INSTALLATION INSTRUCTIONS

Original Issue Date: **1/98**
Model: **135-750 kW**
Market: **Industrial**
Subject: **Remote Radiator Cooling**

The following paragraphs provide general guidelines to consider when designing a remote radiator system. See Figure 1 for generator set model and radiator application data.

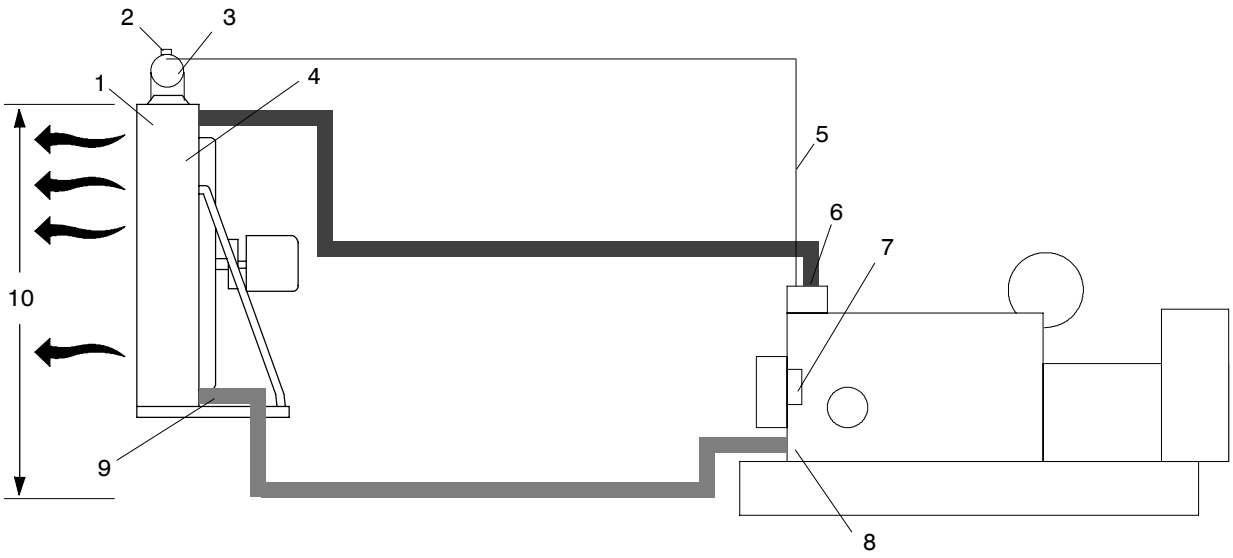
General

Use a remote radiator system for generator sets located in areas into which it is difficult to bring the volume of air required to cool a unit-mounted radiator. An electric motor-driven fan mounted on the radiator circulates air across the radiator's cooling fins. Kohler recommends wiring the cooling fan to the generator output so that the fan operates whenever the generator set operates. There is no need for thermostatic control of the fan motor because the engine thermostat prevents overcooling as it does on generator set-mounted radiator systems. Follow the NEC and local codes when wiring the remote radiator.

Cooling systems are limited by radiator cap ratings. Maximum radiator operating pressure is 138 kPa (20 psi) and maximum operating temperature is 121°C (250°F). Radiators are available for vertical (Figure 2) or horizontal (Figure 3) discharge.

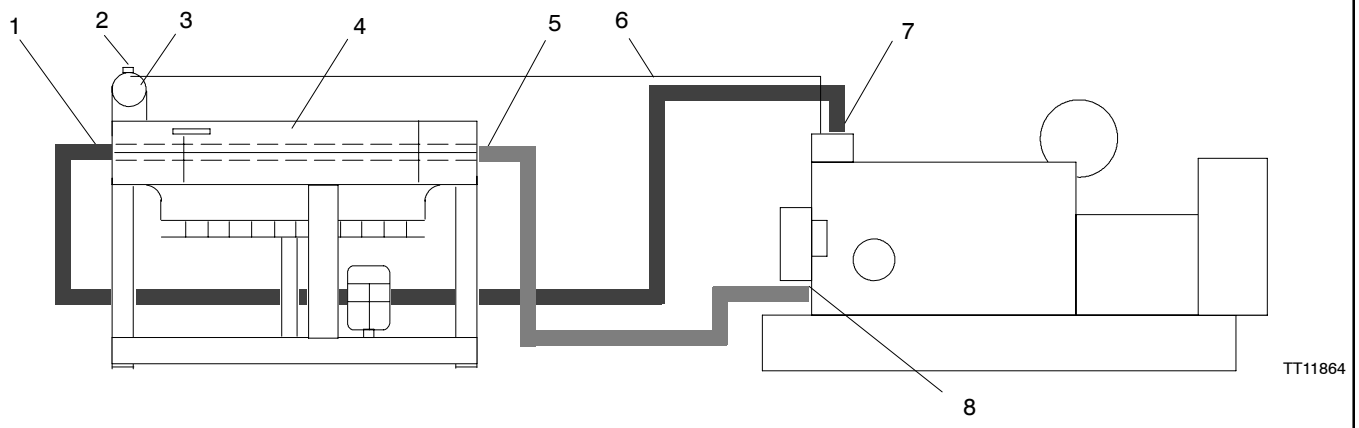
FAA CLIN	Generator Set Model	Remote Radiator Model	Voltage	Remote Radiator Kit	Remote Radiator
14.4	135ROZJ	M-5-HR-2	208	PA-354768	354777
15.4	135ROZJ	M-5-HR-2	208	PA-354768	354777
16.4	150ROZJ	M-7-HR-2	208	PA-354769	354778
17.4	150ROZJ	M-7-HR-2	208	PA-354769	354778
18.4	150ROZJ	M-7-HR-2	480	PA-354770	354779
19.4	150ROZJ	M-7-HR-2	480	PA-354770	354779
20.4	200ROZD	M-12-HR-5	480	PA-354771	354780
21.4	200ROZD	M-12-HR-5	480	PA-354771	354780
22.4	200ROZD	M-12-HR-5	208	PA-354772	354781
23.4	200ROZD	M-12-HR-5	208	PA-354772	354781
24.4	230ROZD	M-12-HR-5	480	PA-354771	354780
25.4	230ROZD	M-12-HR-5	480	PA-354771	354780
26.4	230ROZD	M-12-HR-5	208	PA-354772	354781
27.4	230ROZD	M-12-HR-5	208	PA-354772	354781
28.4	300ROZD	M-20-HR-10	480	PA-354773	354782
29.4	300ROZD	M-20-HR-10	208	PA-354774	354783
30.4	350ROZD	M-20-HR-10	480	PA-354773	354782
31.4	350ROZD	M-20-HR-10	480	PA-354773	354782
32.4	350ROZD	M-20-HR-10	208	PA-354774	354783
33.4	350ROZD	M-20-HR-10	208	PA-354774	354783
34.4	450ROZD	M-30-HR-20	480	PA-354775	354784
35.4	450ROZD	M-30-HR-20	480	PA-354775	354784
36.4	450ROZD	M-30-HR-20	208	PA-354776	354785
37.4	450ROZD	M-30-HR-20	208	PA-354776	354785
38.4	750ROZD	M-30-HR-20	480	PA-354775	354784
39.4	750ROZD	M-30-HR-20	480	PA-354775	354784

