change covering the test groups listed below under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes."

This running change introduces the following Ford Mach-E calibration levels and changes.

Test Group	New Calibration
PFMXV00.0B3A	PCGWC2NA09
PFMXV00.0B3R	PCGWC1NB09
PFMXV00.0B4A	PCGWEJNC09
PFMXV00.0B4R	PCGWEHND09
PFMXV00.0G4A	PCGWEKNB09
	PCGWELNA09

Electric Vehicle Control Module Strategy Changes:

- New Strategy Name: HBVS2

Electric Vehicle Control Module Calibration Changes:

- Updated unused (not applicable to BEVs) FUEL parameters to conform with new Ford rule (APR).

Electric Vehicle Control Module OBD Changes:

- General Diagnostics: Turned off DTC P162F for all BEVs as starter motor hardware is not present (Starter Motor Disabled - Engine Crank Time Too Long).

Primary Drive Control Module Strategy Changes:

- New Strategy Name: PHGS0

Primary Drive Control Module Calibration Changes:

- Thermal
  - Commonized software with P702, bringing in unused calibrations for: Pro power on board, radiator cooling, cloud based cooling threat assessment, and power brake torque assist.

    - Commonized software with P702, bringing in transparent controls for: battery power request, battery coolant communication diagnostics, PTC heater diagnostics, torque de-rate tables based on drive modes, and HV battery chiller operation.
    - Renamed calibrations for high voltage component protection strategy, transparent with the previous calibration release.
    - Enabled battery heating strategy during extreme cold temperatures that will share the cabin heater capability with the battery, to prevent low battery discharge limits that cause drivability complaints. No effect to homologated range tests.
    - New strategy for heating the battery while driving to a DC fast charge station during extreme cold temperatures. Allows the customer to charge the battery faster due to improved charging ability of a warmer pack.
    - New, unused parameters to accommodate new battery thermal control being introduced on 23.5MY+ CX727. Not enabled for 21-23MY CX727.
- Drivability:
    - Shortened the timer to engage the electronic parking brake after drivers door is closed while in 1 pedal drive.
    - Allow regen on the front axle in Reverse to prevent torque split logic from clipping total torque, which results in rolling, rather than stopping, in 1PD. Only applies to base CX727 AWD and aligns cal with CX727 RWD, GT, and P702.
- Bi-Directional Power:
    - Commonized software with P702, test switch to emulate an active bi-directional power transfer, not applicable to CX727.
- HMI:
    - Activating new distance to empty (DTE) history reset function for improved customer experience.
    - Reduced the number of execution loops HMI message "Vehicle not in Park" is sent to conform with new Ford rule (APR).

Primary Drive Control Module OBD Changes:

- General Diagnostics:
    - Increased the fault timer for DTC P07E4_00 (unable to engage park) and P07E6_00 (stuck in park) to avoid false (positive) epark faults.
    - Increased the fault counter threshold for DTCs P073D (unable to engage neutral), P07E6 (stuck in park), and P07E4 (unable to engage park) to avoid false (positive) epark faults.
    - Updated park motor inputs to avoid false (positive) epark DTCs P073D (unable to engage neutral), P07E6 (stuck in park), and P07E4 (unable to engage park).

Secondary Drive Control Module Strategy Changes:

- New Strategy Names: MMHS0 / MHGS0

Secondary Drive Control Module Calibration Changes (Base and GT):

- Thermal:
    - Renamed calibrations for high voltage component protection strategy, transparent with the previous calibration release.
    - Commonized software with P702 SDCM, software includes new parameters for functionality in the PDCM that have no effect in the SDCM.
    - Added new parameters to de-rate motor torque based on drive mode, no change to calibration.

- Motor Generator Control Unit (MGCU):
    - Enabled the calibratable that ensures the TRID utilizes the measured generator resolver offset, and not from the resolver offset determination feature (feature that is disabled). No effect to customer, just a robustness action.

- Torque Monitor:
    - Updated level 1 torque fault thresholds to better coincide with level 2 fault thresholds and avoid any false detections.

Anti-Lock Braking System Software Changes:

- New Software Version: LK9C-2D053-CK
- The new feature Hold&Apply retains the brake pressure from the driver until the park pawl is engaged. Then the pressure is released. This brake pressure release is noticeable due to brakes foundation noise. This noise can be tuned to some extent. The new ABS software is decreasing the time of the brake pressure release, that means the brake pressure reliefs faster and the brake noise is less noticeable. As the parameters to do this change are hard coded, a new application software is required.

Anti-Lock Braking System Calibration Changes:

- Only up-suffix is changing due to the new application software. The parameters itself remain the same.

Because this change affects multiple test groups, the updated revision pages will be documented in each application and included in the Part 2 submissions, but not included with this letter.

In accordance with 40 CFR 86.1842-01 (b)(ii), Ford has determined that this change does not affect emissions, fuel economy, range, or OBD based on engineering evaluation.

