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1995 FORD Mondeo Sedan OEM Service and Repair Workshop Manual

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accomplished by using a narrow frequency band protocol that does not interfere with the pilot signal. Some of these messages include charging mode, charging profile, desired identification and authentication methods, high voltage battery voltage, and charge rate. Power-line communication (PLC) occurs throughout the DC (direct current) fast charge session.

DC (direct current) fast charging requires the charger cordset to lock as an additional safety precaution during charging to prevent the possible exposure to high voltage. When the SOBDM (secondary on-board diagnostic control module A) confirms the vehicle is "On-Plug" and connected to a DC (direct current) fast charge EVSE, it locks the cordset and confirms it is locked. The SOBDM (secondary on-board diagnostic control module A) monitors a feedback signal to verify if the cordset is locked or unlocked.

After the charge cord is confirmed to be locked the OBCC (Off-Board Charger Controller) provides its charging parameters to the EVSE using Power-line communication (PLC) messages. These messages provide status information about the electric vehicle and additional charging parameters, like estimated energy amounts for recharge and the point in time for the end of charge. The OBCC (Off-Board Charger Controller) broadcasts a HS-CAN (high-speed controller area network) message that charging is ready and if the BECM (battery energy control module) is ready for charging it also broadcasts HS-CAN (high-speed controller area network) message "Battery Charge Ready". The SOBDM (secondary on-board diagnostic control module A) closes an internal S2 switch and broadcasts messages that the vehicle is ready for charge via HS-CAN (high-speed controller area network) . The S2 switch is an internal switch in the SOBDM (secondary on-board diagnostic control module A) that reduces the positive portion of the square wave of the pilot signal from +9V to +6V. The closure of the S2 switch notifies the EVSE that the vehicle is ready to receive DC (direct current) power.

The OBCC (Off-Board Charger Controller) requests the EVSE to perform a cable check. The EVSE performs an isolation test on it's charging cable to verify there is no current leakage.

The OBCC (Off-Board Charger Controller) sends pre-charge parameters to the EVSE. The voltage and current parameters originate from the BECM (battery energy control module) . The pre-charge current value of 1A is used to minimize the inrush current when the DC (direct current) fast charge contactors are being closed. Pre-charge is required to reduce stress and prevent damage to the vehicle high voltage electronics. When the high voltage measurement at the charge port is confirmed to be within 20V of the vehicle battery charge voltage requested the BECM (battery energy control module) closes the DC (direct current) fast charge contactors. This allows high DC (direct current) voltage from the EVSE to enter the high voltage battery.

When the BECM (battery energy control module) closes the DC (direct current) fast charge contactors the OBCC (Off-Board Charger Controller) sends a power delivery message to the EVSE and the high voltage battery begins charging. The OBCC (Off-Board Charger Controller) and the BECM (battery energy control module) broadcasts "Charging" messages over the HS-CAN (high-speed controller area network) . The PCM (powertrain control module) enables the DC/DC converter to charge the low voltage 12-volt battery. The BECM (battery energy control module) broadcasts charging voltage and current messages via HS-CAN (high-speed controller area network) messages to the OBCC (Off-Board Charger Controller) based on a charging algorithm. The OBCC (Off-Board Charger Controller) executes the charging profile by communicating the charge current profile to the EVSE. While the high voltage battery is charging the DC (direct current) pins

(generic function module 2) , a DTC (diagnostic trouble code) is set and can be retrieved using a scan tool connected to the DLC (data link connector) .

When the vehicle is connected to a DC (direct current) fast charge EVSE the SOBDM (secondary on-board diagnostic control module A) coordinates high voltage charging operations. It monitors the charge port, BECM (battery energy control module) , and OBCC (Off-Board Charger Controller) for faults. During DC (direct current) level 3 charging the OBCC (Off-Board Charger Controller) communicates directly to the DC (direct current) fast charge EVSE. It houses the Supply Equipment Communication Controller (SECC) that's responsible for communicating to the EVSE using Power-line communication (PLC) technology. The OBCC (Off-Board Charger Controller) communicates over the HS-CAN (high-speed controller area network) to carry out the charging functions and outputs diagnostic messages for service. It must coordinate with SOBDM (secondary on-board diagnostic control module A) to carry out the DC (direct current) charging functions of the high voltage battery. This is accomplished by accepting the 5% control pilot signal from the EVSE and facilitating the DC (direct current) voltage supply from the EVSE to the high voltage battery.