Figure 1 Horizontal Remote Radiator Kits



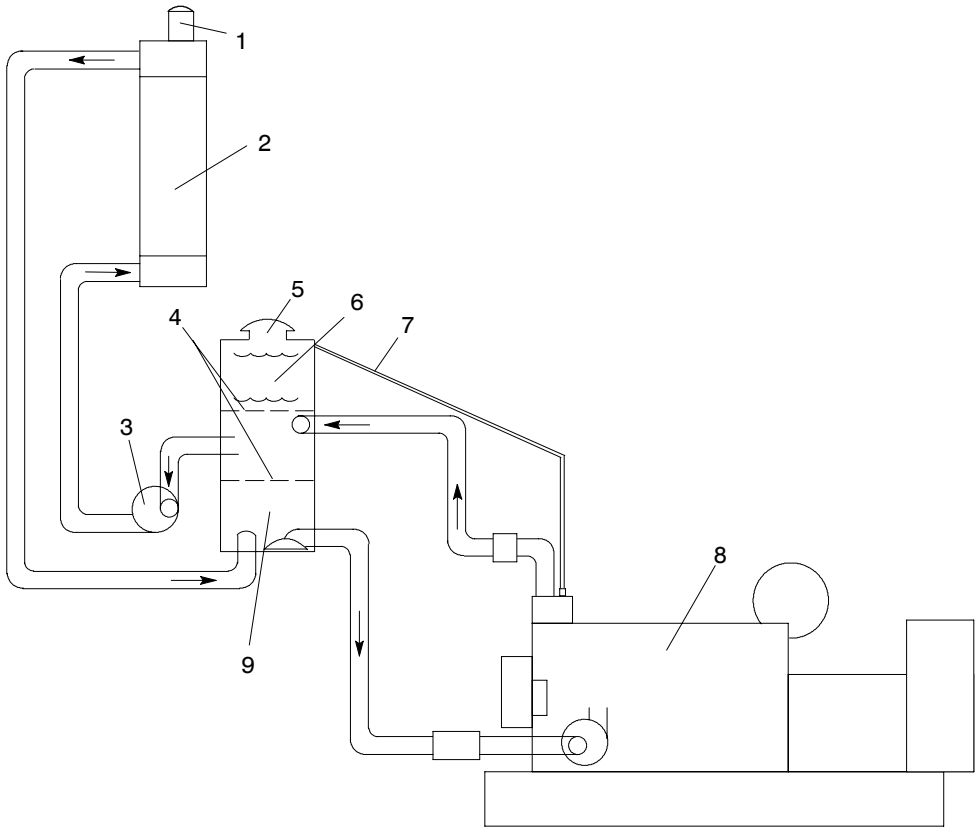
1. Remote radiator
2. Pressure cap
3. Surge tank/expansion tank
4. Vertical radiator
5. 3/8 in. vent line
6. Engine outlet
7. Engine water pump
8. Suction side
9. Radiator outlet
10. Maximum allowable vertical head (varies with engine)

