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1. INTRODUCTION

PANOTO Radiators has been producing reliable and high quality products and service, under ISO 9001:2000 Quality Certificate, at its modern facilities. Radiator sets get checked and tested in every step of production to be ready for shipping.

This mounting, usage and upkeep manual is prepared for users to understand radiator, to use it safely and to renovate.

For your health and safety, please read the related chapters of the manual before carrying, mounting, connecting and upkeeping the system.

Radiator will work maximum performance and capacity as long as you follow recommendations and rules in the manual.

Please specify your suggestions and wishes to support our product and service quality.




PRODUCT MUST BE CONTROLLED WHEN RECEIVED AND SUPPLIER MUST BE INFORMED IN 7(SEVEN) DAYS IF PRODUCT IS DAMAGED OR MISSING A PART.




KEEP PRODUCT IN A DRY PLACE, WHERE BAD WEATHER CONDITIONS CAN NOT AFFECT, UNTIL MOUNTING. PLEASE TAKE PRECAUTIONS TO KEEP IT FROM DIRT AND OTHER ENVIROMENTAL EFFECTS.


1.1. PRODUCT TAG

Each radiator has its own tag which shows radiator model and serial number. Production date, part no, maximum cooling heat and weight are also written on tag. Those tag information are very important and necessary for ordering replacement part, guarantee and service needs.



 RADIATOR MACHINERY INDUSTRY & TRADE INC. CO.		
SERIAL NO		2000/EN ISO 9001 RWTÜV
ENGINE MODEL		
PART NO		 TS-2356
PRODUCT DATE		
AIR ON T.(°C)		Q.C.
WEIGHT (kg)		
FACTORY Mustafa Kurdođlu Cad. No: 18 Post Code: 34520 Beylikdüzü İSTANBUL / TURKEY		Phone : +90 212 875 09 90 Fax : +90 212 875 32 23 e-mail : info@panoto.com.tr Web : www.panoto.com.tr

2. SAFETY

	<p>RADIATOR FAN MAY PRODUCE HIGH LEVEL NOISE WHICH IS HARMFUL FOR HUMAN HEALTH. DO NOT GET CLOSE TO WORKING RADITOR WITHOUT HEADSET.</p>
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	<p>DO NOT PLACE ANY FLAMMABLE, DETONATING TOOL OR MATERIAL THAT MAY BE AFFECTED BY HOT AIR OUTPUT OF THE RADIATOR!</p>
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	<p>KEEP AWAY FROM AIR ABSOPTION AND OUTFALL LINE, WHILE COOLING IMPELLERS ARE WORKING!</p>
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 	<p>ELECTRIC SHOCK MAY CAUSE FATAL ACCIDENTS THAT'S WHY ELECTRIC JUNCTIONS OF RADIATORS WITH FAN THAT POWERED BY ELECTRICAL MOTOR MUST BE CONNECTED UNDER REGIONAL STANDARDS, INSTRUCTIONS, LEGITIMATE LAWS AND RULES BY AUTHORIZED PEOPLE. GROUNDING AND GROUNDING LINES MUST BE STRUCTURED CORRECTLY!</p>
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DESTRUCTION AND RECYCLING OF EXPIRED COOLING LIQUID OR RADIATORS MUST BE DONE BY REGIONAL ENVIROMENTAL LAWS!





DO NOT TURN ON THE SYSTEM WHEN SAFETY BLINDS ARE NOT MOUNTED TO RADIATOR!







KEEP AWAY FABRICS, SHEET METAL PIECES, NUTS, BOLTS, FLAKES AND OTHER MATERIALS THAT MAY GO THROUGH THE SAFETY BLIND FROM AIR ABSORPTION ZONE!







DAMAGED IMPELLERS OR INCORRECT MOUNTINING MAY CAUSE AN UNUSABLE CONDITION OF THE PRODUCT. HURTFUL AND FATAL ACCIDENTS MAY OCCURE DUE TO BROKEN FAN BECAUSE OF DAMAGE OR IRREGULSRITY OF BALANCE!