Please contact Tom Beierschmitt (tbeiers1@ford.com / 313-407-7886) if you have any questions concerning this submittal.

Sincerely,

DocuSigned by:
Craig A. Smith
ACF3C468B1A24EF...

Wade Witte,
Supervisor – Car/LDT/MDPV Emissions Certification & Durability

cc: Syed Mustafa, Steven Hada

Vehicle Homologation and Compliance
Sustainability, Environment and Safety Engineering
Ford Motor Company

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, MI 48101

November 22, 2022

Mr. Robert Peavyhouse
Certification Division
Mobile Source Pollution Control
U. S. Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, Michigan 48105

Dear Mr. Peavyhouse:

Subject: **2023MY Ford All Running Change ARC – 347**

Ford Motor Company is hereby notifying the EPA of its intention to introduce into production a 2023MY running change covering the test groups listed below under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes."

This running change introduces the following Ford Mach-E calibration levels and changes:

Test Group	New Calibration
PFMXV00.0B3A	PCGWC2NA10
PFMXV00.0B3R	PCGWC1NB10
PFMXV00.0B4A	PCGWEJNC10
PFMXV00.0B4R	PCGWEHND10
PFMXV00.0G4A	PCGWEKNB10
	PCGWELNA10

Electric Vehicle Control Module OBD Changes:

- General Diagnostics:
  - Turned off DTC P0850SW as hard wired park/neutral input circuit not present on any BEVs.
  - Calibration parameters updated to allow DTC P1934 (Vehicle Speed Signal fault) to trigger properly for the customer.

Primary Drive Control Module Strategy Changes:

- New Strategy Name: PHGS1

Primary Drive Control Module Calibration Changes:

- Thermal
  - New temperature protection parameters which provide better resolution for component protection.
  - Updates to current temperature component protection tables for increased robustness.
  - Decreased max A/C compressor speed at lower ambient temperatures for better NVH.
- Pro Power on Board
  - New unused Pro Power on Board parameter added to commonize with P702 software, not applicable to CX727.
- Motor Generator Control Unit (MGCU)
  - Initial motor speed threshold for machine movement increased to reduce errors in motor position signaling.
  - Improved noise on electric drive speed signal.
- HMI:
  - New, unused HMI parameters added to commonize with P702 software.

  - Enabled DTE efficiency reset during AC charging feature.
  - Power limits increased to illuminate the turtle light.
  - Base values added for new on demand reduced power turtle indicator and FordPass Notification function.
- Integrated Park Module (PMI):
  - Added robustness to prevent any false positive/faults when going to park, so cam angle does not end up in an unknown position if IPM hardware goes out of spec.

Primary Drive Control Module OBD Changes:

- General Diagnostics:
  - Updated switch setting from non-mil to stop safely now for P174E (Output Shaft Speed / ABS Wheel Speed Correlation) to better align with the failure mode associated with this DTC setting.
  - Updated P07E4 (Unable to Engage Park) fault timer specific to park per the PBW (park-by-wire) requirement of brake holds 3 sec timer [2.92 sec].
  - Decreased P07E6 (Stuck in Park) fault timer to 4 seconds.
  - Updated Delays to avoid false (positive) faults [seen in connected vehicle data] for P07E4 (Unable to Engage Park), P07E6 (Stuck in Park) and P073D (Unable to Engage Neutral).
- Torque Monitor:
  - Increased torque ramp in and out rate to reduce likelihood of falsely setting P061A-92 (Internal Control Module Torque Performance) L2 fault.

Secondary Drive Control Module Strategy Changes:

- New Strategy Names: MMHS1 (Base) / MHGS1 (GT)

Secondary Drive Control Module Calibration Changes (Base and GT):

- Thermal:
  - Updates to current temperature component protection tables for increased robustness.
- Motor Generator Control Unit (MGCU):
  - Initial motor speed threshold for machine movement increased to reduce errors in motor position signaling.
  - Improved noise on electric drive speed signal.
- Torque Monitor (Base only):
  - Motor coolant pump switch turned off since hardware is no longer present on 23+MY CX727 Base vehicles.

Secondary Drive Control Module OBD Changes (Base only):

- General Diagnostics:
  - Updated switch setting from non-mil to stop safely now for P174E (Output Shaft Speed / ABS Wheel Speed Correlation) to better align with the failure mode associated with this DTC setting.

Secondary Drive Control Module OBD Changes (GT only):

- General Diagnostics:
  - Added axle oil over-temp diagnostics (P0711, P0712, P0713 and P0714) to detect error states. DTC settings are common with primary drive axle.