Figure 2 Remote Vertical Radiator System



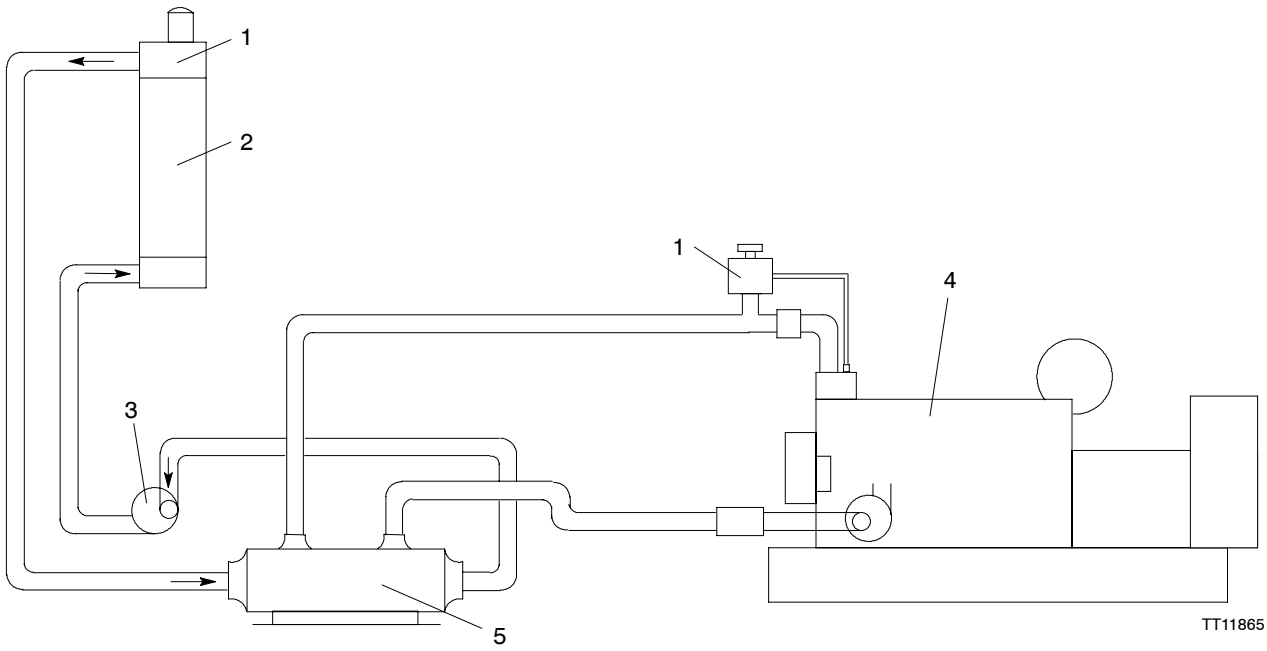
1. Radiator inlet
2. Pressure cap
3. Surge tank/expansion tank
4. Horizontal radiator
5. Radiator outlet
6. 3/8 in. vent line
7. Engine outlet
8. Engine inlet

Figure 3 Remote Horizontal Radiator System



1. Vacuum relief check valve
2. Radiator
3. Auxiliary water pump
4. Baffles
5. High volume breather
6. Expansion space
7. Vent line(s)
8. Generator set
9. Hot well

Figure 4 Compound Cooling System



1. Expansion/surge tank
2. Radiator
3. Auxiliary pump
4. Generator set
5. Heat exchanger

Figure 5 Heat Exchanger/Remote Radiator Cooling System

Remote Horizontal Discharge Radiator

Surge/Expansion Tank. Installation of a remote radiator requires the use of a surge/expansion tank. Locate the surge/expansion tank at the highest point in the cooling system. The surge/expansion tank provides venting, surge/expansion protection, and filling/makeup functions. Equip the surge/expansion tank with gauge glass, overflow tube, and pressure cap.

Size the surge/expansion tank to handle 6%–10% of the total cooling system volume.

Connect the main line from the surge/expansion tank to the highest point of the remote radiator. Most vertical core radiators have the surge/expansion tank as part of the radiator top tank. The setup in the Figure 3 illustration provides for radiator and engine deaeration and a positive pressure at the pump suction inlet. For system protection use a strainer to filter dirt, scale, and core sand from the coolant line.

Sizing

Air Requirements. Consult generator set specification sheet to determine radiator size and air requirements. Cooling air required for generator sets equipped with a remote radiator is based on 14°C (25°F) rise and an ambient temperature of 29°C (85°F). The amount of air required to ventilate the generator set room or enclosure determines the size of the air inlet and outlet. Use a ventilating fan, if necessary to dissipate generator heat loss as well as engine heat loss.

Remote radiators are sized for mounting in an open area. The remote radiator requires resizing if the inlet or outlet air is restricted.

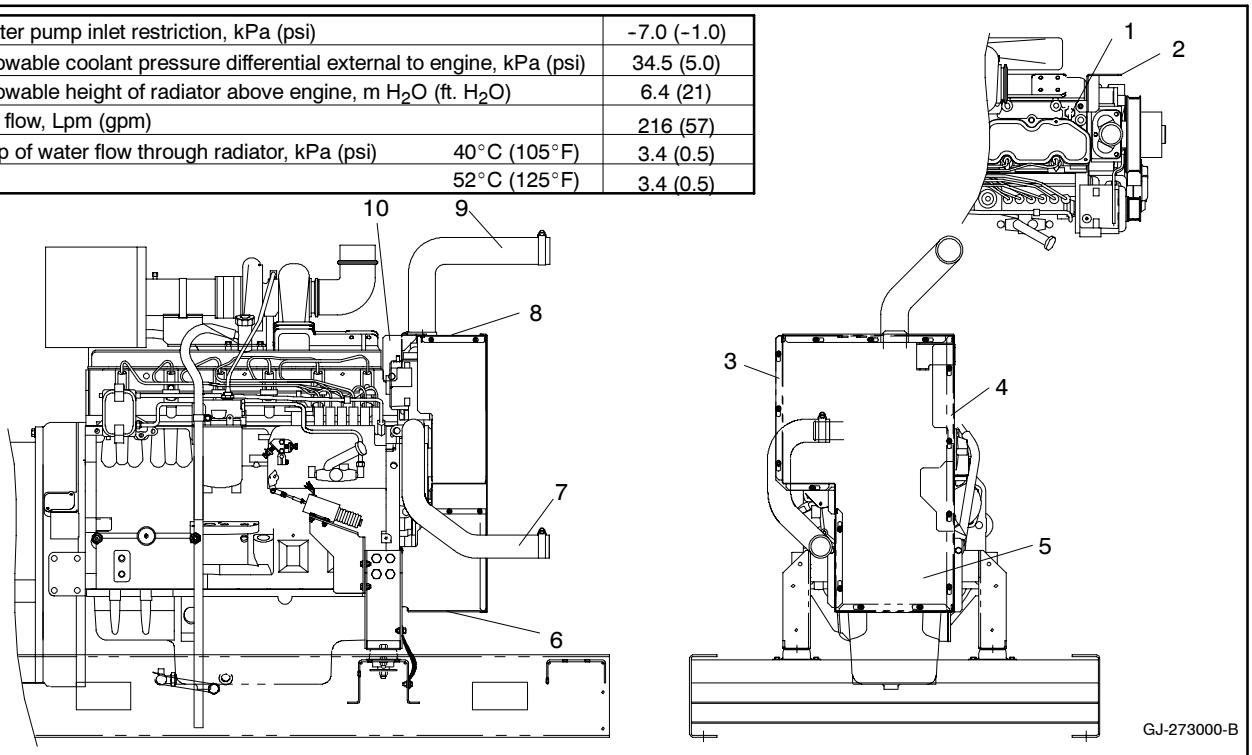
Note: All remote radiators are sized for no additional external devices on the radiator. Louvers, dampers, ductwork, etc. require resizing of the radiator.

