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Signature:	<i>[Signature]</i>
Date:	05/09/2023

EMISSIONS TEST SUMMARY REPORT

Lab Manager: Dan Ogden

Prepared by: Ian Enderby

02/08/2023

The SEMA Emissions Compliance Center is a Certification Ready Automotive Emissions Testing Laboratory located in Diamond Bar, California at 1577 Valley Vista Drive. The lab is equipped with a 48" AVL-Zollner 2 wheel-drive chassis dynamometer, AVL i60 CVS System, AVL i60 AMA emissions analyzer bench with HC, NO_x, CO, CO₂ and CH₄ analyzers, Dilution Tunnel with AVL SPC 478 Particulate Matter (PM) Sampler, an AVL 4-station Canister Loading Bench, and an AVL 300 Liter per Hour Plutron Fuel Flow Meter.

Client: Derive Systems

Contact: Chris Maglio (chris.maglio@derivesystems.com)

Product Under Test: VQ Efficiency for Ford

Part #: 3030EO

Test Vehicle: 2021 Ford F-250

VIN: 1FT7W2BN7MEC46196

Engine: 7.3L NA

Test Group: MFMXD07.363H

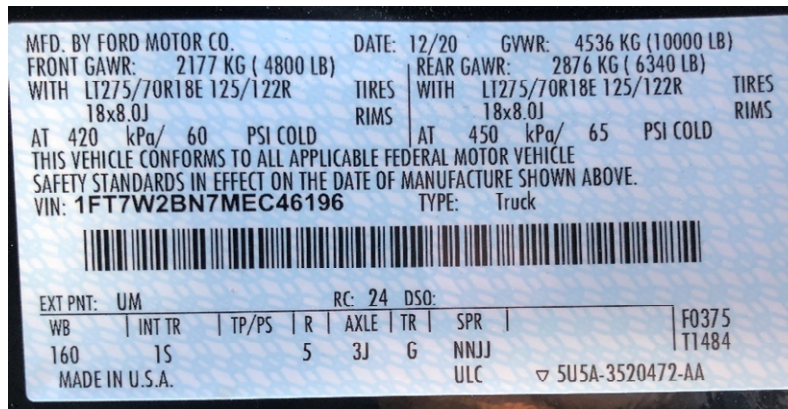
Evaporative Family: MFMXR0250NHJ

CA Emissions Category: LEV3 ULEV200

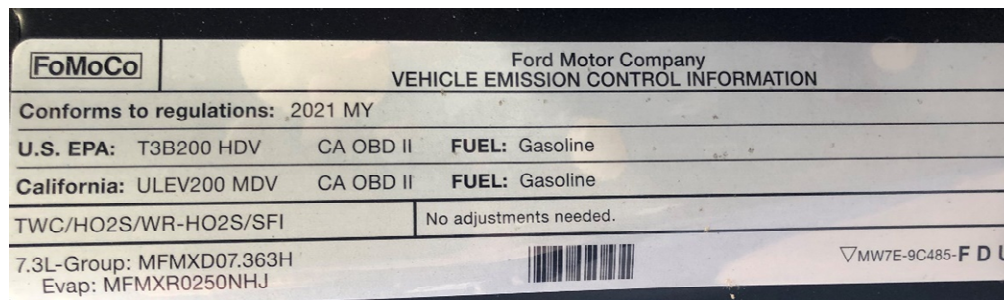
EPA Emissions Category: T3B200 HDV



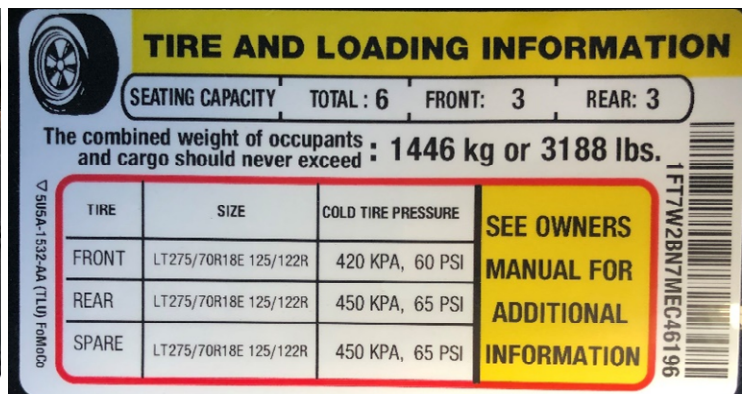
Test Vehicle



VIN Tag



VECI Label



Tire Info

Test Fuel: Single Batch of 91 Octane E10 Pump Fuel

Tire Size: LT275/70R18E

Vehicle Test Weight*: 7200 lbs.