Battery Charge Control Module Changes:

- Implemented linear interpolation for DC fast charge when derating is needed to avoid oscillations caused by the step changes between the upper and lower derate limits. DCR144
- High voltage overvoltage protection robustness action that will allow charging to stop after detecting U3000-49 (Control Module Internal Electronic Failure) three times. Issue 525
- Corrected the precondition for P0D57-00 (Proximity Detection Circuit “A” Range/ Performance No Sub Type Information) to the specification, which is “On Plug”. Issue 526
- Robustness action to no longer perform a re-lock action after a wakeup if BCCM has status of lock position as "retain". Issue 528

Battery Charge Control Module OBD Changes:

- Added AC pin temperature prediction equation and AC thermistor slope calculation as part of the TE charge port overheat strategy. DCR139
- P0CF7-00 was removed and replaced by P0CF7-66

Because this change affects multiple test groups, the updated revision pages will be documented in each application and included in the Part 2 submissions, but not included with this letter.

In accordance with 40 CFR 86.1842-01 (b)(ii), Ford has determined that this change does not affect emissions, fuel economy, range, or OBD based on engineering judgment.

Please contact Avi Friedman (afriedm4@ford.com / 313-590-3505) if you have any questions concerning this submittal.

Sincerely,

DocuSigned by:
Wade Witte
223D2C0DF78F423...

Wade Witte,
Supervisor – Car/LDT/MDPV Emissions Certification & Durability

Vehicle Homologation and Compliance
Sustainability, Environment and Safety Engineering
Ford Motor Company

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, MI 48101

November 22, 2022

Ms. Robin U. Lang, Chief
Emissions Compliance, Automotive Regulations and Science Division
Air Resources Board
4001 Iowa Ave.
Riverside, CA 92507

Dear Ms. Lang:

Subject: **2023MY Ford All Running Change ARC – 347**

Ford Motor Company is hereby notifying the ARB of its intention to introduce into production a 2023MY running change covering the test groups listed below under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes."

This running change introduces the following Ford Mach-E calibration levels and changes:

Test Group	New Calibration
PFMXV00.0B3A	PCGWC2NA10
PFMXV00.0B3R	PCGWC1NB10
PFMXV00.0B4A	PCGWEJNC10
PFMXV00.0B4R	PCGWEHND10
PFMXV00.0G4A	PCGWEKNB10
	PCGWELNA10

Electric Vehicle Control Module OBD Changes:

- General Diagnostics:
  - Turned off DTC P0850SW as hard wired park/neutral input circuit not present on any BEVs.
  - Calibration parameters updated to allow DTC P1934 (Vehicle Speed Signal fault) to trigger properly for the customer.

Primary Drive Control Module Strategy Changes:

- New Strategy Name: PHGS1

Primary Drive Control Module Calibration Changes:

- Thermal
  - New temperature protection parameters which provide better resolution for component protection.
  - Updates to current temperature component protection tables for increased robustness.
  - Decreased max A/C compressor speed at lower ambient temperatures for better NVH.
- Pro Power on Board
  - New unused Pro Power on Board parameter added to commonize with P702 software, not applicable to CX727.
- Motor Generator Control Unit (MGCU)
  - Initial motor speed threshold for machine movement increased to reduce errors in motor position signaling.
  - Improved noise on electric drive speed signal.
- HMI:

  - New, unused HMI parameters added to commonize with P702 software.
  - Enabled DTE efficiency reset during AC charging feature.
  - Power limits increased to illuminate the turtle light.
  - Base values added for new on demand reduced power turtle indicator and FordPass Notification function.
- Integrated Park Module (PMI):
  - Added robustness to prevent any false positive/faults when going to park, so cam angle does not end up in an unknown position if IPM hardware goes out of spec.

Primary Drive Control Module OBD Changes:

- General Diagnostics:
  - Updated switch setting from non-mil to stop safely now for P174E (Output Shaft Speed / ABS Wheel Speed Correlation) to better align with the failure mode associated with this DTC setting.
  - Updated P07E4 (Unable to Engage Park) fault timer specific to park per the PBW (park-by-wire) requirement of brake holds 3 sec timer [2.92 sec].
  - Decreased P07E6 (Stuck in Park) fault timer to 4 seconds.
  - Updated Delays to avoid false (positive) faults [seen in connected vehicle data] for P07E4 (Unable to Engage Park), P07E6 (Stuck in Park) and P073D (Unable to Engage Neutral).
- Torque Monitor:
  - Increased torque ramp in and out rate to reduce likelihood of falsely setting P061A-92 (Internal Control Module Torque Performance) L2 fault.

Secondary Drive Control Module Strategy Changes:

- New Strategy Names: MMHS1 (Base) / MHGS1 (GT)

Secondary Drive Control Module Calibration Changes (Base and GT):

- Thermal:
  - Updates to current temperature component protection tables for increased robustness.
- Motor Generator Control Unit (MGCU):
  - Initial motor speed threshold for machine movement increased to reduce errors in motor position signaling.
  - Improved noise on electric drive speed signal.
- Torque Monitor (Base only):
  - Motor coolant pump switch turned off since hardware is no longer present on 23+MY CX727 Base vehicles.

Secondary Drive Control Module OBD Changes (Base only):

- General Diagnostics:
  - Updated switch setting from non-mil to stop safely now for P174E (Output Shaft Speed / ABS Wheel Speed Correlation) to better align with the failure mode associated with this DTC setting.