 	<p>DO NOT TOUCH COLLECTORS, CONNECTION PIPES, RADIATOR TANKS AND CORE BEFORE BEING SURE THAT USED LIQUID IS NOT WARM ENOUGH. HOT SURFACE MAY CAUSE SERIOUS SCALDS!</p>
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 	<p>KEEP AWAY YOUR BODY ESPECIALLY HANDS, ARMS, CLOTHS FROM IMPELLER, BELT, PULLEY AND OTHER MOVING AND ROTATING PARTS!</p>
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 	<p>BE AWARE OF CONTACT TO SHARP EDGE AND CORNERS!</p>
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 	<p>KEEP YOUR HANDS, FEET, FLOOR, WALKING OR SERVICE ZONE AROUND RADIATOR FROM OIL, WATER, ANTIFREEZE, ETC. IN ORDER TO AVOID SLIDINGS, FALLINGS!</p>
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 	<p>DO NOT OPEN RADIATOR CAP WHEN SYSTEM IS STILL HOT. COMPRESSED AND HOT WATER MAY CAUSE SERIOUS SCALDS!</p>
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 	<p>THE COOLING LIQUID THAT IS USED FOR RADIATOR IS INDUSTRIAL TYPE. TAKE MEASURES TO AVOID ANY CONTACT OF LIQUID WITH SKIN AND/OR GET INTO BODY. IMMEDIATLY ASK FOR MEDICAL HELP IF THE LIQUED GETS INTO YOUR BODY. IN CASE OF CONTACT WITH THE LIQUID, WASH CONTACT AREA WITH PLENTY OF WATER AND SOAP!</p>
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3. GENERAL APPLICATIONS

