6.10 CHARGE AIR COOLER

On vehicle and industrial engines, a CAC (charge air cooler) is normally mounted ahead of the cooling system radiator. On keel-cooled marine engines the charge air cooler is incorporated into the keel cooler tank. On heat exchanger-cooled engines, the charge air cooler is part of the intake manifold. The compressed air leaving the turbocharger is directed through the CAC before it goes to the air inlet side of the intake manifold. See Figure 6-65. Refer to section 4.4 for CAC Water Pump.

Figure 6-65  Typical Charge Air Cooler
The CAC is used to reduce the temperature of the compressed air leaving the turbocharger before it reaches the intake manifold. This permits a more dense charge of air to be delivered to the engine.

Cooling is accomplished by incoming air flowing past the tubes and fins of the charge air cooler. The compressed intake charge flowing inside the CAC core transfers the heat to the tubes and fins where it is picked up by the incoming outside air (vehicle and industrial engines) or raw water (marine engines). See Figure 6-66. See Figure 6-67 and see Figure 6-68.

![Radiator—mounted Charge Air Cooler Cross-section](image)
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1. Hose</td>
<td>8. Gasket</td>
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<tr>
<td>2. Elbow</td>
<td>9. CAC Matrix</td>
</tr>
<tr>
<td>3. Gasket</td>
<td>10. Housing Lower</td>
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<tr>
<td>4. Sleeve</td>
<td>11. Sensor</td>
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<tr>
<td>5. Seal Ring</td>
<td>12. Seal Ring</td>
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<td>15. Bolt</td>
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</tbody>
</table>

**Figure 6-67** Heat Exchanger Charge Air Cooler and Related Parts
1. Bracket, Charge Air Cooler Mounting  
2. Charge Air Cooler  
3. Tube, Charge Air Cooler Air Inlet  
4. Bracket, Charge Air Cooler Rear Mounting  
5. Gear Case  
6. Gear Case Cover  
7. Tube, Charge Air Cooler Air Inlet  
8. Inlet Tube, Raw Water

Figure 6-68 Keel—Cooled Commercial Marine Charge Air Cooler
On diesel engines, flexible rubber couplings and hose clamps are used to secure the ductwork to the turbocharger, the CAC inlet and outlet, and the intake manifold.

Ductwork is used to transfer the air from the turbocharger outlet to the CAC, and from there to the intake manifold. See Figure 6-69. See Figure 6-70.

**Figure 6-69** Radiator—mounted Charge Air Cooler and Related Parts (Series 60 Diesel Engine)
1. Raw Water Pump
2. Charge Air Cooler Outlet Pipe
3. Charge Air Cooler
4. Charge Air Cooler Inlet
5. Air Intake Manifold

Figure 6-70 Keel—Cooled Charge Air Cooler and Related Parts (Series 60 Diesel Engine)
For the Series 60G Genset engines, hoses connect steel piping from the turbo to the CAC, and from the CAC to the throttle. See Figure 6-71.

Figure 6-71  Charge Air Cooler and Related Parts (Series 60G Engine) Genset
6.10 CHARGE AIR COOLER

6.10.1 Repair or Replacement of Charge Air Cooler

Refer to the OEM guidelines for CAC repair and replacement procedures.

6.10.2 Removal and Cleaning of Charge Air Cooler

Refer to the OEM guidelines for CAC service procedures.

6.10.2a Inspection of Charge Air Cooler System

The CAC system must be routinely inspected for broken hoses, loose clamps and dirty/obstructed coolers. Damage to any of these components or obstructions require immediate repairs.

⚠️ CAUTION:

To avoid injury while performing the test or procedure, wear adequate eye, face protection, and heat-resistant gloves.

Inspect the charge air cooler CAC system as follows:

1. Air inlet adaptor plugs should be constructed to fit into the charge air cooler plumbing between the turbocharger compressor-out location and the charge air cooler. See Figure 6-72.

2. The adaptor should be fitted with an accurate 0-414 kPa (0-60 psi) gage and air coupling see Figure 6-72.

3. The air pressure regulator should be used in line with the shop air supply to control the test pressure.

4. After the adaptor is attached to the hose at the turbocharger compressor-out location, the air inlet system should be charged to 172 kPa (25 psi) air pressure.

5. A water/soap solution should be applied (sprayed) at each hose connection across the face of the charge air cooler and at the intake manifold/head mating area. All welds on the charge air cooler and the tube header areas should be carefully checked for stress cracks.

6. If the intake manifold leaks it should be removed. Refer to section 6.4.2.

7. Both the intake manifold mating surface and the head port area should be cleaned. Refer to section 6.4.3.

8. After the intake manifold has been cleaned the mating ports should be checked for warpage. Refer to section 6.4.3.1.

9. Reinstall the intake manifold refer to section 6.4.4.
6.10.2b Charge Air Cooler Pressure Check

Disconnect the charge air cooler and plug the inlet and outlet. Use an adaptor plug on the inlet see Figure 6-72. The charge air cooler is considered acceptable if it can hold 172 kPa (25 psi) pressure with less than a 34.5 kPa (5 psi) loss in 15 seconds after the hand valve is turned off.

Figure 6-72 Charge Air Cooler Pressure Test Kit J 41473

1. Charge Air Cooler
2. Charge Air Cooler Inlet
3. Shop Air Inlet
4. Pressure Regulator
5. Regulated Pressure Gauge
6. On/Off Valve
7. Plug Adaptor
8. Cylinder Pressure Gauge
9. Flexable Hose
10. Quick Disconnect
11. Adaptor Plug
6.10.3  Installation of Charge Air Cooler

Refer to the OEM guidelines for CAC installation procedures.

When installation is completed, refer to section 11.8 for engine test.
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6.11 THROTTLE ACTUATOR FOR THE SERIES 60G ENGINE

The throttle actuator is used to control the amount of air and fuel mixture to the engine. A butterfly valve within the body is positioned by an electric actuator that is controlled by DDEC III/IV. See Figure 6-73.

Figure 6-73  Throttle Actuator for the Series 60G Engine