Secondary Drive Control Module OBD Changes (GT only):

- General Diagnostics:
  - Added axle oil over-temp diagnostics (P0711, P0712, P0713 and P0714) to detect error states. DTC settings are common with primary drive axle.

Battery Charge Control Module Changes:

- Implemented linear interpolation for DC fast charge when derating is needed to avoid oscillations caused by the step changes between the upper and lower derate limits. DCR144
- High voltage overvoltage protection robustness action that will allow charging to stop after detecting U3000-49 (Control Module Internal Electronic Failure) three times. Issue 525
- Corrected the precondition for P0D57-00 (Proximity Detection Circuit “A” Range/ Performance No Sub Type Information) to the specification, which is “On Plug”. Issue 526
- Robustness action to no longer perform a re-lock action after a wakeup if BCCM has status of lock position as "retain". Issue 528

Battery Charge Control Module OBD Changes:

- Added AC pin temperature prediction equation and AC thermistor slope calculation as part of the TE charge port overheat strategy. DCR139
- P0CF7-00 was removed and replaced by P0CF7-66

Because this change affects multiple test groups, the updated revision pages will be documented in each application and included in the Part 2 submissions, but not included with this letter.

In accordance with 40 CFR 86.1842-01 (b)(ii), Ford has determined that this change does not affect emissions, fuel economy, range, or OBD based on engineering judgment.

Please contact Avi Friedman (afriedm4@ford.com / 313-590-3505) if you have any questions concerning this submittal.

Sincerely,

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Wade Witte
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Wade Witte,
Supervisor – Car/LDT/MDPV Emissions Certification & Durability

cc: S. Mustafa, S. Hada

Vehicle Homologation and Compliance
Sustainability, Environment and Safety Engineering
Ford Motor Company

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, MI 48101

April 13, 2023

Ms. Robin U. Lang, Chief
Emissions Compliance, Automotive Regulations and Science Division
Air Resources Board
4001 Iowa Ave.
Riverside, CA 92507

Dear Ms. Lang:

Subject: **2023MY Ford All Running Change ARC – 361**

Ford Motor Company is hereby notifying the ARB of its intention to introduce into production a 2023MY running change covering the test groups listed below under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes."

This running change introduces the following Ford Mach-E calibration levels and changes:

Test Group	New Calibration
PFMXV00.0B3A	PCGWC2NA11
PFMXV00.0B3R	PCGWC1NB11
PFMXV00.0B4A	PCGWEJNC11
PFMXV00.0B4R	PCGWEHND11
PFMXV00.0G4A	PCGWEKNB11
	PCGWELNA11

This running change also introduces the following Ford Mach-E High Voltage (HV) Battery Assembly part numbers:

Test Group	Part Name	New Part Numbers
PFMXV00.0B3A	HV Battery Assembly	PJ98-10B579-DC PJ98-10B579-XC
PFMXV00.0B3R	HV Battery Assembly	PJ98-10B579-CC PJ98-10B579-VC
PFMXV00.0B4A	HV Battery Assembly	PJ98-10B579-AC PJ98-10B579-TC
PFMXV00.0B4R	HV Battery Assembly	PJ98-10B579-BC PJ98-10B579-UC
PFMXV00.0G4A	HV Battery Assembly	PJ98-10B579-AC

Electric Vehicle Control Module Strategy Changes:

- New Strategy – HBVS4
  - Update to DCDC logic to ensure the EVCM will not enable DCDC while high voltage contactors are closing.

Electric Vehicle Control Module Calibration Changes:

- Driver Assist
  - Updated remote park assist calibrations to allow max vehicle attribute performance.

Electric Vehicle Control Module OBD Changes:

- General Diagnostics
  - Updated DTC P068A (ECM/PCM Power Relay De-Energized - Too Early) switch setting to illuminate a wrench to conform with Ford rule (APR).
  - Disabled DTC P1001 (Key On Engine Running Not Able to Complete, KOER Aborted). Not applicable to BEVs, engine applications only.
  - Disabled DTC P1595 (Forced Engine Shutdown - Remote Start System Fault, Transmission Range Not In Park Position). Cannot set on BEV EVCM. Secure Idle+remote start diags covered by PDCM.
  - Disabled DTC P1596 (Forced Engine Shutdown - Secure Idle System Fault, Transmission Range Not In Park Position). Cannot set on BEV EVCM. Secure Idle+remote start diags covered by PDCM.
  - Disabled DTC P2227 (Barometric Pressure Sensor "A" Circuit Range/Performance). DTC will not pass due to missing sensor references on BEVs.
  - Updated DTC P2228 (Barometric Pressure Sensor "A" Circuit Low) from non-mil to mil. Associated FMEM to set the Ambient Air temp CAN signal to report as faulty will only occur if the P2228 represents a "MIL" type.
  - Updated DTC P2229 (Barometric Pressure Sensor "A" Circuit High) from non-mil to mil. Associated FMEM to set the Ambient Air temp CAN signal to report as faulty will only occur if the P2229 represents a "MIL" type.
  - Updated read only memory bitmaps for crank inhibit during OTA (over-the-air) update events.