Static Head. Use the engine water pump to circulate water through the remote radiator providing that the pressure drop through the piping and remote radiator does not exceed the engine manufacturer's limits. The allowable static head ranges from 5.2–15.2 m (17–50 ft.). Consult the generator set specification sheet and Figure 6 through Figure 11 for limits. The allowable static head is important because greater height results in excessive head pressure on engine components, causing problems such as leaking water pump seals.

Note: Detroit Diesel Engines: The maximum static head allowed on Detroit Diesel engines is 15.3 m H_2O (50 ft. H_2O). Size the pressure relief valve or cap to not exceed the limit of 149.6 kPa (21.7 psi). Consider a nonpressurized vented cap system for radiators mounted 10.7 m (35 ft.) and higher.

Note: John Deere Engines: The maximum static head allowed on John Deere engines is 6.4 m H_2O (21 ft. H_2O). Size the pressure relief valve or cap to not exceed the limit of 62.7 kPa (9.1 psi).

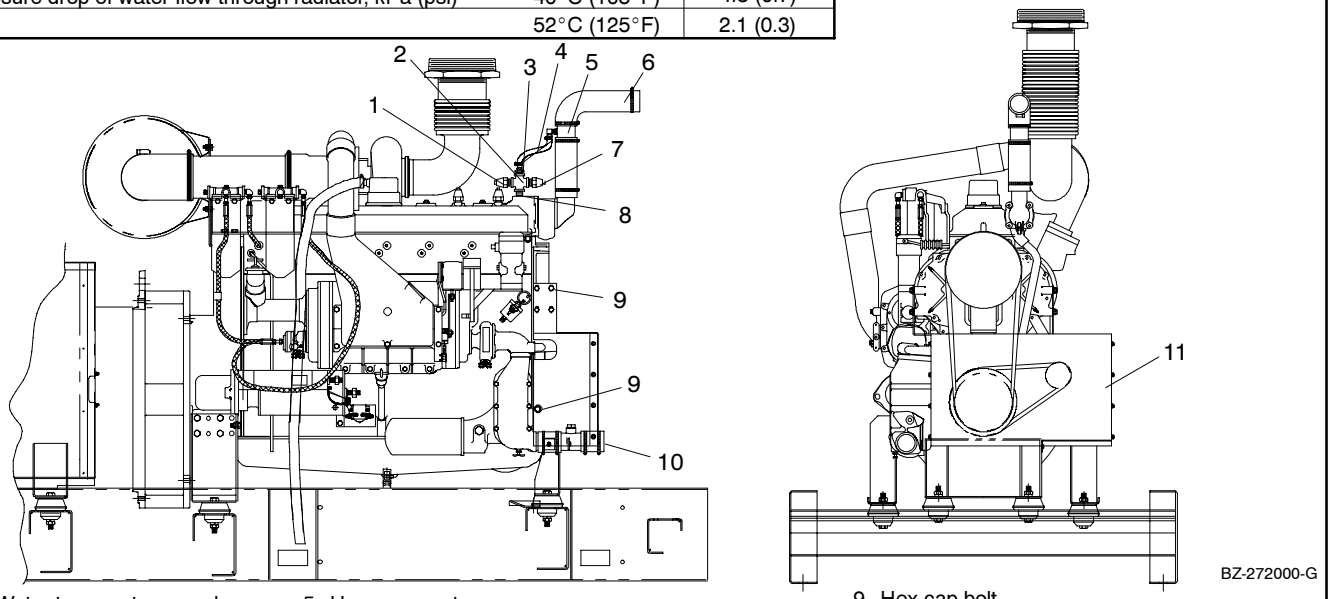
Maximum water pump inlet restriction, kPa (psi)		-7.0 (-1.0)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		6.4 (21)
Engine water flow, Lpm (gpm)		216 (57)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	3.4 (0.5)
	52°C (125°F)	3.4 (0.5)



1. Drain valve
2. Belt guard bracket
3. Right-hand belt guard
4. Left-hand belt guard
5. Front belt guard
6. Bottom belt guard
7. Lower radiator hose inlet ID 51 mm (2.0 in.)
8. Top belt guard
9. Upper radiator hose outlet ID 64 mm (2.5 in.)
10. Top mounting bracket

Figure 6 135/150ROZJ Remote Radiator Setup Kit

Maximum water pump inlet restriction, kPa (psi)		10.1 (1.5)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		15.3 (50)
Engine water flow, Lpm (gpm)		333 (88)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	4.8 (0.7)
	52°C (125°F)	2.1 (0.3)



1. Water temperature sender
2. Pipe cross
3. Reducer bushing
4. Rubber hose
5. Hose connector
6. Upper radiator hose outlet ID 57 mm (2.25 in.)
7. High water temperature switch
8. Pipe
9. Hex cap bolt
10. Hose connector and radiator hose inlet ID 57 mm (2.25 in.)
11. Belt guard

