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1996 FORD Mondeo Sedan OEM Service and Repair Workshop Manual

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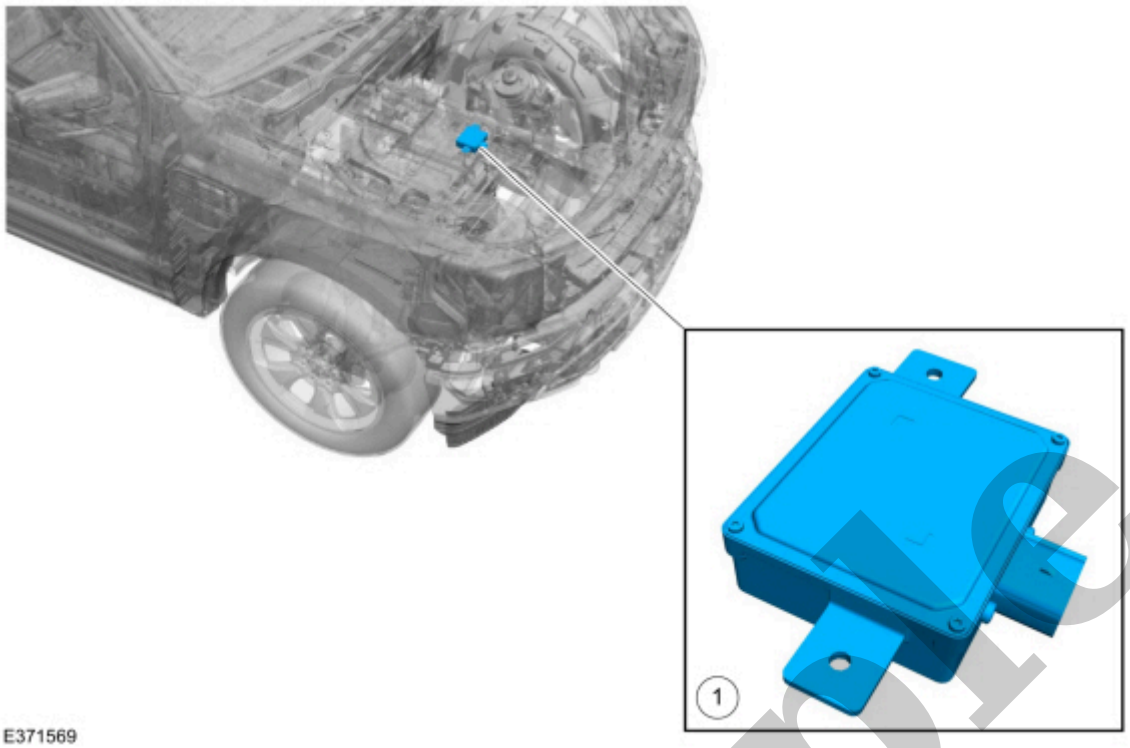
Off-Board Charger Controller



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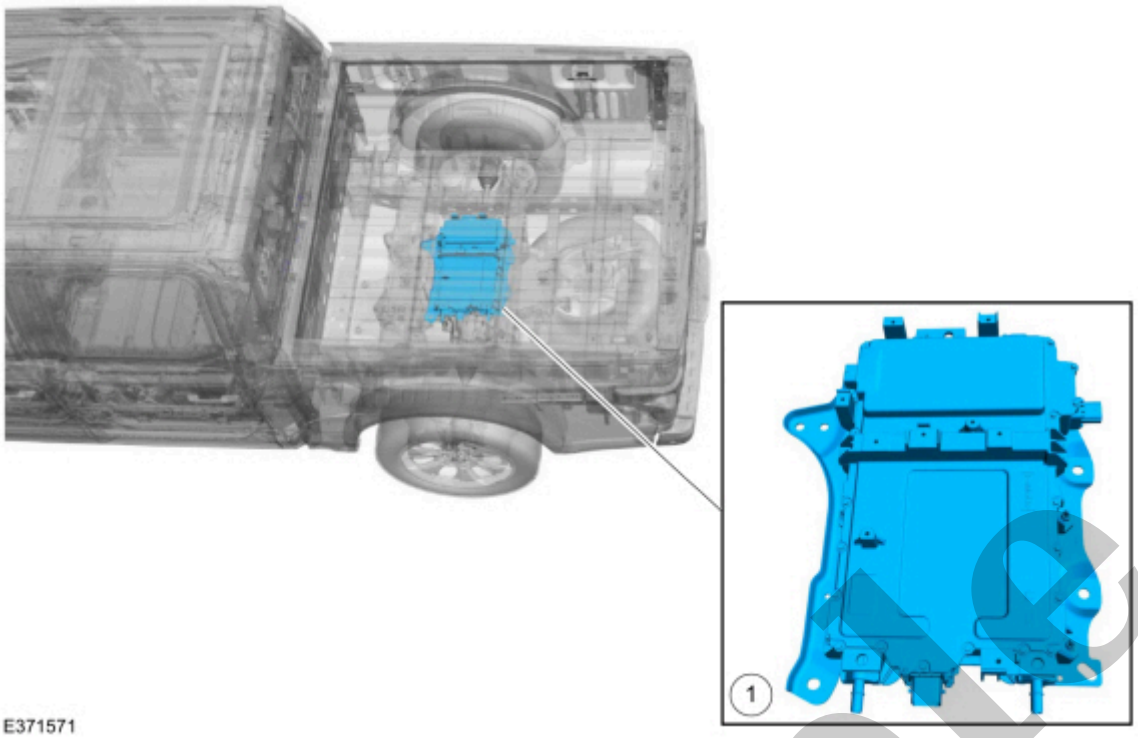
Item	Description
1	OBCC (Off-Board Charger Controller)