Dyno Set Coefficients: A=36.428, B=0.53141, C=0.047043

Dyno Target Coefficients: A=60.670, B=1.01780, C=0.044460

*ETW lowered from 8500 lbs. to 7200 lbs. to allow vehicle to perform custom drive traces without driver errors

Notes:

- The test vehicle remained in the custody of the SEMA Emissions Lab staff throughout the testing process.
- Testing parameters taken from EPA CSI document
- All emissions testing was conducted with an AVL road speed fan.
- All tests included modal and bag emissions data, fuel flow measurements via Plutron Flow Meter and OBD datalogging via Data Monster scan tool.

Product Settings:

1. **Tune Selection:** 7.3L Super Duty
2. **Engine Economy:** Maximum
3. **Idle Reduction:** Maximum
4. **Reverse Speed Limit:** Disabled
5. **Speed Limit:** 65 MPH



ATTACHMENTS

- Vehicle Check In Form
- Road Load Determination Printouts
- SilverScan OBD Report, Project Start
- Custom Baseline Drive Cycle Emissions Test Report (Test ID: Cust_HWFET_BASELINE_20221214_03_TC1)
- OBD Log (Log105_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20221214_03)
- Custom Baseline Drive Cycle Emissions Test Report (Test ID: Cust_HWFET_BASELINE_20221215_01_TC1)
- OBD Log (Log107_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20221215_01)
- Custom Baseline Drive Cycle Emissions Test Report (Test ID: Cust_HWFET_BASELINE_20221215_04_TC1)
- OBD Log (Log113_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20221215_04)
- Long Idle Emissions Test Report (Test ID: HWFET_LA92H_20230116_01_TC1)
- OBD Log (Log132_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230116_01)
- Long Idle Emissions Test Report (Test ID: HWFET_LA92H_20230116_02_TC1)
- OBD Log (Log133_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230116_02)
- Long Idle Emissions Test Report (Test ID: HWFET_LA92H_20230116_03_TC1)
- OBD Log (Log134_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230116_03)
- SilverScan OBD Report, Post Baseline Testing
- SilverScan OBD Report, Clear
- Mileage Accumulation Log
- SilverScan OBD Report, Post Mileage Accumulation
- Custom Released Drive Cycle Emissions Test Report (Test ID: Cust_HWFET_RELEASED_20230206_02_TC1)
- OBD Log (Log142_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230206_02)
- Long Idle Emissions Test Report (Test ID: HWFET_LA92H_20230206_03_TC1)
- OBD Log (Log144_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230206_03)
- Custom Released Drive Cycle Emissions Test Report (Test ID: Cust_HWFET_RELEASED_20230207_06_TC1)
- OBD Log (Log149_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230207_06)
- Long Idle Emissions Test Report (Test ID: HWFET_LA92H_20230207_07_TC1)
- OBD Log (Log150_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230207_07)
- Custom Released Drive Cycle Emissions Test Report (Test ID: Cust_HWFET_RELEASED_20230208_06_TC1)
- OBD Log (Log153_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230208_06)
- Long Idle Emissions Test Report (Test ID: HWFET_LA92H_20230208_08_TC1)
- OBD Log (Log154_(2021_1FT7W2BN7MEC46196_FORD STANDARD_Rate)10 Hz_1.23.0))
- Plutron Fuel Flow Data (PLUTRON_20230208_08)
- SilverScan OBD Report, Post Modified Testing

PROCEDURE SEQUENCE (Baseline)

- 04/15/22: Vehicle Check In
- 05/02/22: Road Load Determination
- 11/17/22: OBD Read and Report, Project Start
- 12/13/22: Drain and Fill with Test Fuel
- 12/13/22: 6-36 hour soak
- 12/14/22: Custom Baseline Drive Cycle Test (Test ID: Cust_HWFET_BASELINE_20221214_03_TC1)
- 12/15/22: Custom Baseline Drive Cycle Test (Test ID: Cust_HWFET_BASELINE_20221215_01_TC1)
- 12/15/22: Custom Baseline Drive Cycle Test (Test ID: Cust_HWFET_BASELINE_20221215_04_TC1)
- 01/16/23: Long Idle Test (Test ID: HWFET_LA92H_20230116_01_TC1)
- 01/16/23: Long Idle Test (Test ID: HWFET_LA92H_20230116_02_TC1)
- 01/16/23: Long Idle Test (Test ID: HWFET_LA92H_20230116_03_TC1)
- 01/16/23: OBD Read and Report, Post Baseline Testing

PROCEDURE SEQUENCE (Modified)

- 02/02/23: Product Installed (Released Calibration)
- 02/02/23: OBD Read and Report, Clear
- 02/02/23: Mileage Accumulation
- 02/02/23: OBD Read and Report, Post Mileage Accumulation
- 02/05/23: 6-36 hour soak
- 02/06/23: Custom Released Drive Cycle Test (Test ID: Cust_HWFET_RELEASED_20230206_02_TC1)
- 02/06/23: Long Idle Test (Test ID: HWFET_LA92H_20230206_03_TC1)
- 02/07/23: Custom Released Drive Cycle Test (Test ID: Cust_HWFET_RELEASED_20230207_06_TC1)
- 02/07/23: Long Idle Test (Test ID: HWFET_LA92H_20230207_07_TC1)
- 02/08/23: Custom Released Drive Cycle Test (Test ID: Cust_HWFET_RELEASED_20230208_06_TC1)
- 02/08/23: Long Idle Test (Test ID: HWFET_LA92H_20230208_08_TC1)
- 02/08/23: OBD Read and Report, Post Modified Testing

