## Section 8

### Engine

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ENGINE

Various Detroit Diesel Engines are used in MC-9 coaches. The 6V-92TA engine is the standard engine; 8V-71 and 8V-92TA engines are optional. Electronically controlled models of the 6V-92TA and the 8V-92TA engines are also used. The general specifications of the engines are shown in the following chart.

### Engine Specifications

<table>
<thead>
<tr>
<th></th>
<th>6V-92TA</th>
<th>8V-92TA</th>
<th>8V-71</th>
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<tbody>
<tr>
<td>Type</td>
<td>2 Cycle</td>
<td>2 Cycle</td>
<td>2 Cycle</td>
</tr>
<tr>
<td>Number of Cylinders</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Bore (inches)</td>
<td>4.84</td>
<td>4.84</td>
<td>4.25</td>
</tr>
<tr>
<td>Bore (mm)</td>
<td>123</td>
<td>123</td>
<td>108</td>
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<tr>
<td>Stroke (inches)</td>
<td>5</td>
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<td>5</td>
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<tr>
<td>Stroke (mm)</td>
<td>127</td>
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<td>127</td>
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<tr>
<td>Comp. Ratio (Nominal)</td>
<td>17 to 1</td>
<td>17 to 1</td>
<td></td>
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<tr>
<td>(Turbo, Engines)</td>
<td>18.7 to 1</td>
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<td></td>
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<tr>
<td>Comp. Ratio (Nominal)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&quot;N&quot; Engines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Displacement</td>
<td>362</td>
<td>736</td>
<td>568</td>
</tr>
<tr>
<td>Cu. In.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Displacement</td>
<td>9.05</td>
<td>12.07</td>
<td>5.32</td>
</tr>
<tr>
<td>Liters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Main Bearings</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Rated Full Load Speed (RPM)</td>
<td>2100</td>
<td>2100</td>
<td>2050</td>
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Maintenance and repair information on the engine will be found in the engine manufacturer's service manuals. Engine controls, accessories and related components are covered in the applicable sections of this manual. Refer to Section 6 (Cooling), 7 (Electrical), 9 (Fuel), and 10 (Lubrication).

To conform with engine manufacturer's practice, TMC/MCI Parts Book, Maintenance Manuals, Service Bulletins and other technical publications identify all engine parts as "L.H.", "R.H.", "Front" or "Rear" when viewing the engine from the flywheel end. This is opposite to the position of these parts with the engine installed in the coach, but the engine manufacturer's designations have been retained to eliminate potential misunderstanding in engine parts identification.

All other parts of the coach are designed "L.H.", "R.H.", "Front" or "Rear" in relation to the normal position of the driver facing forward.

REMOVAL AND REPLACEMENT

The engine unit, including transmission, clutch, air compressor and alternator, may be removed from the coach as a unit for repair to engine or related components. Refer to figure 8-1.

To facilitate removal and replacement of the engine unit and to provide a convenient means of supporting the engine and related components during service work, the use of a dolly is recommended. Such a dolly may be made locally. Refer to tool listings at the end of this section for drawing of dolly.

1. The coach should be driven into a twin-rail hoist and blocks placed between axle bumpers and bumper stops. Dis-
connect height control valve links and pull down to vent air from rear suspension bellows.
2. Drain the engine cooling system as directed in Section 6 of this manual, remove the cooling blower drive belt.
3. Open drain cock and vent air from the brake system. Disconnect the propeller shaft as outlined in Section 14 of this manual. Disconnect transmission and clutch operating linkage. Disconnect clutch cable. Disconnect throttle linkage.
4. Disconnect exhaust muffler slip joint. Disconnect air lines to air compressor governor and fast idle air cylinder.
5. Disconnect electrical connection to speedometer unit if used, starting motor, starting motor solenoid, alternator, engine controls, tachometer (if used), oil pressure and engine temperature sending units. If the engine is an electronically controlled model (DDEC), disconnect the main DDEC harness from the electronic control module which is on top and to the front of the engine.
6. Disconnect and remove cooling system connections to radiators, surge tank and cooling system heating unit. Disconnect fuel supply and return lines. Remove connections between air cleaner and engine air inlet horn.
7. Remove the air conditioning compressor drive belts. Raise the car approximately 4-6" (101.6-152.4 mm) above the road height.
8. Remove the clamp bolts securing the engine sub-frame to the body. Position the body under the engine cradle. Lower the coach body only sufficiently to transfer the weight of the engine onto the dolly.

CAUTION: Due to the minimum clearance between the air compressor and the top of the engine compartment, extreme care should be used to lower the coach body only enough to free the engine cradle. Clearance between engine cradle and coach engine mounting rail should be 1/4" (3.1-6.3 mm).