Primary Drive Control Module Strategy Changes:

- New Strategy – PHGS3
  - Updates to distance to empty efficiency reset during AC charging.
  - Updates to connected vehicle data monitoring.
  - Adding the PDCM as a receiver of the 12V battery state of charge signal in the CAN database.

Primary Drive Control Module Calibration Changes:

- Thermal
  - Updated calibration for increased component temperature protection.
  - Updated calibration for battery conditioning in cold climate.
  - Calibration ICA to improve chiller monitor robustness.
  - Calibration update to fix chiller inhibit toggling during extreme high pressure AC situations.
- HMI
  - Lowered thresholds to align amber turtle threshold to set if max torque is below minimum capability acceptance criteria to reduce occurrence of turtle lights setting when sufficient torque is available.
  - Updated the time HPCM stays awake to ensure customer HMI setting changes are written.
  - Increased power limits to display both yellow and red turtle lights.
  - Distance-to-empty calibration updates for temperature dependency reset function.
  - Changed default low SOC warning to 30 miles.
  - Cal update that introduces a preemptive warning signal to notify the customer via Ford Pass App that they are approaching a limited operational state.
- MGCU
  - Max number of pulses during high voltage interlock updated to meet Ford internal rule (APR).
  - Motor power up discharge time reduced to meet Ford internal rule (APR).
- Drivability
  - Rollback mitigation cal is more robust to noise due to rock-back and is now common with V363 and P702. Avoids torque bumps and oscillations during rock-back after a brake stab or hard stop at low speed.
- LV Battery System
  - New battery current threshold parameters for high voltage to low voltage transfer.

Primary Drive Control Module OBD Changes:

- General Diagnostics:
  - Cal update to ensure customer state of charge target is not lost during OTA updates.

  - Updated 12V diagnostic voltage and timer thresholds for more robust fault detection.
  - Stuck in Park DTC timer adjusted for more robust fault detection.
  - Turning on DTC P2C94 (Hybrid/EV Battery Contactor Control Supply Circuit Low) for detecting open circuit/short to ground faults for 12V power to the contactor power relay in the power distribution box.

Secondary Drive Control Module Strategy Changes:

- New Strategy – MHGS2
  - Adding current sensor, capacitor and ISC side Busbar thermal model-based temperature estimates. (GT Only)

Secondary Drive Control Module Calibration Changes:

- Thermal:
  - Updated calibration for increased component temperature protection.
  - Turned off front motor electronics coolant pump calibrations. Hardware is no longer present on 23.5MY CX727 variants (Base AWD Only).
- MGCU (GT Only):
  - Motor power up discharge time reduced to meet Ford internal rule (APR).

Secondary Drive Control Module OBD Changes:

- General Diagnostics:
  - Cal update to ensure customer state of charge target is not lost during OTA updates.
  - Updated 12V diagnostic voltage and timer thresholds for more robust fault detection.

Battery Energy Control Module Changes:

- SSFT-27610, 28123: Software compensation and cell calibrations for the low range current sensor chip shortage. BECM will no longer set the low range current faulted DTC if the low range current sensor is not present. BECM will still use backup strategy for faulted low range current sensor of defaulting to using the high range current sensor alone.
- SSFT-27881, 27882, 27883, 27903: Without the low range current sensor, the BECM will update its charging strategy to avoid cases where endless charging could occur.
- BECMSW-20399: Update plug-in charge current stepdown logic (top of charge current requests) for robust charge current stepdown
- BECMSW-20428: Remove unnecessary wait time for SOC adjustment at top of charge for AC charging
- SSFT-28400: Update strategy in BECM to use SOC instantaneous estimate to adjust SOC during AC charging when low range current sensor measurement is not available AND high range current sensor measurement is available
- SSFT-28360: HV Battery Display SOC Strategy Update to prevent display SOC drop when battery is charging and likewise, display SOC increase when battery is discharging, when difference between customer SOC and display SOC is small
- SSFT-28123: Increase charge complete target voltage to ensure robust distribution of charge ending voltage to accommodate low range current sensor depopulation. Unrestricted power limit SOC limit, charge resume, and charge full thresholds updated accordingly
- BECMSW-18353: Correct issue where BECM would not close contactors during DCFC due to EVSE voltage rate of change exceeding thresholds. BECM charging criteria updated to confirm voltage delta within acceptable limits even if rate of change is higher than expected.
- SSFT-25856, 19224: Robustness action for Cell voltage Deviation fault (DTC P0B24) to tighten thresholds for new batteries while widening thresholds for older batteries. This change allows for better diagnosing of when true cell voltage deviation faults occur.
- BECMSW-20222, 27751: Update cell calibration power limits at 0% SOC to be common with other BEV programs. Change will allow additional energy to pulled out of the HV battery when SOC reaches 0%.
- SSFT-27443: Cell calibrations for increased charge current during DCFC above 25 deg C and mid SOC range
- BECMSW-20506: Contactor Damage DTCs will latch until counter for contactor damage events is reset or lowered below 5 counts and power limits are lowered when DTCs are active. This prevents cases where contactors can still weld even if DTCs are present and prevents DTCs from clearing unintentionally from OTA events