While charging, the SOBDM (secondary on-board diagnostic control module A) monitors the temperature of the AC (alternating current) and DC (direct current) pins. If the temperature exceeds 90°C charging is derated and/or stopped. The SOBDM (secondary on-board diagnostic control module A) houses both actuator controls and position feedback sensors for DC (direct current) charge locking pin control. This function locks the charger cord as an additional safety measure during DC (direct current) charging. When a fault is sensed by the OBCC (Off-Board Charger Controller) , a DTC (diagnostic trouble code) is set and can be retrieved using a scan tool connected to the DLC (data link connector) .

The Charge Status Indicator (CSI) displays the current Customer State-of-Charge (CSoC) and charging operations of the high voltage battery. The Charge Status Indicator (CSI) is connected to the SOBDM (secondary on-board diagnostic control module A) using a pigtail harness located on the left front fender of the vehicle, just behind and above the left front wheel opening. When plugged into an external power source AC (alternating current) (120 or 240 volts) or DC (direct current) fast charge, the SOBDM (secondary on-board diagnostic control module A) activates the Charge Status Indicator (CSI) around the charge cord unlock button and performs a cord acknowledgment. If successful one light segment is flashed one at a time in order. This sequence repeats 2 times. During this sequence the Charge Status Indicator (CSI) monitors the light segments for faults. If a non-functional segment is detected a DTC (diagnostic trouble code) sets in the SOBDM (secondary on-board diagnostic control module A) . The Charge Status Indicator (CSI) displays charging, charging faults, and charging status. The light ring is segmented into 5 equal lights, each indicating the state of charge: • One segment flashing < 20% charged • One segment lit (one segment flashing) > 20% charged • Two segments lit (one segment flashing) > 40% charged • Three segments lit (one segment flashing) > 60% charged • Four segments lit (one segment flashing) > 80% charged. A flashing ring segment indicates a charge is in progress. When all five rings are solidly lit, the charging operation is complete. If less than five rings are lit solid charging is not ready. When the charge is complete the LED (light emitting diode) s turn off and the module goes to sleep mode. The LED (light emitting diode) s remain off until a Puddle Light Activation command is sent via the key fob or door handle. If the SOBDM (secondary on-board diagnostic control module A) receives a fault, all LED (light emitting diode) segments illuminate solid orange for no more than 5

High Voltage Battery Charging System - Electric

414-03B High Voltage Battery Charging System	***2022 F-150***
Diagnosis and Testing	***Procedure revision date: 12/16/2022***

High Voltage Battery Charging System - Electric

Diagnostic Trouble Code (DTC) Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: Diagnostic Methods

(100-00 General Information, Description and Operation).

WARNING

To prevent the risk of high-voltage shock, always follow precisely all warnings and service instructions, including instructions to depower the system. The high-voltage system utilizes approximately 450 volts DC, provided through high-voltage cables to its components and modules. The high-voltage cables and wiring are identified by orange harness tape or orange wire covering. All high-voltage components are marked with high-voltage warning labels with a high-voltage symbol. Failure to follow these instructions may result in serious personal injury or death.

NOTE

The FDRS (Ford Diagnosis and Repair System) SOBDM (secondary on-board diagnostic control module A) and OBCC (Off-Board Charger Controller) self-tests must be performed with Electric Vehicle Supply Equipment (EVSE) disconnected from the vehicle charge port.

The color orange on the charge status indicator indicates a charging fault. Faults can occur internal to the vehicle charging system or external from the vehicle, such as with the EVSE charge cord, charge station or electrical supply. If the system detects a fault in the vehicle charging system at any point in a charge cycle, the

module A)		Information	A
SOBDM (secondary on-board diagnostic control module A)	P0A1F:00	Battery Energy Control Module "A" Performance: No Sub Type Information	GO to Pinpoint Test B
SOBDM (secondary on-board diagnostic control module A)	P0CF4:29	Control Pilot Circuit Range/Performance: Signal Invalid	GO to Pinpoint Test C
SOBDM (secondary on-board diagnostic control module A)	P0CF4:77	Control Pilot Circuit Range/Performance: Commanded Position Not Reachable	GO to Pinpoint Test C
SOBDM (secondary on-board diagnostic control module A)	P0CF5:00	Control Pilot Circuit Low: No Sub Type Information	GO to Pinpoint Test C
SOBDM (secondary on-board diagnostic control module A)	P0CF7:00	Control Pilot Circuit Intermittent/Erratic: No Sub Type Information	GO to Pinpoint Test C
SOBDM (secondary on-board diagnostic control module A)	P0CF7:66	Control Pilot Circuit Intermittent/Erratic: Signal Has Too Many Transitions / Events	GO to Pinpoint Test C
SOBDM (secondary on-board diagnostic control module A)	P0D21:00	Battery Charger "A" Output Voltage Too Low: No Sub Type Information	GO to Pinpoint Test D
SOBDM (secondary on-board diagnostic control module A)	P0D23:00	Battery Charger "A" Output Shorted: No Sub Type Information	GO to Pinpoint Test D
SOBDM (secondary on-board diagnostic control module A)	P0D24:00	Battery Charger Temperature Too High: No Sub Type Information	GO to Pinpoint Test E
SOBDM (secondary on-board diagnostic control module A)	P0D27:00	Battery Charger "A" Input Voltage Too Low: No Sub Type Information	GO to Pinpoint Test F