3.1. COOLING SYSTEM

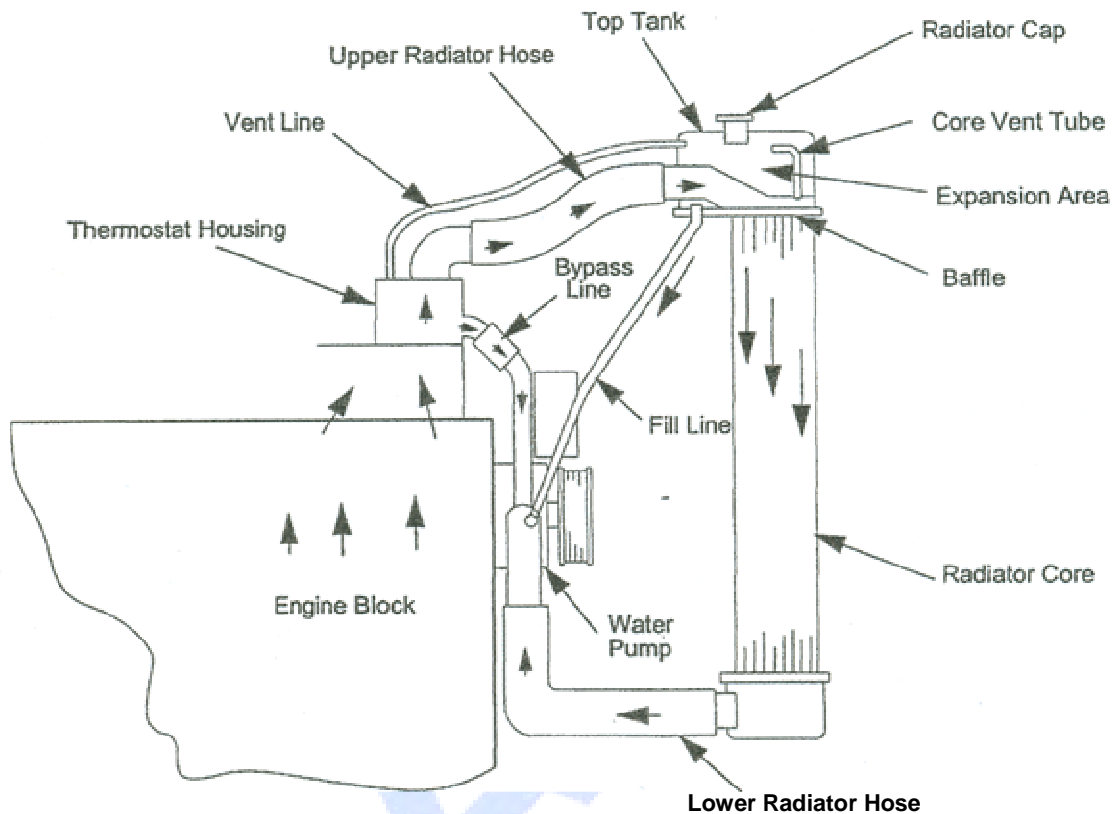


Figure 3-1
Basic cooling system

3.2. RADIATOR TYPES

1. Engine mounted radiators
 - Radiators with Belt Driven fan
 - Radiators with fan mounted to crank or water pump pulley
2. Remote mounted radiators
 - Vertical mounted
 - Horizontal mounted

4. INSTALLATION GUIDELINES

4.1. LOCATION

- D.G. room should be located considering wind direction and there should be no obstruction to natural wind flow.
- Position the generator set so that the prevailing wind do not enter into the radiator / exhaust outlet. If this is not possible, install a wind barrier. Distance of the wind barrier from the room should be at least three times radiator core height. (figure 4-1)

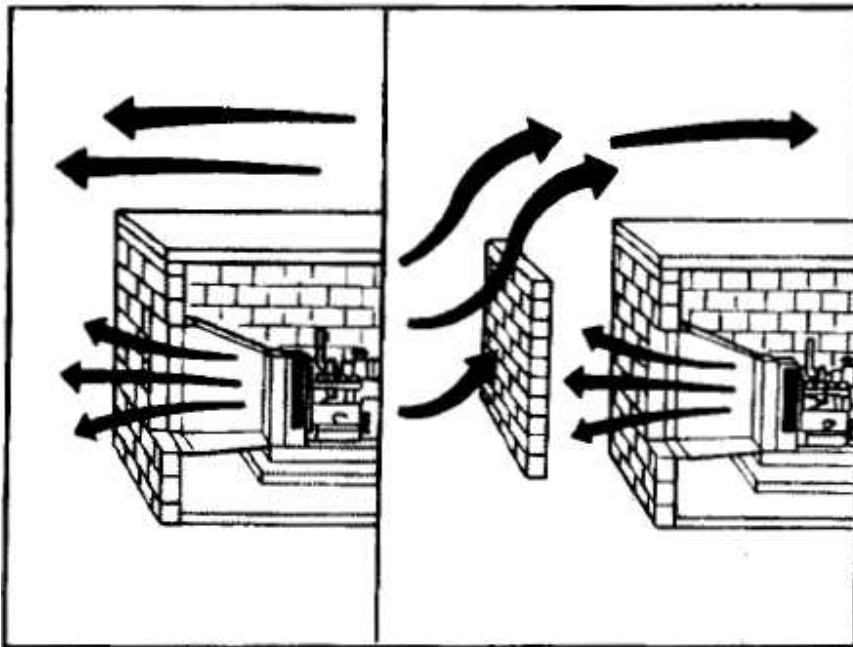


figure 4-1

- Genset should be located away from polluted atmosphere like acidic fumes, cement dust, stone dust cotton fibres, furnace chemicals etc. wherever possible.
- In case location is dusty or polluted, Heat exchanger cooled system is recommended for such installations as radiator gets clogged in dusty atmosphere.

4.2. ROOM VENTILATION

- Ventilation of the generator room is necessary to remove heat and fumes dissipated by the engine, alternator and its accessories and to provide clean and fresh combustion air. Ventilation requirement is mandatory for all engines.