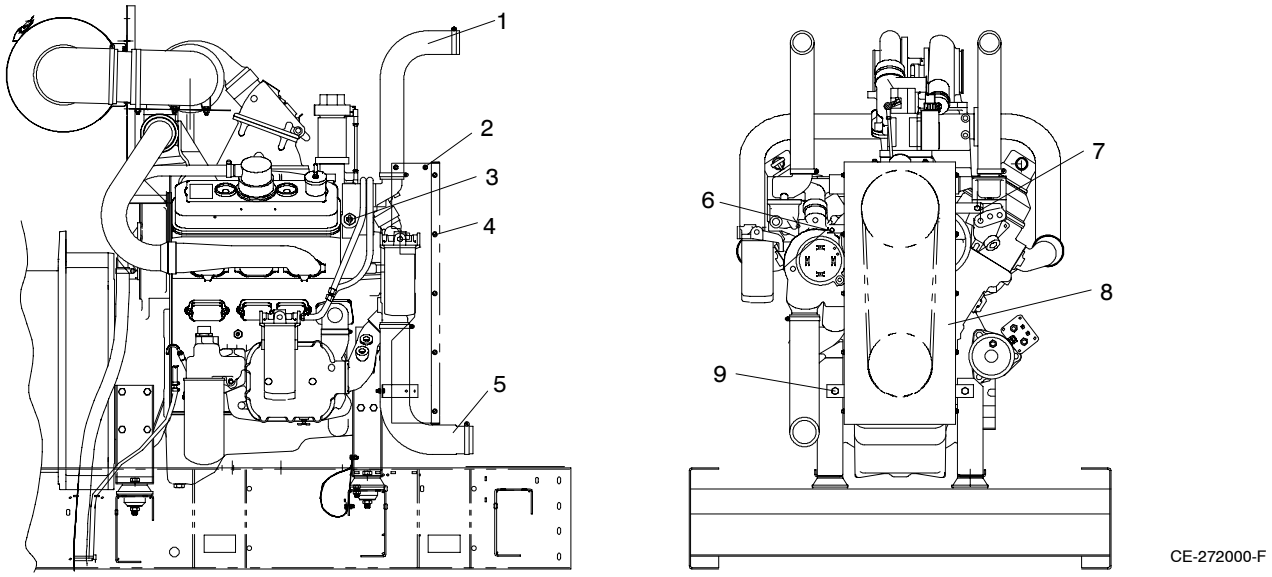
Figure 7 200ROZD Remote Radiator Setup Kit

230ROZD

Maximum water pump inlet restriction, kPa (psi)		10.1 (1.5)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		15.3 (50)
Engine water flow, Lpm (gpm)		435 (115)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	11.7 (1.7)
	52°C (125°F)	5.5 (0.8)

300ROZD

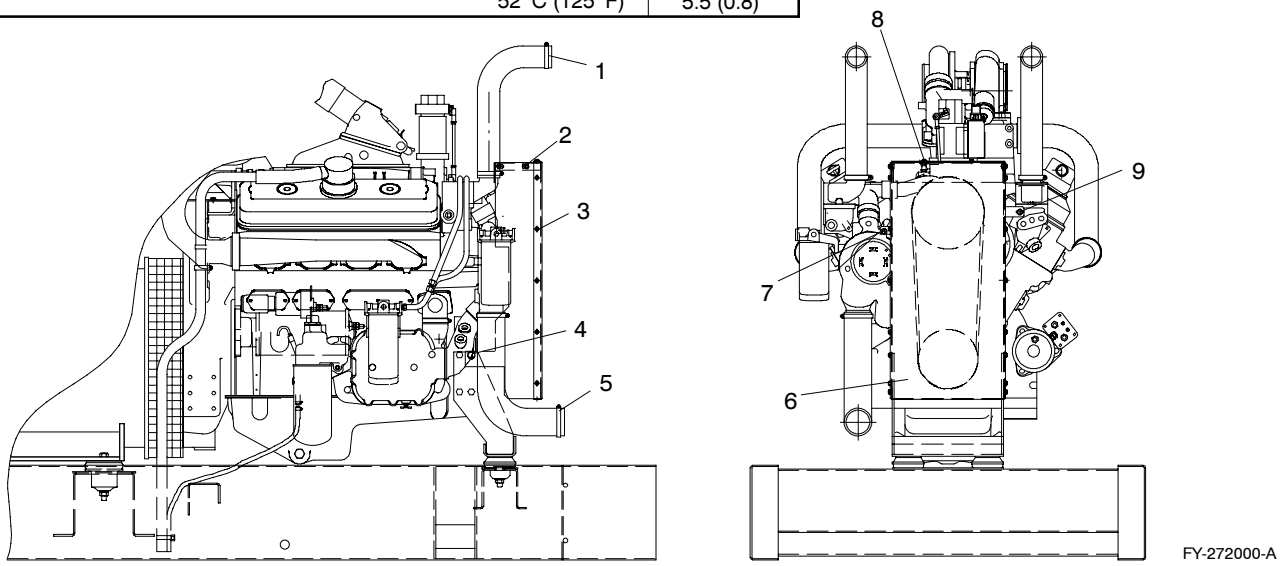
Maximum water pump inlet restriction, kPa (psi)		10.1 (1.5)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		15.3 (50)
Engine water flow, Lpm (gpm)		454 (120)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	5.5 (0.8)
	52°C (125°F)	5.5 (0.8)



1. Upper radiator hose outlet ID 57 mm (2.25 in.) and clamps
2. 1/4-20 screws
3. Reducer bushing and drain valve
4. Drill screws
5. Lower radiator hose inlet 70 mm (2.75 in.)
6. 7/16 in. washer
7. Hex cap bolt and 3/8 washer
8. Belt guard
9. 5/16-18 hardware