- BECMSW-18001: Add additional entry condition to DCFC contactor stuck open fault that main pos and main neg need to be closed. This prevents a case of false positive DTC P2BC6 setting
- BECMSW-17419, 16732: Implementation of cloud-based development DIDs in BECM to support cloud-based controls development. No functional impact.
- BECMSW-17380: Update isolation detection equation to be common with other EV programs. Updated equation is more accurate, and lowers threshold of mild isolation fault from 400 kOhms to 300 kOhms
- BECMSW-20143: Update isolation fault action to latch fault until DTC is cleared, rather than checking for the fault on the next power cycle. This change avoids case where a vehicle with a fault can achieve functionality unintentionally.
- BECMSW-20029, 19984: Clarified recovery strategy for leakage detection circuit check fault to state that the fault shall not be cleared until the vehicle is serviced
- BECMSW-13817: Mild isolation leakage fault now triggers service light (previously warning light). No change to severe isolation leakage fault actions
- BECMSW-13839: Move overcurrent fault detection strategy from BCCM to BECM, and update detection strategy, to fix certain EVSE current inaccuracy issues
- BECMSW-17907: Reduced malfunction confirmation timer for U3003 and U3012 from 100ms to 10ms if no malfunction conditions are present during contactor closing sequence. Reduced overall length of contactor closure sequence
- BECMSW-18018, 17632: BECM will make CAN messaging between single bus and dual bus architectures common to avoid incompatibility issues.
- SSFT-27204: BECM will transmit cell voltage and thermistor CAN signals at a faster rate, i.e., updated transmission rate from 1000ms to 100ms
- BECMSW-19373: Implementation of backup strategy to track lifetime discharge Amp-hour throughput in case BECM memory is corrupted.
- SSFT-26182: BECM will remove instantaneous low contactor power criteria and keep the confirmed low contactor power criteria (6ms) to set U3012-00 DTC
- BECMSW-13843: BECM will support automation of charge and hold process. Current charge and hold process charge the vehicle to top of charge, capture cell voltages, unplug charger and disconnect 12v, wait 5 days, then re-connect 12V battery and capture cell voltages to detect an outlier cell voltage with higher self-discharge rate. Process was originally manual and is only performed at VO.
- BECMSW-15230, 19989, 18927, 18816, 18557: Automation or build tool updates that do not affect BECM SW functionality
- BECMSW-14059, 18435: Updates to China Data Monitoring (CDM) to be common with other BECM software branches. CDM is not active on this program, so no functional impact

Hardware Changes:

- HV battery pack (-10B759-) part number suffix change due to BECM part number change. No physical change to the high voltage pack.

Because this change affects multiple test groups, the updated revision pages will be documented in each application and included in the Part 2 submissions, but not included with this letter.

In accordance with 40 CFR 86.1842-01 (b)(ii), Ford has determined that this change does not affect emissions, fuel economy, range, or OBD based on engineering judgment.

Please contact Tom Beierschmitt (tbeiers1@ford.com / 313-407-7886) if you have any questions concerning this submittal.

Sincerely,

DocuSigned by:
Wade Witte
223D2C0DF78F423...

Wade Witte,
Supervisor – Car/LDT/MDPV Emissions Certification & Durability

cc: S. Mustafa, M. Desai

Vehicle Homologation and Compliance
Sustainability, Environment and Safety Engineering
Ford Motor Company

Allen Park Test Laboratory
1500 Enterprise Drive, Suite 3W-200
Allen Park, MI 48101

April 13, 2023

Mr. Robert Peavyhouse
Certification Division
Mobile Source Pollution Control
U. S. Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, Michigan 48105

Dear Mr. Peavyhouse:

Subject: **2023MY Ford All Running Change ARC – 361**

Ford Motor Company is hereby notifying the EPA of its intention to introduce into production a 2023MY running change covering the test groups listed below under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes."

This running change introduces the following Ford Mach-E calibration levels and changes:

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This running change also introduces the following Ford Mach-E High Voltage (HV) Battery Assembly part numbers:

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PFMXV00.0B4R	HV Battery Assembly	PJ98-10B579-BC PJ98-10B579-UC
PFMXV00.0G4A	HV Battery Assembly	PJ98-10B579-AC

Electric Vehicle Control Module Strategy Changes:

- New Strategy – HBVS4
  - Update to DCDC logic to ensure the EVCM will not enable DCDC while high voltage contactors are closing.

Electric Vehicle Control Module Calibration Changes:

- Driver Assist
  - Updated remote park assist calibrations to allow max vehicle attribute performance.

