

# Uniform Procedures For Collision Repair

# DT01–Engine

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v.2.3



## 1. Description

This procedure describes the removal and reinstallation of a vehicle engine or engine-transmission assembly. Procedures for removal and reinstallation from the top and bottom of the engine compartment are included.



## 2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing a high-quality engine removal and installation to provide access for collision damage repairs. This procedure is intended for use by professionals who are qualified through training and experience.



### **3. Referenced Documents**

The following documents are considered part of this procedure by reference.

#### **3.1 Procedures**

- AC01 Air Conditioning
- BR11 Brakes
- BR51 Brakes, Anti-Lock And Traction Control
- CO01 Radiator Assembly
- CO21 Fan, Mechanical
- CO22 Fan, Electric
- DT11 Engine Mount
- DT21 Halfshafts
- DT31 Driveshaft
- EL21 Self-Diagnostics
- EM01 Emission Label
- EM11 Charcoal Canister
- EX01 Exhaust
- FU11 Lines
- HO21P Hood
- HO21S Hood
- HM01 Hazardous Materials
- ME01 Three-Dimensional Measuring
- PS01 Personnel Safety
- SP21S Crossmember, Welded
- SP22S Engine Cradle
- SR51 Power Steering

#### **3.2 Other Information**

- Equipment-specific information
- Vehicle-specific dimension specifications
- Vehicle-specific repair information



## 4. Equipment And Material Requirements

### 4.1 Equipment

The use of this equipment is included in this procedure:

- engine hoist or sling
- universal support fixture
- engine support adapters
- engine dolly and cradle



### 4.2 Measuring Equipment

Use measuring equipment as described in **ME01**.



## 5. Damage Analysis

Does not apply.



## 6. Personnel Safety

### 6.1 General Safety

General safety information is in **PS01**.

### 6.2 Safety With Engine Assemblies

To prevent injury when removing or installing an engine assembly:

- Properly support the vehicle and the engine and transmission.
- Use the proper tools, and follow the equipment and vehicle makers' recommendations.
- Depressurize the brake and fuel systems following the vehicle maker's recommendations. See **BR11**, **BR51**, and **FU11**.



## 7. Environmental Safety

### 7.1 Vehicle Fluids

Collect and properly recycle or dispose of vehicle fluids and air conditioning (AC) refrigerant.

Hazardous material safety information is in **HM01**.



## 8. Vehicle Protection

### 8.1 Engine And Attached Parts

To prevent damage to the engine and attached parts:

- Ensure there is enough available workspace.
- Make sure the vehicle and engine are properly supported during service.
- Follow the vehicle maker's recommendations for lift points.
- Make sure the engine is properly balanced when hoisted.
- Do not leave the engine suspended on a hoist. Raise and lower it onto a stand or dolly.
- Use the proper tools, and follow the equipment maker's recommendations.
- Torque all fasteners to the vehicle maker's recommendations.
- Replace worn parts and one-time fasteners.
- Mark wiring, hoses, and lines to avoid misconnection.
- Plug or cap disconnected lines to prevent spillage and contamination.

### 8.2 Adjacent Areas

Protect finished areas, glass, and other cosmetic surfaces when raising and lowering the engine or removing the drivetrain assembly. If required for access, carefully remove and store the hood to protect it from damage.

### 8.3 Electronic Parts

To protect electronic and other sensitive parts from damage:

- Disconnect and remove or reposition wiring, if required.
- Follow the vehicle maker's recommendations for recording and resetting **electronic memories**.
- Ensure that the ignition switch is in the LOCK position, and the key is removed.
- Disconnect and remove the battery.

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## 8. Vehicle Protection (cont'd)

- Disarm the **passive restraint system**. Follow the vehicle maker's recommendations.
- Protect computer modules, connectors, and wiring from dirt, heat, static electricity, and moisture.
- Loosen or remove any electrical parts that could be damaged during the repair process.



## 9. Repair Procedure

Follow the vehicle maker's recommendations for determining how the engine will be removed. In some cases the engine and transaxle, or engine and transmission, may have to be removed as an assembly. For removing and installing the engine from the top of the engine compartment, see **9.1** and **9.2**. For removing and installing the engine from the bottom of the engine compartment, see **9.3** and **9.4**.

### 9.1 Engine Removal By Hoisting

To remove an engine by hoisting it from the top of the engine compartment:

- 1. Disconnect and remove the battery.
- 2. Remove the hood, if required.
- 3. Release the pressure from the brake and fuel systems, following the vehicle maker's recommendations.
- 4. Disconnect the starter cable, engine ground strap, and engine wiring harnesses. Disconnect harnesses at the main junction block, if possible. Mark the connectors for reinstallation. Seal the connectors from dust and dirt. Remove the battery tray, if required.
- 5. Drain and collect the **coolant** from the radiator. Remove the cooling system parts, including hoses, radiator, radiator shroud, and fan.
- 6. Disconnect transmission cooler lines, linkages, cables, and wiring; clutch linkages and cables; and throttle linkages and cables, if required. Mark them for reinstallation. If the transmission will not be removed with the engine, disconnect the transmission from the engine.
- 7. Disconnect and plug the vacuum hoses, if required. Mark them for reinstallation.
- 8. Drain and disconnect the power steering system, if required.
- 9. Discharge and recover the refrigerant, and disconnect the AC system, if required. Reposition, or remove and seal, lines and hoses.