9. Remove engine assembly as a unit, carefully withdrawing it from the rear of the coach. To reinstall, the procedure is the reverse of the above.
10. Refill cooling system. If engine fuel system has been drained, it will air restarting if fuel filters are filled with fuel oil. Remove vent plugs and pour fuel oil into filter body until filters are full.
11. Start engine and check operation. Check fuel and cooling system connections for leakage. Test operation of engine controls and accessories.

Diesel Engine Lubricating Oils

The oil capacity of coaches equipped with a 6V-92 engine is 30 U.S. quarts (28.2 liters). Coaches equipped with an 8V-71 or 8V-92 engine have an oil capacity of 32 U.S. quarts (30.28 liters). Oil is added through the oil fill tube (figure 8-2).

All diesel engines require heavy-duty lubricating oils. Basic requirements of such oils are lubricating quality, high heat resistance and control of contaminants.

Lubricating Oil Recommendation

<table>
<thead>
<tr>
<th>API Service Classification</th>
<th>Military Specification</th>
<th>SAE Grade</th>
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<tbody>
<tr>
<td>CB</td>
<td>MIL-L-2106A (Supplement 1)</td>
<td>40 or 30</td>
</tr>
<tr>
<td>CC</td>
<td>MIL-L-2106B</td>
<td>40 or 30</td>
</tr>
<tr>
<td>CD/SC</td>
<td>MIL-L-2106C</td>
<td>40 or 30</td>
</tr>
<tr>
<td>CD</td>
<td>MIL-L-45198 (Series 3)</td>
<td>40 or 30</td>
</tr>
<tr>
<td>CC/SE</td>
<td>MIL-L-46152</td>
<td>40 or 30</td>
</tr>
<tr>
<td>Numerous</td>
<td>Universal</td>
<td>40 or 30</td>
</tr>
</tbody>
</table>

SAE 40 grade oil is recommended in 8V-71 and Series 92 diesel engines. The expected ambient temperatures and engine cranking capability must be considered by the owner-operator when selecting the proper grade of oil. Only when the ambient temperatures and engine cranking capabilities result in difficult starting should SAE 30 grade oil be used.

The 8V-71 and Series 92 engines have given optimum performance and experienced the longest service life with the following oil operations: fifteen hours of operation not exceeding the following ash and zinc limits: The sulfated ash limited (ASTMD-874) shall not exceed 1.000% by weight, except lubricants that contain only barium or metallized dispersants, which limit is 5.000% by weight. The zinc content, as zinc diorganophosphate shall, be a minimum of 0.07% by weight.

Lubricants meeting specification MIL-L-16167 are used in Alaska and other extreme sub-zero locations. Generally they may be described as W-15 multigrade lubricants made up of synthetic base stock and having low volatility characteristics. Although they have been used successfully in some severe cold regions, they are not recommended as desirable as SAE 40, or SAE 30 oils with auxiliary heating aids. For this reason, they should be considered only where engine cranking is a severe problem and auxiliary heating aids are not available on the engine.

Polycy on Lubricant Additives

TMC/MCI does not recommend or support the use of any supplementary lubricant additives. These include all products marketed as top oils, break-in oils, graphitizers and friction-reducing compounds.

Servic and Inspection Intervals

Generally, operating conditions will vary for each engine application, even with comparable mileage or hours and, therefore, maintenance schedules can vary. A rule of thumb for piston, ring and liner inspection, however, would be at 45,000 miles (72,416 km) or 1,500 hours for the first such inspection and at 30,000 miles (48,280 km) or 1,000 hour intervals thereafter.

A suggested preventive maintenance practice is a regularly scheduled testing of fuel and lubricating oils by either the oil supplier or an independent testing laboratory. Since the oil supplier knows the physical properties of his products and maintains laboratories to determine practical oil drain intervals, this advantage of this service and request him to check drained oil samples frequently and report the results to you.

Engine Mounts

The engine is mounted to the engine cradle by means of six rubber mounts, two on each side of the flywheel housing and two at the front of the engine (rear of the coach). See figures 8-3 and 8-4.
These rubber mounts should be replaced whenever the
engine is removed from the coach (e.g., clutch change, etc.). The following procedure is recommended for replacement of
motor mounts:
1. Remove the existing rubber mounts from brackets.
2. Lubricate new rubber mounts with water and place in
position between bracket and engine cradle. By use of a small
jack under the cradle, the mounts may be installed in engine
bracket.

CAUTION: To properly insert the engine mounts,
only water should be used as a
lubricant. Insertation of the mounts into
the socket using glycerine or any other lubri-
cant will result in the tail of the mounts
flaking out from the rubber rupturing or a
potential rupture after each installation.

3. Install engine mount bolts with new retainer bushing but
should not tighten until the full weight of engine is bearing on cradle
assembly.