Electric Vehicle Control Module OBD Changes:

- General Diagnostics
  - Updated DTC P068A (ECM/PCM Power Relay De-Energized - Too Early) switch setting to illuminate a wrench to conform with Ford rule (APR).
  - Disabled DTC P1001 (Key On Engine Running Not Able to Complete, KOER Aborted). Not applicable to BEVs, engine applications only.
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  - Updated DTC P2228 (Barometric Pressure Sensor "A" Circuit Low) from non-mil to mil. Associated FMEM to set the Ambient Air temp CAN signal to report as faulty will only occur if the P2228 represents a "MIL" type.
  - Updated DTC P2229 (Barometric Pressure Sensor "A" Circuit High) from non-mil to mil. Associated FMEM to set the Ambient Air temp CAN signal to report as faulty will only occur if the P2229 represents a "MIL" type.
  - Updated read only memory bitmaps for crank inhibit during OTA (over-the-air) update events.

Primary Drive Control Module Strategy Changes:

- New Strategy – PHGS3
  - Updates to distance to empty efficiency reset during AC charging.
  - Updates to connected vehicle data monitoring.
  - Adding the PDCM as a receiver of the 12V battery state of charge signal in the CAN database.

Primary Drive Control Module Calibration Changes:

- Thermal
  - Updated calibration for increased component temperature protection.
  - Updated calibration for battery conditioning in cold climate.
  - Calibration ICA to improve chiller monitor robustness.
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  - Max number of pulses during high voltage interlock updated to meet Ford internal rule (APR).
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  - Rollback mitigation cal is more robust to noise due to rock-back and is now common with V363 and P702. Avoids torque bumps and oscillations during rock-back after a brake stab or hard stop at low speed.
- LV Battery System
  - New battery current threshold parameters for high voltage to low voltage transfer.

Primary Drive Control Module OBD Changes:

- General Diagnostics:
  - Cal update to ensure customer state of charge target is not lost during OTA updates.

  - Updated 12V diagnostic voltage and timer thresholds for more robust fault detection.
  - Stuck in Park DTC timer adjusted for more robust fault detection.
  - Turning on DTC P2C94 (Hybrid/EV Battery Contactor Control Supply Circuit Low) for detecting open circuit/short to ground faults for 12V power to the contactor power relay in the power distribution box.

Secondary Drive Control Module Strategy Changes:

- New Strategy – MHGS2
  - Adding current sensor, capacitor and ISC side Busbar thermal model-based temperature estimates. (GT Only)

Secondary Drive Control Module Calibration Changes:

- Thermal:
  - Updated calibration for increased component temperature protection.
  - Turned off front motor electronics coolant pump calibrations. Hardware is no longer present on 23.5MY CX727 variants (Base AWD Only).
- MGCU (GT Only):
  - Motor power up discharge time reduced to meet Ford internal rule (APR).

Secondary Drive Control Module OBD Changes:

- General Diagnostics:
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Battery Energy Control Module Changes:

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- SSFT-25856, 19224: Robustness action for Cell voltage Deviation fault (DTC P0B24) to tighten thresholds for new batteries while widening thresholds for older batteries. This change allows for better diagnosing of when true cell voltage deviation faults occur.
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- BECMSW-18001: Add additional entry condition to DCFC contactor stuck open fault that main pos and main neg need to be closed. This prevents a case of false positive DTC P2BC6 setting
- BECMSW-17419, 16732: Implementation of cloud-based development DIDs in BECM to support cloud-based controls development. No functional impact.
- BECMSW-17380: Update isolation detection equation to be common with other EV programs. Updated equation is more accurate, and lowers threshold of mild isolation fault from 400 kOhms to 300 kOhms
- BECMSW-20143: Update isolation fault action to latch fault until DTC is cleared, rather than checking for the fault on the next power cycle. This change avoids case where a vehicle with a fault can achieve functionality unintentionally.
- BECMSW-20029, 19984: Clarified recovery strategy for leakage detection circuit check fault to state that the fault shall not be cleared until the vehicle is serviced
- BECMSW-13817: Mild isolation leakage fault now triggers service light (previously warning light). No change to severe isolation leakage fault actions
- BECMSW-13839: Move overcurrent fault detection strategy from BCCM to BECM, and update detection strategy, to fix certain EVSE current inaccuracy issues
- BECMSW-17907: Reduced malfunction confirmation timer for U3003 and U3012 from 100ms to 10ms if no malfunction conditions are present during contactor closing sequence. Reduced overall length of contactor closure sequence
- BECMSW-18018, 17632: BECM will make CAN messaging between single bus and dual bus architectures common to avoid incompatibility issues.
- SSFT-27204: BECM will transmit cell voltage and thermistor CAN signals at a faster rate, i.e., updated transmission rate from 1000ms to 100ms
- BECMSW-19373: Implementation of backup strategy to track lifetime discharge Amp-hour throughput in case BECM memory is corrupted.
- SSFT-26182: BECM will remove instantaneous low contactor power criteria and keep the confirmed low contactor power criteria (6ms) to set U3012-00 DTC
- BECMSW-13843: BECM will support automation of charge and hold process. Current charge and hold process charge the vehicle to top of charge, capture cell voltages, unplug charger and disconnect 12v, wait 5 days, then re-connect 12V battery and capture cell voltages to detect an outlier cell voltage with higher self-discharge rate. Process was originally manual and is only performed at VO.
- BECMSW-15230, 19989, 18927, 18816, 18557: Automation or build tool updates that do not affect BECM SW functionality
- BECMSW-14059, 18435: Updates to China Data Monitoring (CDM) to be common with other BECM software branches. CDM is not active on this program, so no functional impact