Figure 8 230–300ROZD Remote Radiator Setup Kit

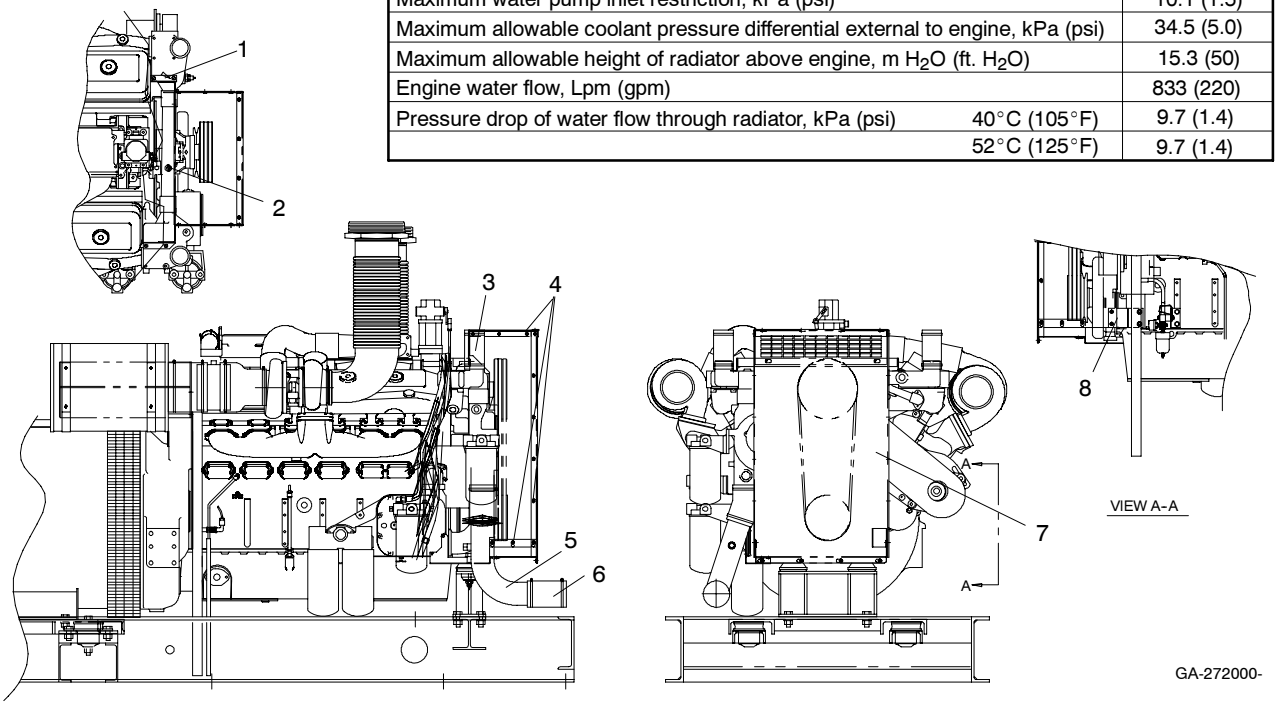
Maximum water pump inlet restriction, kPa (psi)		10.1 (1.5)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		15.3 (50)
Engine water flow, Lpm (gpm)		606 (160)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	6.9 (1.0)
	52°C (125°F)	5.5 (0.8)



1. Upper radiator hose outlet ID 57 mm (2.25 in.) and clamps
2. 1/4-20 hardware
3. Drill screws
4. Hex cap bolt and washer
5. Lower radiator hose inlet ID 76 mm (3.00 in.) and clamps
6. Belt guard
7. 7/16 in. washer
8. Drain valve
9. Hex cap screw and 3/8 washer

Figure 9 350ROZD Remote Radiator Setup Kit

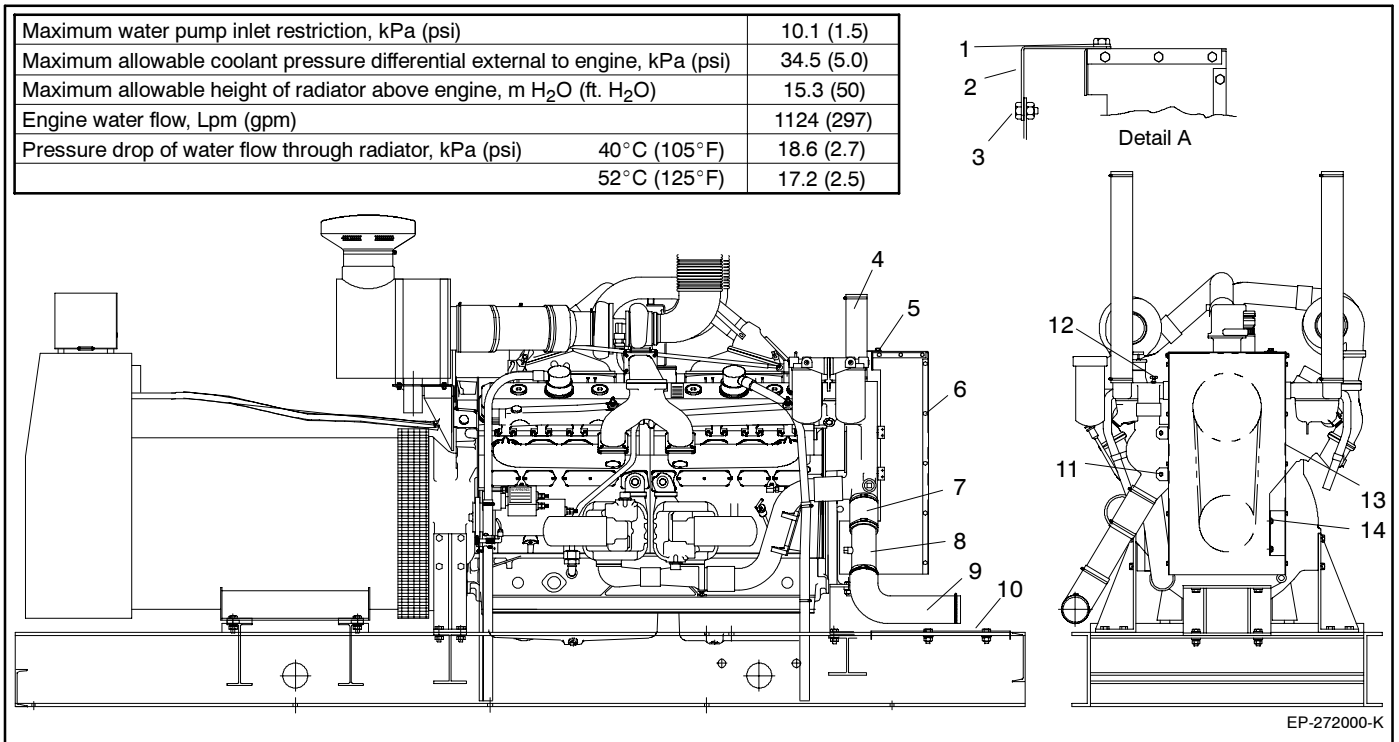
Maximum water pump inlet restriction, kPa (psi)		10.1 (1.5)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		15.3 (50)
Engine water flow, Lpm (gpm)		833 (220)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	9.7 (1.4)
	52°C (125°F)	9.7 (1.4)