Improper installation of the press fit type motor mounts can
contribute to excessive engine vibration. When new mounts are
installed, mount bolts should be left loose until engine can be
run for a short period of time. If engine is accelerated a few
times, the rubber mount will find its correct position and
then mount bolts can be torqued and cotter keys installed.

4. When reinstalling the engine cradle assembly, the body
tie bar should be installed before attempting to tighten cradle
U-bolts, the center U-bolts should be tightened first.

If motor-mount studs are being installed in the transmission
case, turn the studs in until they "shoulder out." Check to
ensure each stud has reached full thread engagement and
snug up by 3/4 turn. Motor-mount bracket and hard-
ware can then be installed. Tighten lock nuts to 170-198 ft. lbs.
(231-268 Nm) torque.

TWO SPEED GOVERNOR ADJUSTMENT
(Mechanically Controlled Engines)

The service procedure below provides the necessary inspec-
tion instructions for obtaining the maximum operating ef-
ciciency of the two speed governor (figure 8-5). This procedure
should be accomplished every 30 months or every 50,000 miles
(80,000 km), as part of regular coach maintenance.

The engine speeds specified in this procedure are recom-
mended as follows: High maximum no-load speed 2250 rpm;
low maximum no-load speed 1850 rpm. The 2250 rpm is
achieved by a shim pack inside the two speed governor. Adding
shims increases the high maximum no-load and taking shims
out decreases the speed. The low maximum no-load engine
speed is achieved by an adjusting screw (see figure 8-6).

NOTE: The 2250 rpm is required for coaches equipped
with the later version automatic transmission (MT-740), unless the trans-
mision shift points have been adjusted downward. The 1850 rpm will give a coach
high speed of approximately 67 mph when equipped with a
3.33:1 rear axle.

![Figure 8-5. Location of Governor.](image)

**GOVERNOR ASSEMBLY**

1. The engine injector control levers should be set in accord-
ence with DDA Service Manual 6SE350, Section 14.3. Make
sure the fast idle cylinder projects 3/4" (15.88 mm) from the
lock nut to prevent interference while adjusting the maximum no-
load speeds.

2. Start the engine and allow it to reach normal operating
temperature.

3. Refer to figure 8-6. Disconnect the air line to the
two speed governor spring housing.

4. Set the speed control lever (figure 8-7) in the maximum
speed position. Using a tachometer, check and record the
engine rpm. This is the maximum no-load low engine speed
(approximately 1850 rpm) which will be restored at the end of
this procedure.

![Figure 8-6. Engine Parts Breakdown.](image)

5. Return the speed control lever to the low speed setting
and turn the engine off.

6. Connect the air line previously removed from the gover-
nor spring housing.

7. Start the engine and place the speed control lever in the
maximum position. Check and record the engine rpm (maxi-
mum no-load high engine speed -- recommended to be 2250
rpm). Turn the engine off.

8. Determine the shims required for the 2250 high maximum
no-load speed engine speed. Each 0.010-inch shim added or taken
from the shim pack will increase or decrease engine rpm 10 rpm. Shims 0.010-inch thick change engine speed approximately 100 rpm.

NOTE: The shim pack is inside the two speed governor, DDA part number of
the 0.010-inch shim is #123922. The 0.100-inch shim's part number is #123923.

9. Disconnect the air line to the governor spring housing.

10. Remove the two capscrews mounting the housing to the
governor and remove the housing. Refer to figure 8-8.

11. Place the housing on a clean work surface and separate
the retaining and sleeve from the piston. The shim pack
is located inside the piston, between the piston and the sleeve.

12. Add to the shim pack (or take from it) the number of shims
necessary for a high maximum no-load speed of 2250 rpm.
Reassemble the shims, sleeve, retaining and piston in the
housing.

13. Install the housing with the gaskets on the governor and
clean the air line.

14. Place the main battery switch in the ON position.

15. Start the engine and allow it to reach normal operating
temperature.

NOTE: Do not increase engine idle speed
more than 15 rpm with fast idle cylinder.

16. Place the speed control lever in the high speed position
and check for the recommended high maximum no-load speed
(2250 rpm) with the tachometer. If the speed is too high or too
low, repeat steps 7 thru 14 to add or take out shims.

17. Place the speed control lever in the low position and turn
off the engine.

18. Disconnect the air line to the governor spring housing
and start the engine.

19. Place the speed control lever in the high speed position
and check the low maximum no-load speed with the tachome-
ter. Adjust the low maximum no-load speed adjusting screw (on
the governor spring housing) for 1850 rpm or the engine speed
that was recorded in step 4.