Secondary On-Board Diagnostic Control Module A



E371571

Item	Description
1	GFM2 (generic function module 2) [Battery Charger Control Module (BCCM)] - if equipped

Some vehicles are equipped with a secondary On-board Battery Charger Control Module (BCCM), also known as the GFM2 (generic function module 2) is a liquid-cooled component that facilitates and provides additonal charging capacity for the high voltage battery when an high output level 2 EVSE is utilized. The primary On-board Battery Charger Control Module (BCCM), also known as the SOBDM (secondary on-board diagnostic control module A) communicates and controls operations of the GFM2 (generic function module 2) via dedicated communication circuits.

DC Fast Charging

DC (direct current) fast charging allows the vehicle to be charged at a high current rate dramatically reducing charge time. This is accomplished by an off-board DC (direct current) fast charge Electric Vehicle Supply Equipment (EVSE) that is capable of suppling high voltage DC (direct current) directly to the high voltage battery. The advantage of DC (direct current) fast charging is that the voltage does not need to be converted by the vehicle's on-board charger prior to entering the high voltage battery which maximizes efficiency. The vehicle is equipped with two additional DC (direct current) positive and DC (direct current) negative terminals at the vehicle charge port known as a combo plug, that allows a DC (direct current) fast charge EVSE to be connected. The OBCC (Off-Board Charger Controller) incorporates a Electric Vehicle Communication Controller (EVCC) to communicate with the Electric Vehicle Supply Equipment (EVSE) Supply Equipment Communication Controller (SECC) via Power-line communication (PLC).

High voltage cables connect the vehicle charge port to the high voltage battery. The high voltage battery junction box, internal to the high voltage battery, houses two DC (direct current) fast charge contactors that close to allow high voltage DC (direct current) from the EVSE to enter the high voltage battery during charging. 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 the SOBDM (secondary on-board diagnostic control module A) to carry out the DC (direct current) charging functions of the high voltage battery. The SOBDM (secondary on-board diagnostic control module A) controls an actuator pin at the charge port to lock the charger plug to the vehicle prior to closing of the high voltage contactors. This is a safety measure to prevent the plug from being disconnected while high voltage DC (direct current) is present.

Charge Status Indicator (CSI)

When the vehicle is plugged into an EVSE, the Charge Status Indicator (CSI) indicates the current Customer State-of-Charge (CSoC) and charging operations of the high voltage battery. The Charge Status Indicator (CSI) is a light ring next to the charge port inlet that displays charging, charging faults and charging status using four LED (light emitting diode) light segments. The four charge port indicator light colors indicate a specific action: White is used as a courtesy light to help with plugging in and to acknowledge actions such as plugging and unplugging. Blue indicates when the vehicle is plugged in and is either charging or waiting to charge. Green indicates power transfer using the intelligent backup power system. Orange indicates charge faults. The Charge Status Indicator (CSI) pigtail harness is connected to the SOBDM (secondary on-board diagnostic control module A) . The SOBDM (secondary on-board diagnostic control module A) controls and receives fault

High Voltage Battery Charging System - Electric - System Operation and Component Description

414-03B High Voltage Battery Charging System	***2022 F-150***
Description and Operation	***Procedure revision date: 03/10/2022***

High Voltage Battery Charging System - Electric - System Operation and Component Description