1. Belt guard bracket
2. Drain valve
3. Radiator hose outlets OD 64 mm (2.5 in.) and clamps
4. 1/4-20 hardware
5. Lower radiator tube
6. Radiator hose inlet ID 89 mm (3.5 in.) and clamps
7. Belt guard
8. Belt guard bracket

Figure 10 450ROZD Remote Radiator Setup Kit

Maximum water pump inlet restriction, kPa (psi)		10.1 (1.5)
Maximum allowable coolant pressure differential external to engine, kPa (psi)		34.5 (5.0)
Maximum allowable height of radiator above engine, m H_2O (ft. H_2O)		15.3 (50)
Engine water flow, Lpm (gpm)		1124 (297)
Pressure drop of water flow through radiator, kPa (psi)	40°C (105°F)	18.6 (2.7)
	52°C (125°F)	17.2 (2.5)



1. Hex cap bolt and 1/4 washer
2. Mounting bracket
3. 3/8-16 hardware
4. Radiator hose outlet ID 76 mm (3.0 in.) and clamps
5. See bracket mounting Detail A
6. 1/4-20 hardware
7. Radiator hose and hose clamps
8. Lower radiator tube
9. Lower radiator hose inlet ID 102 mm (4.0 in.) and clamps
10. Cover plate
11. 5/16 in. washer
12. Drain valve
13. Belt guards
14. Hex cap bolts

Figure 11 750ROZD Remote Radiator Setup Kit

Piping. Size water piping between the engine and the remote radiator to eliminate the need for a booster pump. If the cooling system requires a booster pump contact the factory.

Use piping of ample size and with as few bends or elbows as possible. Use long sweep elbows or long bends.

Vent Lines. Remove trapped air in the cooling system by installing a vent line from the engine to the radiator.

Hot Well/Heat Exchanger. When vertical distances exceed the above limitations, use a hot well tank or heat exchanger and auxiliary circulating pump as shown in Figure 4 or Figure 5. Always wire the circulating pump in parallel with the remote radiator fan so that both operate whenever the generator set operates.

A partial baffle divides a hot well tank into two or more compartments. The engine pump forces heated water into the hot side and the auxiliary pump then draws the water off and forces it into the radiator. After circulating through the radiator, coolant drains back to the cold side of the well where the engine water pump removes it. A hot well isolates head pressures from the engine.

Note: The water in the hot well tank drains into the radiator when the generator set is not running.

The use of a heat exchanger and remote radiator will also isolate pressure between the engine and remote radiator.

Note: The size of the remote radiator and heat exchanger need to be designed for each application. Standard remote radiators and heat exchangers are not designed to be used together.

Location

For economical installation and operation locate the radiator as close as practical to the engine and on the same level/elevation to reduce piping, coolant, and wiring costs.

The radiator fill must be the highest point in the cooling system. Also route the vent line(s) to be at the highest point in the cooling system.

Cooling Air. Allow adequate space around the unit for cooling air entry and future service access. Plan the installation to ensure a free flow of air to and from the radiator. Locate radiator to prevent recirculation of the heated exhaust air from the radiator back into the intake stream. Locate the radiator no closer than one fan diameter from a wall, another radiator, or any other obstruction which would restrict air movement. Do not mount radiator in an area where prevailing winds might hamper the free air flow.

Mounting. Bolt the unit to a level, solid foundation. Use vibration isolators to prevent excessive vibration, if required. For a rooftop installation, avoid location near critical sound areas and near ventilation or hood exhausts.

Installation

Listed below are some basic recommendations that apply to most installations. Use them as a guide for installing a remote radiator system and to assure correct operation and long life.