Improper ventilation can lead to :

- Poor fuel efficiency
 - Poor performance of genset
 - Failures of rubber components
 - High exhaust temperature and related failures
 - Unbearable working conditions due to higher room temperatures
 - High temperature rise in generator windings and possible failures / insulation properties deterioration
- Cross ventilation and free flow of cool, clean and fresh air is must for satisfactory operation of DG set. Air should flow from alternator end to engine.(figure 4-2)

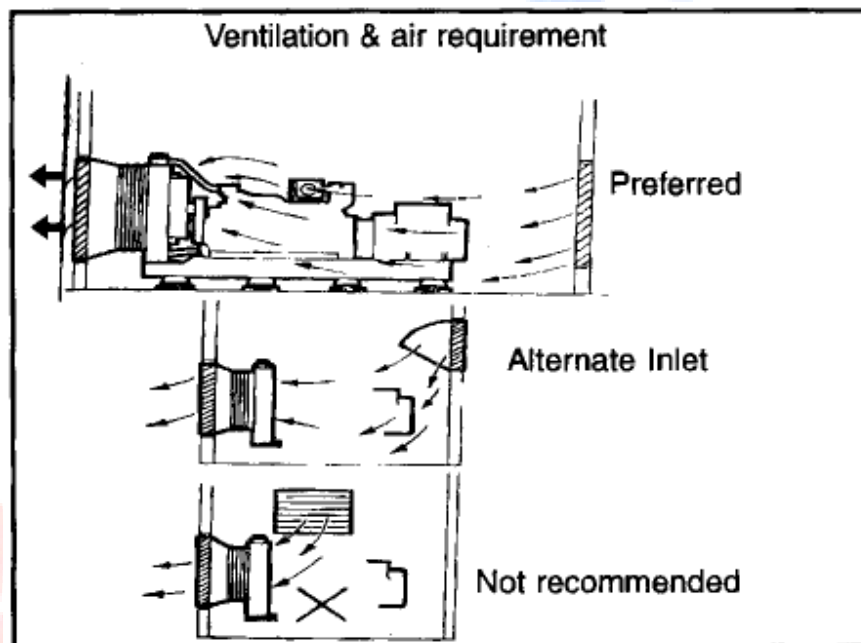


figure 4-2

- For radiator cooled engines opening in front of radiator should be 1.5 times radiator core and at back 2.25 to 3 times radiator core. Ducting in front of radiator is recommended, however it is not mandatory. If exact

opening in front of the radiator is not possible then ducting should be done to take out hot air. If opening in the back side of genset is not possible then opening on both sides of genset at the rear of the alternator may be acceptable. In this case total openings in two side walls should be at least 3 times radiator core.(figure 4-3)

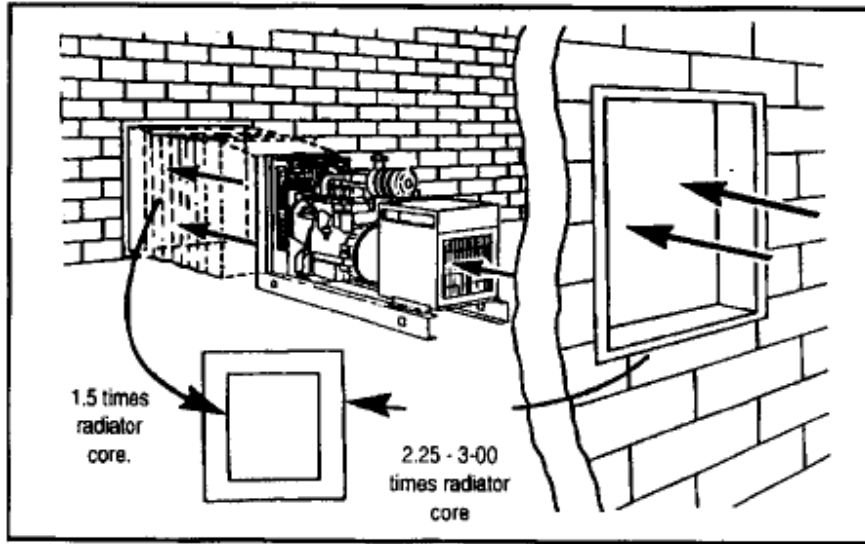


figure 4-3

- Additional ventilation arrangement may be required for radiator cooled engines installed in acoustic rooms/enclosures. Typical arrangements are shown in figure 4-4. Radiator cooled engines may create slight negative pressure inside the the genset room / enclosure. Maximum static restriction should not increase 6-mm of water column.