System Diagram

6	DCDC (direct current/direct current converter control module)
7	BCM (body control module)
8	CSI (charge status indicator)
9	EVSE (Electric Vehicle Supply Equipment)
10	BMS (battery monitoring sensor)
11	BECM (battery energy control module)
12	High Voltage Battery Junction Box
13	SOBDM (secondary on-board diagnostic control module A)
14	GFM2 (generic function module 2)

System Operation

Network Message Chart — Secondary On-Board Diagnostic Control Module A (SOBDM)

Broadcast Message	**Originating Module**	**Message Purpose**
12V battery charging support (gateway)	PCM (powertrain control module)	Notification that 12V battery charging support is requested.
12V battery voltage (gateway)	BCM (body control module)	Battery voltage measured with battery sensor.
Ambient air temperature (gateway)	PCM (powertrain control module)	Ambient air temperature measured.
Cabin ambient air temperature (gateway)	PCM (powertrain control module)	Cabin ambient air temperature measured.
Auxiliary contactor open/close	BECM (battery energy control module)	High voltage battery auxiliary contactor command.
EVSE charge output DC (direct current) current	OBCC (Off-Board Charger Controller)	Charge output current of the EVSE.

Cabin drive sustain request (gateway)	SOBDMC (secondary on-board diagnostic control module C)	This signal indicates the request of required modules to remain awake to support cabin drive pre-conditioning.
High battery charge now event status (gateway)	SOBDMC (secondary on-board diagnostic control module C)	This signal indicates the required modules are awake due to the charge now event.
12V battery transfer sustain request (gateway)	SOBDMC (secondary on-board diagnostic control module C)	This signal indicates the request of required modules to remain awake to support the 12V voltage battery charging.
High voltage battery contactor supply voltage status (gateway)	SOBDMC (secondary on-board diagnostic control module C)	Used to determine if the 12V contactor supply voltage is asserted or not asserted.
DC (direct current) charging ready status (not ready, initialization, charge ready, weld check, precharge, charging, charge complete)	OBCC (Off-Board Charger Controller)	This signal represents the DC (direct current) charging status.
DC (direct current) charger Electric Vehicle Supply Equipment (EVSE) maximum power	OBCC (Off-Board Charger Controller)	Maximum Electric Vehicle Supply Equipment (EVSE) power
Digital communication gateway mode status	OBCC (Off-Board Charger Controller)	Status of digital communication from EVSE.
High voltage battery isolation monitoring disable request	OBCC (Off-Board Charger Controller)	Request to disable high voltage battery isolation monitoring.
High voltage battery coolant pump status	BECM (battery energy control module)	Status of the high voltage battery coolant pump (On, Off, Fault)
Customer State-of-Charge (CSoC)	BECM (battery energy control module)	High voltage battery state of charge (SOC) for display.
High voltage battery charge sustain request	BECM (battery energy control module)	This signal indicates the request of required modules to remain awake to support high voltage battery charging.

High voltage battery charge voltage request	BECM (battery energy control module)	Used to limit and set target setpoint of charger.
Odometer master value (gateway)	BCM (body control module)	Vehicle odometer value.
OBDII warm up completions (gateway)	PCM (powertrain control module)	Used to increment counters for DTC (diagnostic trouble code) aging.
Transmission selector (PRNDL) requested (gateway)	PCM (powertrain control module)	Requested transaxle gear selection.
Vehicle configuration data (gateway)	BCM (body control module)	Vehicle configuration strategy.
Vehicle operating mode (gateway)	PCM (powertrain control module)	Vehicle must be in non-torque producing mode prior to charging.

Network Message Chart — Off-Board Charger Controller

Broadcast Message	**Originating Module**	**Message Purpose**
12V battery voltage (gateway)	BCM (body control module)	Battery voltage measured with battery sensor.
Global clock time (gateway)	BCM (body control module)	Global time data.
Ambient air temperature (gateway)	PCM (powertrain control module)	Ambient air temperature measured.
Charge port DC (direct current) charging temperature fault	SOBDM (secondary on-board diagnostic control module A)	Over temperature fault during DC (direct current) charging. If temperature exceeds a calibrated threshold charging will be derated or aborted.
Charge port DC (direct current) fast charge over current fault	SOBDM (secondary on-board diagnostic control module A)	Over current fault during DC (direct current) charging.