EMISSIONS AND FUEL FLOW RESULTS FOR CUSTOM DRIVE TRACES

<u>Config.</u>	<u>Dist (mi)</u>	<u>Plutron Volume (gal)</u>	<u>Plutron Fuel Economy (mpg)</u>	<u>OBD Calc Volume (gal)*</u>	<u>OBD Fuel Economy (mpg)</u>	<u>NMHC (g)</u>	<u>NOx (g)</u>	<u>CO (g)</u>	<u>CO2 (g)</u>	<u>PM (g)</u>	<u>CO2 Fuel Economy (mpg)</u>
Baseline	29.64	2.901	10.22	2.797	10.60	0.5080	0.783	524.8	21982.2	0.0582	11.20
Baseline	29.68	2.910	10.20	2.835	10.47	0.5520	0.971	562.9	22140.4	0.0561	11.11
Baseline	29.62	2.881	10.28	2.797	10.59	0.5302	1.177	448.6	21866.7	0.0532	11.31
AVG:		2.897	10.23	2.810	10.55	0.5301	0.977	512.1	21996.4	0.0558	11.21
Modified	29.68	2.482	11.96	2.447	12.13	0.5602	1.328	132.7	19601.8	0.0552	12.98
Modified	29.73	2.473	12.02	2.428	12.24	0.2839	0.957	282.1	19687.9	0.0512	12.79
Modified	29.68	2.507	11.84	2.450	12.11	0.2402	1.360	195.8	19628.5	0.0475	12.89
AVG:		2.487	11.94	2.442	12.16	0.3614	1.215	203.5	19639.4	0.0513	12.89
Delta:		0.410	1.71	0.368	1.61	-0.1686	0.238	-308.5	-2357.0	-0.0045	1.68
		-14%	17%	-13%	15%	-32%	24%	-60%	-11%	-8%	15%

* Calculated from Mass Air Flow divided by Air Fuel Ratio, using fuel density data from Plutron

EMISSIONS AND FUEL FLOW RESULTS FOR IDLE TRACES

<u>Condition</u>	<u>Avg Idle Speed (rpm)</u>	<u>Plutron Avg Mass Flow (kg/h)</u>	<u>Plutron Avg Vol Flow (l/h)</u>	<u>NMHC (g)</u>	<u>NOx (g)</u>	<u>CO (g)</u>	<u>CO2 (g)</u>	<u>PM (g)</u>
Baseline	600	1.643	2.340	0.0487	0.002	3.203	2022.4	0.0005
Baseline	599	1.671	2.410	0.0415	0.002	3.145	2044.2	0.0011
Baseline	600	1.676	2.431	0.0485	0.000	3.307	2028.9	0.0017
AVG:		1.663	2.394	0.0462	0.001	3.218	2031.8	0.0011
Released	550	1.515	2.180	0.0049	0.000	5.274	1849.8	0.0011
Released	549	1.501	2.157	0.0129	0.000	4.933	1852.4	0.0002
Released	549	1.516	2.182	0.0445	0.001	5.226	1834.3	0.0003
AVG:		1.511	2.173	0.0208	0.000	5.144	1845.5	0.0005
Delta:		0.153	0.221	-0.0255	-0.001	1.926	-186.3	-0.0006
%:		9%	9%	-53%	na	58%	-9%	-33%

OBD SUMMARY

Date	Mileage	Report Type	Misfire	Fuel System	Component	Catalyst	Evaporative	O2 Sensor	O2 Sens. Heater	EGR/VVT	MIL Status	OBD Codes	CAL ID	CVN
11/17/2022	5954	Project Start	C	C	C	C	C	C	C	C	OFF	None	MC3A-14C204-BAC	C4 C9 49 CB
1/16/2023	6691	Post-Test (Baseline)	C	C	C	C	C	C	C	C	OFF	None	MC3A-14C204-BAC	C4 C9 49 CB
2/2/2023	6691	OBD Clear (Modified)	C	I	C	I	I	I	I	I	OFF	None	MC3A-14C204-BAC	76 FC 09 92
2/2/2023	6806	Post-Mileage (Modified)	C	C	C	C	I	C	C	C	OFF	None	MC3A-14C204-BAC	76 FC 09 92
2/8/2023	7019	Post-Test (Modified)	C	C	C	C	C	C	C	C	OFF	None	MC3A-14C204-BAC	76 FC 09 92

C=Monitor Complete

I=Monitor Incomplete