- Design/size radiator for no connections to either side of the radiator. Resize radiator if adding louvers or duct work to the radiator.
- Install radiator in a location which prevents prevailing winds from affecting the free air flow.
- Level radiator assembly on a firm, solid foundation.
- Securely bolt assembly to foundation.
- Follow wiring diagram on motor. Motor rotation must match fan blade design. The manufacturer supplies most units with counterclockwise fan rotation as viewed from motor side. The fan is a blower type, blowing air from the fan side of the radiator, through the core and out the front side.
- Brace unit as needed especially in areas with strong winds.
- Consider weather conditions (possible deep snow or ice accumulation, flooding from heavy rain, etc.).
- Consider seasonal and environmental conditions (accumulation of leaves, industrial fallout, dusty areas, etc.).
- Use vibration isolators, where needed, to keep vibration from radiator or radiator vibration from other areas.
- Use hose clamps at all nonthreaded connections.
- Install remote radiator setup kit. See Figure 6 through Figure 11.

Piping

Installation. Support piping externally, not from the radiator or engine. Use piping of ample size and with as few bends or elbows as possible. Use long sweep elbows or long bends, if required. Avoid using elbows, tees and couplings.

On standard remote radiators connect radiator bottom outlets only to suction side of pump. Plumb lines to prevent air from becoming trapped in the lines. Route piping in one general direction, either upward or downward. A combination of both upward and downward piping creates air pockets in the piping. Route vent lines to the expansion/surge tank without creating low spots in the lines.

Flexible Connections. Provide flexible connections when connecting piping to the radiator assembly. Use hose clamps at all non threaded connections.

Shutoff Valve. Locate shutoff valves between the engine and cooling system to allow for isolation of both the radiator and the engine. A shutoff valve eliminates the need to drain the entire cooling system during service.

Coolant/Antifreeze

Reliable engine operation depends upon coolant maintenance. Use only clean, nonacid coolant (ethylene glycol and clean, softened water mixture).

Use coolant containing corrosion and scale inhibitors as required by the engine manufacturer. Use coolant inhibitors compatible with the coolant. Keep the coolant mixture neutral or slightly akaline with a PH value of 8 or more at all times.

Install a strainer or sediment trap to eliminate foreign matter in coolant.

Filling

For radiators designed for full deaeration, connect and fill the radiator according to the following procedure:

1. Fill radiator at the filler neck.
2. Initially, fill radiator through one of the top tank or expansion/surge tank inlets before final hose connection for faster and more positive fill-up.
3. Fill the system to cover the filler neck bottom until coolant appears in the sight glass located in the radiator top tank.
4. Check and correct any leaks in the system.

Filling without Deaeration

For radiators designed without deaeration, connect and fill the radiator according to the following procedure:

1. Initially, fill radiator through one of the top tank inlets before final hose connection for faster and more positive fill-up.
2. Fill the system to cover the filler neck bottom until coolant appears in the sight glass located in the radiator top tank.
3. Check and correct any leaks in the system.

Startup

If any problems arise during startup, immediately shut down generator set. Even after a successful startup, shut down generator set after 5–10 minutes and recheck belt tension to make sure hardware has not loosened during startup operation. Perform another recheck after 8–12 hours of operation.

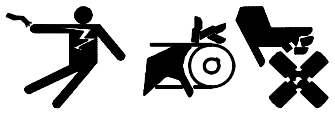
✓	Operation
	Verify cooling fan position in the fan shroud
	Check mounting hardware
	Check fan motor for free rotation
	Check V-belts for alignment and tension
	Fill system with coolant and check all connections for tightness and leaks
	Verify that all electrical connections are secure and that power source matches motor nameplate
	Verify that no foreign material is loose in fan air stream
	With unit running, check for:
	fan clearance
	excessive vibration
	excessive noise
	coolant leaks

Figure 12 Startup Checklist

Servicing

With the radiator at a remote location, the radiator is easily overlooked when the generator set is serviced. For this reason, low water alarms, or automatic *makeup* controls are often included in these systems. Use an antifreeze mixture suitable for ambient temperatures.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

Checking the coolant level. Hot coolant can cause severe injury or death. Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

Checking Coolant Level

Check coolant level at the sight glass located in the center of the top tank. Fill cooling system as required according to procedure given in this instruction. Use coolant mixture of ethylene glycol and clean, softened water as described in the engine operation manual.

Coolant Replacement

Drain the radiator twice a year and flush with a reputable radiator cleaner, and refill. Keep exterior surfaces of the cooling core clean at all times. If the cooling core becomes clogged with dirt and debris, blow dirt and debris out with compressed air. If oil is involved in the clogging of the cooling core, clean core using steam.

Inclement Weather Inspection

Perform additional maintenance for snow removal or ice buildup during snow storms or freezing rain to enable fan rotation and sufficient air flow. Inspect radiator system during and after storms.

V-Belt Tension

Make periodic V-belt checks for tension and condition. Never use belt dressing to prevent belt slippage. The dressing material causes the fabrics and rubber components in the belts to physically deteriorate.

In general, check belt tension by using a belt tension gauge. Apply a force large enough to deflect the belt 0.4 mm (1/64 in.) for every inch of belt span between two sheaves. Most belt manufacturers recommend checking belt tension at least twice during the first day of operation. Then check belt tension periodically.

Electric Fan Motor Service

The electric motor bearings are prelubricated and require periodic lubrication. Use the lubrication schedule in Figure 13.

Hours of Service per Year	Suggested Lubrication Interval
5000	Every 5 years
Continuous—normal application	Once a year
Continuous—In high ambient, or dirty or moist location; or where motor is idle for more than 6 months, and applications with high vibration	Every 6 months

Figure 13 Lubrication Schedule

Use high grade lithium-based ball bearing grease. Use consistency of grease suitable for class of insulation stamped on motor nameplate.

If fan motor is equipped with grease fitting, wipe tip clean and apply grease with a grease gun, approximately 2-3 full strokes. Keep grease clean. Do not mix petroleum grease and silicone grease in motor bearings. Add grease slowly. Use a sufficient grease volume to purge the bearing seals of old lubricant. Rotate bearing during lubrication.