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## 9. Repair Procedure (cont'd)

- 10. Remove the accessory drive belts, if required. Replace any worn belts.
- 11. Disconnect emission control system parts, if required.
- 12. Properly raise and support the vehicle. Remove the deflectors and splash shields, if required.
- 13. Disconnect, drain, and plug the brake and fuel lines, if required.
- 14. Disconnect the exhaust system.
- 15. Drain the transaxle, if required.
- 16. Disconnect and support the **halfshafts** or driveshaft, if required. Follow the vehicle maker's recommendations.
- 17. Disconnect any upper engine mounts.
- 18. Lower the vehicle.
- 19. Support the transmission and remove the transmission mounting fasteners.
- 20. Loosen the engine-mount through-bolts.
- 21. Attach the engine hoist. Follow the vehicle maker's recommendations for lift points.  
Note: Brackets may have to be installed for lift points.
- 22. Raise the engine enough to allow removal of the engine-mount fasteners.
- 23. Remove the engine-mount through-bolts. Replace one-time or damaged fasteners. Use replacement fasteners that are the same grade, size, and type as the original fasteners.
- 24. Disconnect any remaining hoses, lines, and wiring. Mark them for reinstallation.
- 25. Raise the engine slowly. Lower the vehicle or raise the engine until clear.
- 26. Counterweight the vehicle, if required to compensate for the weight of the removed engine and transmission.
- 27. Lower the engine and properly support it on an engine stand or dolly.
- 28. Replace any worn engine mounts.

### 9.2 Engine Reinstallation From The Top

Verify that the engine compartment and the engine-mounting locations have been restored to the vehicle maker's dimension specifications before attempting to install the engine or engine-transmission assembly.

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## 9. Repair Procedure (cont'd)

To reinstall the engine through the top of the engine compartment:

- 1. Raise the engine and transmission if applicable, and lower it into position enough to loosely install the engine-mount through-bolts. Follow the vehicle maker's tightening sequence and torque recommendations.
- 2. Remove the engine lift brackets.
- 3. Reinstall the transmission mounting fasteners, if applicable. Follow the vehicle maker's tightening sequence and torque recommendations.
- 4. Reconnect the halfshafts or driveshaft in the proper position. Follow the vehicle maker's recommendations for fasteners that must be replaced.
- 5. Reconnect the engine ground strap.
- 6. Reconnect the exhaust system, brake lines, fuel lines, etc., that were disconnected for engine removal. Torque all fasteners to the vehicle maker's recommendations.
- 7. Reconnect any emission control system parts that were removed.
- 8. Reinstall the AC lines and hoses. Recharge the AC system, following the vehicle maker's recommendations.
- 9. Reconnect all linkages and cables that were disconnected for engine removal. Follow the vehicle maker's recommendations for adjusting the shift, clutch, throttle, cruise control cables, etc.
- 10. Reconnect the power steering lines. Refill the reservoir.
- 11. Install the accessory drive belts. Follow the vehicle maker's recommended belt tension adjustments.
- 12. Reinstall the radiator and cooling fan and reconnect the cooling system hoses and transmission cooling lines. Refill the radiator with the proper engine coolant, following the vehicle maker's recommendations. Bleed air from the cooling system, if required.
- 13. Check the engine and transmission oil level and add oil, if required.
- 14. Reconnect the electrical system and reinstall the battery. Reactivate the passive restraint system.
- 15. Repressurize the fuel system, following the vehicle maker's recommendations. Start the engine and check for leaks.
- 16. Adjust the transmission and throttle linkage.
- 17. Bleed the brake system, following the vehicle maker's recommendations. Check for proper fluid level and for leaks.
- 18. Check and fill all fluid levels with the proper fluid. Follow the vehicle maker's recommendations.
- 19. Reinstall and align the hood.
- 20. Continue vehicle reassembly.
- 21. Road-test the vehicle. See **11.2**.

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## 9. Repair Procedure (cont'd)

### 9.3 Engine Removal From The Bottom

To remove an engine from the bottom of the engine compartment:

1. Disconnect and remove the battery.
2. Remove the hood, if required.
3. Release the pressure from the brake and fuel systems, following the vehicle maker's recommendations.
4. Disconnect the starter cable, engine ground strap, and engine wiring harnesses. Disconnect the harness at the main junction block, if possible. Mark the connectors for reinstallation. Remove the battery tray, if required.
5. Drain and collect the coolant from the radiator. Remove the cooling system parts, including hoses, radiator, shroud, and fan.
6. Disconnect transmission cooler lines, linkages, cables, and wiring; clutch linkages and cables; and throttle linkages and cables, if required. Mark them for reinstallation. If the transmission will not be removed with the engine, disconnect the transmission from the engine.
7. Disconnect and plug the vacuum hoses, if required. Mark them for reinstallation.
8. Disconnect the throttle linkages and cables, if required. Mark them for reinstallation.
9. Drain and disconnect the power steering system, if required.
10. Discharge and recover the refrigerant, and disconnect the AC system, if required. Remove and seal or reposition lines and hoses.
11. Disconnect the emission control system, if required.
12. Properly raise and support the vehicle. Remove the splash shields and deflectors, if required.
13. Disconnect, drain, and plug the brake and fuel lines, if required.
14. Disconnect the exhaust system.
15. Remove the accessory drive belts, if required. Replace any worn belts.
16. Disconnect and support the halfshafts or driveshaft, if required.
17. Disconnect any upper engine mounts.
18. Lower the vehicle just enough to allow an engine dolly and cradle to be installed under the vehicle.
19. Loosen the engine-mount fasteners on the cradle. Lower the vehicle and position the cradle mounts until the engine is resting on the mounts. Torque the mount fasteners to the cradle frame.
20. Install safety straps to hold the engine to the cradle.
21. Lower the vehicle so the weight of the engine, and transmission if applicable, is resting only on the cradle.



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## 9. Repair Procedure (cont'd)

- 22. Disconnect the lower engine mounts, and transmission mounts if applicable. Replace one-time or damaged fasteners. Use replacement fasteners that are the same grade, size, and type as the original fasteners.
- 23. Remove the strut-to-strut tower fasteners, if required.
- 24. Lift the vehicle slowly, positioning the engine and cradle to allow the engine to clear.
- 25. Counterweight the vehicle, if required to compensate for the weight of the removed engine and transmission.
- 26. Replace any worn engine mounts.

### 9.4 Engine Reinstallation From The Bottom

Verify that the engine compartment and the engine-mounting locations have been restored to the vehicle maker's dimension specifications before attempting to install the engine or engine-transmission assembly.

To reinstall the engine through the bottom of the engine compartment:

- 1. Position the engine, and transmission if applicable, under the vehicle and slowly lower the vehicle.
- 2. Align the engine mounts, transmission mounts, and struts to the attaching points, and install the mounting fasteners. Connect the engine to the transmission, if applicable. Follow the vehicle maker's tightening sequence and torque recommendations.
- 3. Remove the safety straps from the engine. Slowly raise the vehicle enough to remove the dolly and cradle.
- 4. Reconnect the engine ground strap.
- 5. Reconnect the exhaust system. Torque the fasteners to the vehicle maker's recommendations.
- 6. Install the axle halfshafts or driveshaft, following the vehicle maker's recommendations.
- 7. Reconnect the brake and fuel lines.
- 8. Reinstall any splash shields that were removed for access.
- 9. Reconnect the emission control system.
- 10. Reinstall the AC hoses and lines. Recharge the AC system, following the vehicle maker's recommendations.
- 11. Reinstall the power steering pump and attaching parts.
- 12. Reinstall the accessory drive belts. Follow the vehicle maker's recommended belt-tension adjustments.
- 13. Reconnect the vacuum hoses, following the installation marks.
- 14. Reinstall the cooling system parts, including hoses, radiator, shroud, and fan. Refill the radiator with the proper engine coolant. Bleed any air from the system.

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## 9. Repair Procedure (cont'd)

- 15. For automatic transmissions, reconnect the cooler lines. For manual transmissions, reconnect the clutch cable and connecting linkage. Follow the vehicle maker's recommendations for adjusting the cables and linkages.
- 16. Reconnect the electrical system and reinstall the battery. Reactivate the passive restraint system.
- 17. Check the engine oil level, and add oil if required.
- 18. Repressurize the fuel system, following the vehicle maker's recommendations. Start the engine and check for leaks.
- 19. Adjust the transmission and throttle linkage, if required.
- 20. Bleed the brake system, following the vehicle maker's recommendations. Check for proper fluid level and for leaks.
- 21. Check and fill all fluid levels with the proper fluid. Follow the vehicle maker's recommendations.
- 22. Reinstall and align the hood.
- 23. Continue vehicle reassembly.
- 24. Road-test the vehicle. See **11.2**.



## 10. Use Of Recycled (Salvage) Parts

Does not apply.



## 11. Inspection And Testing

### 11.1 Engine Inspection

When the engine assembly has been reinstalled, inspect for these conditions:

- proper engine and drivetrain alignment
- fasteners torqued to the vehicle maker's recommendations
- hoses, lines, and wires properly installed and routed
- fluids at proper levels, and no leaks
- proper adjustment of transmission linkage
- proper operation of all electrical and attaching parts
- proper operation of all warning lamps
- proper tension of all accessory drive belts
- proper operation of the cooling system

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## 11. Inspection And Testing (cont'd)

- proper operation of the exhaust system
- proper operation of the AC system

Correct any defects.

### 11.2 Road-Test

Road-test the vehicle and check for these conditions:

- proper acceleration, shifting, and braking
- unusual noises or vibration when accelerating, shifting, turning, etc.
- proper operation of all accessories
- proper handling
- proper engine cooling

Verify that no stored trouble codes indicate an engine, transmission, or emission system problem. See **EL21**.

Correct any defects.