SOBDM (secondary on-board diagnostic control module A)	P0D58:00	Proximity Detection Circuit "A" Low: No Sub Type Information	GO to Pinpoint Test G
SOBDM (secondary on-board diagnostic control module A)	P0D59:00	Proximity Detection Circuit "A" High: No Sub Type Information	GO to Pinpoint Test G
SOBDM (secondary on-board diagnostic control module A)	P0D5C:00	Battery Charger Hybrid/EV Battery Output Power Performance: No Sub Type Information	GO to Pinpoint Test D
SOBDM (secondary on-board diagnostic control module A)	P0D5E:00?	Battery Charger Hybrid/EV System Discharge Time Too Long: No Sub Type Information	GO to Pinpoint Test F
SOBDM (secondary on-board diagnostic control module A)	P0D80:00	Battery Charger Input Circuit/Open: No Sub Type Information	GO to Pinpoint Test H
SOBDM (secondary on-board diagnostic control module A)	P0D81:24	Battery Charger Input Circuit Range/Performance: Signal Stuck High	GO to Pinpoint Test H
SOBDM (secondary on-board diagnostic control module A)	P0D81:25	Battery Charger Input Circuit Range/Performance: Signal Shape / Waveform Failure	GO to Pinpoint Test H
SOBDM (secondary on-board diagnostic control module A)	P0D85:00	Battery Charging Output Voltage Too High: No Sub Type Information	GO to Pinpoint Test D
SOBDM (secondary on-board diagnostic control module A)	P0D8F:00	Battery Charger Cooling System Performance: No Sub Type Information	GO to Pinpoint Test E
SOBDM (secondary on-board diagnostic control module A)	P0D90:00	Battery Charger Input Frequency Incorrect: No Sub Type Information	GO to Pinpoint Test I

SOBDM (secondary on-board diagnostic control module A)	P0EE7:11	Battery Charger Coupler Temperature Sensor "B" Circuit: Circuit Short To Ground	GO to Pinpoint Test M
SOBDM (secondary on-board diagnostic control module A)	P0EE7:12	Battery Charger Coupler Temperature Sensor "B" Circuit: Circuit Short To Battery	GO to Pinpoint Test M
SOBDM (secondary on-board diagnostic control module A)	P0EE7:13	Battery Charger Coupler Temperature Sensor "B" Circuit: Circuit Open	GO to Pinpoint Test M
SOBDM (secondary on-board diagnostic control module A)	P0EE7:1A	Battery Charger Coupler Temperature Sensor "B" Circuit: Circuit Resistance Below Threshold	GO to Pinpoint Test M
SOBDM (secondary on-board diagnostic control module A)	P0EEE:00	Battery Charger Coupler Temperature "B" Too High: No Sub Type Information	GO to Pinpoint Test N
SOBDM (secondary on-board diagnostic control module A)	P1A3C:00	Hybrid/EV Battery Charging Disabled - DC Charging Station Performance: No Sub Type Information	GO to Pinpoint Test BB
SOBDM (secondary on-board diagnostic control module A)	P1A3C:23	Hybrid/EV Battery Charging Disabled - DC Charging Station Performance: Signal Stuck Low	GO to Pinpoint Test BB
SOBDM (secondary on-board diagnostic control module A)	P2E4F:11	Battery Charger Coupler Temperature Sensor "D" Circuit: Circuit Short To Ground	GO to Pinpoint Test O
SOBDM (secondary on-board diagnostic control module A)	P2E4F:12	Battery Charger Coupler Temperature Sensor "D" Circuit: Circuit Short To Ground	GO to Pinpoint Test O
SOBDM (secondary on-board diagnostic control module A)	P2E4F:13	Battery Charger Coupler Temperature Sensor "D" Circuit: Circuit Open	GO to Pinpoint Test O