High voltage battery current flow	BECM (battery energy control module)	Electric current flow into or out of the high voltage battery.
High voltage battery voltage	BECM (battery energy control module)	Voltage level of high voltage battery.
High voltage battery DC (direct current) fast charge contactor command	BECM (battery energy control module)	Command to open or close the high voltage battery DC (direct current) fast charge contactors.
High voltage isolation disable status	BECM (battery energy control module)	Status of the vehicle-side high voltage isolation disable status.
High voltage battery charge current request	BECM (battery energy control module)	Used to limit and set target setpoint of the DC (direct current) fast charge EVSE.
High voltage battery charge voltage request	BECM (battery energy control module)	Used to limit and set target setpoint of the DC (direct current) fast charge EVSE.
High voltage battery charge voltage request	BECM (battery energy control module)	Used to limit and set target setpoint of the DC (direct current) fast charge EVSE.
High voltage battery charge mode actual	BECM (battery energy control module)	Used to determine if the high voltage battery is charging or not charging.
High voltage battery charge maximum voltage	BECM (battery energy control module)	Maximum charge voltage used to limit charger.
High voltage battery charge maximum temperature	BECM (battery energy control module)	Maximum battery temperature to allow charging.
High voltage battery cell maximum temperature	BECM (battery energy control module)	Maximum battery cell temperature.
High voltage battery cell minimum temperature	BECM (battery energy control module)	Minimum battery cell temperature.
High voltage battery charge maximum cell voltage	BECM (battery energy control module)	Maximum cell voltage charge limit.
High voltage battery charge rate	BECM (battery energy	Nominal high voltage battery charge rate.

Some vehicles are equipped with a secondary On-board Battery Charger Control Module (BCCM), also known as the GFM2 (generic function module 2) is a liquid-cooled component that facilitates and provides additional charging capacity to the high voltage battery if a high output level 2 EVSE is utilized. The primary On-board Battery Charger Control Module (BCCM), also known as the SOBDM (secondary on-board diagnostic control module A) communicates and controls operations of the GFM2 (generic function module 2) via dedicated communication circuits. Similar to the SOBDM (secondary on-board diagnostic control module A) the GFM2 (generic function module 2) monitors internal operations such as temperature, input/output voltages and currents and sets a DTC (diagnostic trouble code) if a fault occurs. In some cases faults may result in only disabling charging operations for only the GFM2 (generic function module 2) or may completely disable charging of the high voltage battery.

When the Electric Vehicle Supply Equipment (EVSE) cord is plugged in the SOBDM (secondary on-board diagnostic control module A) wakes up by sensing a control pilot signal. A pilot signal with a duty cycle between 10-96% indicates a 120V or 240V AC (alternating current) Electric Vehicle Supply Equipment (EVSE) has been connected to the vehicle. The pilot signal is analyzed to determine AC (alternating current) line capacity and the frequency is monitored to make sure it is in the proper range. The Electric Vehicle Supply Equipment (EVSE) monitors the pilot signal to determine when to turn on AC (alternating current) output. A separate proximity circuit signal is analyzed to confirm if the connection is stable and the S3 button on the external charger cord is released. If both signals are in correct range, the SOBDM (secondary on-board diagnostic control module A) transmits an on-plug message via HS-CAN (high-speed controller area network) . The SOBDM (secondary on-board diagnostic control module A) confirms the vehicle is not in torque producing mode and closes an internal S2 switch signaling the Electric Vehicle Supply Equipment (EVSE) to send AC (alternating current) voltage to the SOBDM (secondary on-board diagnostic control module A) .

Switch S2 detection is determined by the pilot signal voltage change. If the AC (alternating current) voltage input is within range the SOBDM (secondary on-board diagnostic control module A) enables 12-volt battery charging and wakes up the BECM (battery energy control module) . The SOBDM (secondary on-board diagnostic control module A) is ready for high voltage power conversion when it transmits a charger ready message via the HS-CAN (high-speed controller area network) .

The SOBDM (secondary on-board diagnostic control module A) internally transitions from a ready state to charging state of the high voltage battery upon receipt of a battery charge ready or charging message from the BECM (battery energy control module) via the HS-CAN (high-speed controller area network) . When the BECM (battery energy control module) status goes from a charge ready to a charging state the contactors are closed to begin charging the high voltage battery. The SOBDM (secondary on-board diagnostic control module A) limits the voltage and current to the high voltage battery based on the maximum voltage and current requests from the BECM (battery energy control module) via the HS-CAN (high-speed controller area network) . The SOBDM (secondary on-board diagnostic control module A) transmits high voltage and current output internal measurements to the BECM (battery energy control module) via the HS-CAN (high-speed controller area network) . While the high voltage battery is charging the temperature of the AC (alternating current) pins at the charge port is measured by a thermistor that are hardwired to the SOBDM (secondary on-board diagnostic control module A) . If the temperature exceeds a calibrated threshold the SOBDM (secondary on-