20. Reconnect the air line to the housing and install the
locking wire.

NOTE: Major changes in the shim pack
thickness may change the settings of the
governor gap, injector rack control levers,
idle speed and buffer screw. Refer to sec-
tion 14 of the applicable DDA engine man-
ual to adjust the above items.
CAUTION: Exercise care in removing the spring housing so that the mounting gaskets are not damaged.

3. Remove the two capscrews mounting the housing to governor and remove the housing. Keep the internal parts with the housing when removing the housing from the governor.
4. Remove any cylinders and/or auxiliary devices mounted on the governor cover.
5. Remove the eight cover screws and lift the cover, with the stop lever and cover gaskets, from the governor

CAUTION: The retainer to be removed in Step 6 is under spring tension from inside the governor. Use adequate counter-force when removing it to prevent the expulsion of parts due to internal spring pressure.

6. Refer to figure 8-8. Remove the spring retainer from the governor governor by rotating it counterclockwise. Use DDA special tool J-1652-01.
7. Refer to figure 8-8. Remove the two-speed governor spring assembly from inside the governor. Keep the parts intact as you guide them through the hole in the governor wall.
8. Disassemble the parts necessary to isolate and remove the high-speed spring. Do not change the location of the lock nut on the set screw.
9. Replace the old spring. Check that the color code on the new spring is red and brown.
10. Reassemble the parts. Make sure the adjusting pin seats properly in the plunger (figure 8-8). Insert the assembly through the hole and into position inside the governor.
11. Place the retainer over the spring and compress it to start the threads into the hole of the governor. Tighten the retainer securely.
12. Install a new gasket P/N 8924869 and reinstall the governor cover with the eight bolts.
13. Install the spring housing with the gaskets on the governor. Connect the air line.

NOTE: Replacing the high speed spring may change the settings of the Governor Gap, Injector Rack Control Levers, Maximum No-Load Engine Speed, Idle Speed and Buffer Screw. Refer to section 14 of the applicable DDA engine maintenance manual to adjust the above items.

14. Start the engine and check for normal operation. Stop the engine and install a new locking wire. This completes the procedure.

FAST IDLE OVERRULE AND ENGINE SHUT-DOWN VALVES AND CYLINDERS

COLD WEATHER ETHER START SYSTEM

DESCRIPTION
Cold weather starting is facilitated by the injection of ether into the engine. Ether travels through a line from the ether solenoid valve to an atomizer which is installed in the engine blower housing. A replaceable ether bottle is connected to the solenoid valve.

OPERATION
The coach must be in the start mode (main switch "ON") and the ether switch at the driver’s instrument panel must be depressed before the ether injection process will occur. The ether start switch is wired to the starting circuit and becomes inoperative after the engine is running and fuel pressure reaches 9 p.s.i., preventing ether injection during normal engine operation. Additionally, the ether system thermostat, which is surface mounted at the water pump housing, must be sensing a temperature of 60° + 6°F before the solenoid valve will open and allow ether to flow to the engine. Refer to the wiring diagram for the ether start system in Section 7 of this manual.

FAST IDLE OVERRULE 1 AIR CYLINDER

SHUT-DOWN AIR CYLINDER

SENDER UNIT MANIFOLD

The sending unit manifold is mounted in the engine compartment upper frame to provide additional protection to sending units. Figure 8-13 shows the manifold with the 3 lb. oil tell-tale sending unit, oil pressure gauge sending unit and the manual oil pressure gauge.

Figure 8-12. Engine Control System.

Figure 8-13. Sending Unit Manifold.

Figure 8-14. Pressurized Ether Starting System.
MC-9 MAINTENANCE MANUAL

MISCELLANEOUS ENGINE TORQUE VALUES

(For complete engine specifications refer to the appropriate Detroit Diesel Engine Service Manual)

Crankshaft Pulley Bolt .................................................. 300 lb-ft (407 Nm)
Crankshaft Pulley to Hub Bolts .................................. 35 lb-ft (47 Nm)
Front Motor Mount Bolts (8V-92) ................................. 180 lb-ft (244 Nm)
(Rear of Coach) ................................................... 225 lb-ft (308 Nm)
Rear Motor Mount Bolts (8V-92) .................................. 30 lb-ft (41 Nm)
Front Motor Mount Bolts (6V-92 & 8V-71) ................. 225 lb-ft (308 Nm)
(Rear of Coach) ................................................... 225 lb-ft (308 Nm)

FAST IDLE SOLENOID AND CYLINDER SPECIFICATIONS

Solenoid
Manufacturer .................................................. Bendix
Model .......................................................... V6C-4830
Voltage ......................................................... 8V

Air Cylinder
Manufacturer .................................................. B.F. Goodrich
Model .......................................................... 93x-17
20-1 Engine Dolly
Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of bulletins pertaining to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

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