Hardware Changes:

- HV battery pack (-10B759-) part number suffix change due to BECM part number change. No physical change to the high voltage pack.

Because this change affects multiple test groups, the updated revision pages will be documented in each application and included in the Part 2 submissions, but not included with this letter.

In accordance with 40 CFR 86.1842-01 (b)(ii), Ford has determined that this change does not affect emissions, fuel economy, range, or OBD based on engineering judgment.

Please contact Tom Beierschmitt (tbeiers1@ford.com / 313-407-7886) if you have any questions concerning this submittal.

Sincerely,

DocuSigned by:
Wade Witte
223D2C0DF78F423...

Wade Witte,
Supervisor – Car/LDT/MDPV Emissions Certification & Durability

Vehicle Homologation & Compliance
Ford Motor Company

1500 Enterprise Drive
Allen Park, Michigan 48101

June 1, 2023

Mr. Robert Peavyhouse
Certification Division
Office of Mobile Source Air Pollution Control
Environmental Protection Agency
2000 Traverwood
Ann Arbor, Michigan 48105

Dear Mr. Peavyhouse:

Under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes," Ford Motor Company is hereby notifying the EPA of our intention to introduce into production 2023 Model Year Running Change B3A-001 for the PFMXV00.0B3A test group.

As was previously approved by the EPA (e-mail from Robert Peavyhouse 2/9/2023) and CARB (approval in eFiles 2/7/2023), this running change introduces a HV battery part & alternative part with new battery chemistry (lithium-ion phosphate) into production, as well as corresponding calibration revisions to the new parts.

New Vehicle Line	New Part No.	Calibration No.
Mustang Mach-E AWD LFP	PZ98-10B759-BC	PCGWENNE05 (Cert Code PCGWENNE0002)
Mustang Mach-E AWD LFP	PZ98-10B759-BD (Alt)	PCGWENNE06 (Cert Code PCGWENNE0003)

This running change does not adversely affect range, MPGe, electrical energy consumption, or charge time. Certification testing was conducted and waived by the EPA.

EPA Test Numbers:
City - PFMX10079928
Highway - PFMX10079929

As allowed under 86.1842-01 (b)(ii), Ford has determined that the above addition or change does not cause noncompliance based on engineering evaluation of the addition or change.

Please contact Avi Friedman (313-590-3505 / afriedm4@ford.com) if you have any questions concerning this submission.

Sincerely,

DocuSigned by:
Wade Witte
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Wade Witte
Supervisor
Car, LD & MDPV Emissions Certification & Durability

Vehicle Homologation & Compliance
Ford Motor Company

1500 Enterprise Drive
Allen Park, Michigan 48101

June 1, 2023

Ms. Robin U. Lang, Chief
Emissions Compliance, Automotive Regulations and Science Division
Air Resources Board
4001 Iowa Ave.
Riverside, CA 92507

Dear Ms. Lang:

Under the provisions of 40 CFR 86.1842-01, "Alternative Procedure for Notification of Additions and Changes," Ford Motor Company is hereby notifying CARB of our intention to introduce into production 2023 Model Year Running Change B3A-004 for the PFMXV00.0B3A test group.

As was previously approved by the EPA (e-mail from Robert Peavyhouse 2/9/2023) and CARB (approval in eFiles 2/7/2023), this running change introduces a HV battery part & alternative part with new battery chemistry (lithium-ion phosphate) into production, as well as corresponding calibration revisions to the new parts.

New Vehicle Line	New Part No.	Calibration No.
Mustang Mach-E AWD LFP	PZ98-10B759-BC	PCGWENNE05 (Cert Code PCGWENNE0002)
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This running change does not adversely affect range, MPGe, electrical energy consumption, or charge time. Certification testing was conducted and waived by the EPA.

EPA Test Numbers:
City - PFMX10079928
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As allowed under 86.1842-01 (b)(ii), Ford has determined that the above addition or change does not cause noncompliance based on engineering evaluation of the addition or change.

Please contact Avi Friedman (313-590-3505 / afriedm4@ford.com) if you have any questions concerning this submission.

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Supervisor
Car, LD & MDPV Emissions Certification & Durability

cc: S. Mustafa, M. Desai