SOBDM (secondary on-board diagnostic control module A)	U0447:00	Invalid Data Received From Serial Data Gateway "A": No Sub Type Information	GO to Pinpoint Test AA
SOBDM (secondary on-board diagnostic control module A)	U0554:00	Invalid Data Received From Accessory Protocol Interface Module: No Sub Type Information	GO to Pinpoint Test AB
SOBDM (secondary on-board diagnostic control module A)	U057D:00	Invalid Data Received From Off-Board Charger Control Module: No Sub Type Information	GO to Pinpoint Test AC
SOBDM (secondary on-board diagnostic control module A)	U0594:00	Invalid Data Received From Hybrid/EV Powertrain Control Module: No Sub Type Information	GO to Pinpoint Test AD
SOBDM (secondary on-board diagnostic control module A)	U1020:00	Lost Communication With Generic Function Module 2: No Sub Type Information	GO to Pinpoint Test AE
SOBDM (secondary on-board diagnostic control module A)	U1021:00	Invalid Data Received From Generic Function Module 2: No Sub Type Information	GO to Pinpoint Test AF
SOBDM (secondary on-board diagnostic control module A)	U3000:47	Control Module: Watchdog / Safety µC Failure	GO to Pinpoint Test AG
SOBDM (secondary on-board diagnostic control module A)	U3000:49	Control Module: Internal Electronic Failure	GO to Pinpoint Test AH
SOBDM (secondary on-board diagnostic control module A)	U3002:62	Vehicle Identification Number: Signal Compare Failure	GO to Pinpoint Test AI
SOBDM (secondary on-board diagnostic control module A)	U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test BA

GFM2 (generic function module 2)	P0D21:00	Battery Charger "A" Output Voltage Too Low: No Sub Type Information	GO to Pinpoint Test AO
GFM2 (generic function module 2)	P0D23:00	Battery Charger "A" Output Shorted: No Sub Type Information	GO to Pinpoint Test AO
GFM2 (generic function module 2)	P0D24:00	Battery Charger "A" Temperature Too High: No Sub Type Information	GO to Pinpoint Test AR
GFM2 (generic function module 2)	P0D27:00	Battery Charger "A" Input Voltage Too Low: No Sub Type Information	GO to Pinpoint Test AZ
GFM2 (generic function module 2)	P0D28:00	Battery Charger "A" Input Voltage Too High: No Sub Type Information	GO to Pinpoint Test AZ
GFM2 (generic function module 2)	P0D2A:00	Battery Charger "A" Input Current Too High: No Sub Type Information	GO to Pinpoint Test AZ
GFM2 (generic function module 2)	P0D38:00	Battery Charger "A" Input Current Sensor "A" Circuit: No Sub Type Information	GO to Pinpoint Test AZ
GFM2 (generic function module 2)	P0D3D:00	Battery Charger "A" Input Voltage Sensor "A" Circuit: No Sub Type Information	GO to Pinpoint Test AZ
GFM2 (generic function module 2)	P0D4C:00	Battery Charger Hybrid/EV Battery Output Voltage Sensor "A" Circuit: No Sub Type Information	GO to Pinpoint Test AO
GFM2 (generic function module 2)	P0D51:00	Battery Charger Hybrid/EV Battery Output Current Sensor "A" Circuit: No Sub Type Information	GO to Pinpoint Test AO
GFM2 (generic function module 2)	P0D59:00	Proximity Detection Circuit High: No Sub Type Information	GO to Pinpoint Test AQ

GFM2 (generic function module 2)	U3513:00	High Voltage System Interlock Circuit "B" Low: No Sub Type Information	GO to Pinpoint Test AY
OBCC (Off-Board Charger Controller)	P1A3C:00	Hybrid/EV Battery Charging Disabled - DC Charging Station Performance: No Sub Type Information	GO to Pinpoint Test BB
OBCC (Off-Board Charger Controller)	P1A3C:89	Hybrid/EV Battery Charging Disabled - DC Charging Station Performance: Data Transfer Failure	GO to Pinpoint Test BC
OBCC (Off-Board Charger Controller)	P0634:00	Control Module Internal Temperature "A" Too High: No Sub Type Information	GO to Pinpoint Test BD
OBCC (Off-Board Charger Controller)	U0111:00	Lost Communication With Battery Energy Control Module "A": No Sub Type Information	GO to Pinpoint Test BE
OBCC (Off-Board Charger Controller)	U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test BF
OBCC (Off-Board Charger Controller)	U0146:00	Lost Communication With Serial Data Gateway "A": No Sub Type Information	GO to Pinpoint Test BG
OBCC (Off-Board Charger Controller)	U019B:00	Lost Communication With Battery Charger Control Module "A": No Sub Type Information	GO to Pinpoint Test BH
OBCC (Off-Board Charger Controller)	U0293:00	Lost Communication with Hybrid/EV Powertrain Control Module: No Sub Type Information	GO to Pinpoint Test BI
OBCC (Off-Board Charger Controller)	U0412:00	Invalid Data Received From Battery Energy Control Module "A": No Sub Type Information	GO to Pinpoint Test BJ
OBCC (Off-Board Charger Controller)	U0447:00	Invalid Data Received From Serial Data Gateway "A": No Sub Type Information	GO to Pinpoint Test BK