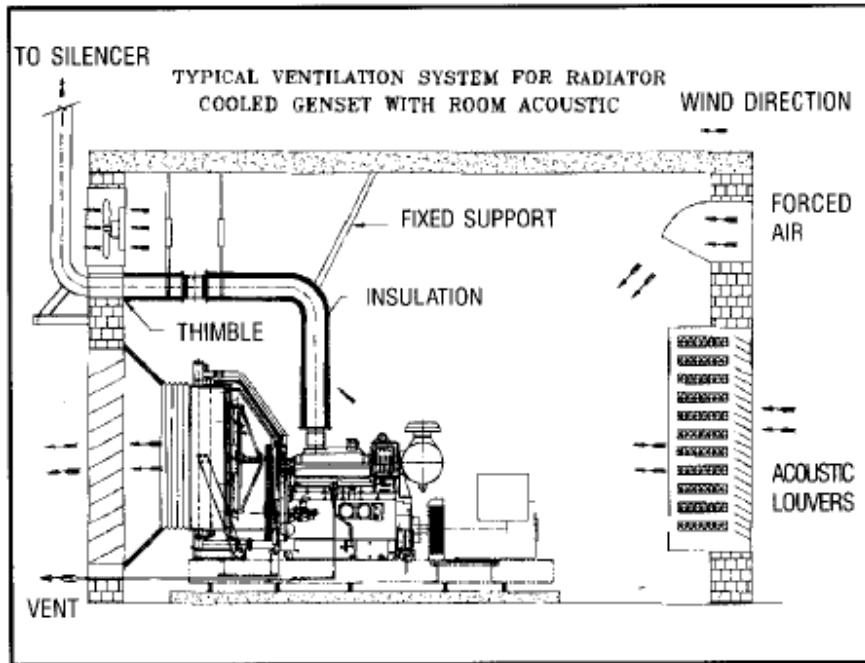


figure 4-4

- Typically for heat exchanger cooled engines, forced ventilation is required. This can be achieved by –
 - Providing forced air / axial flow fans at the rear side of the genset as shown in figure 4-5 (A). Suitable openings in front (similar to that for radiator cooled genset) should be provided.
 - Suction fan/s at front as shown in figure 4-5(B). Multiple exhaust fans may be required to generate sufficient air flow in the room. Suitable opening at rear side of genset (similar to that for radiator cooled genset) should be provided.

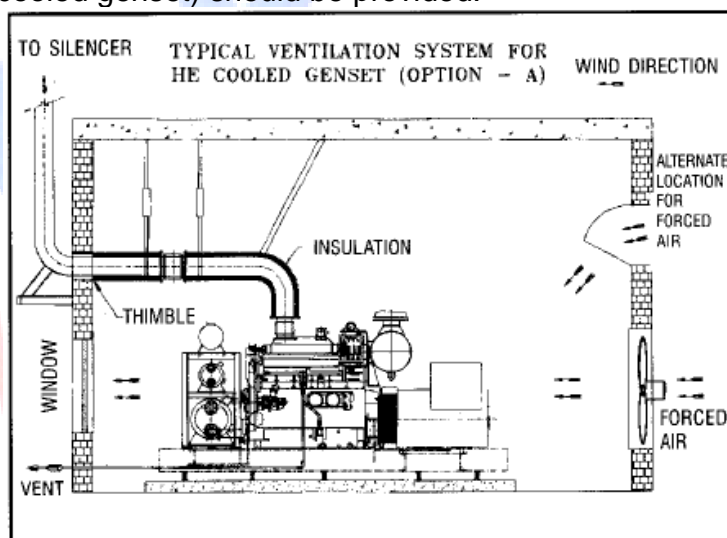


figure 4-5 (A)

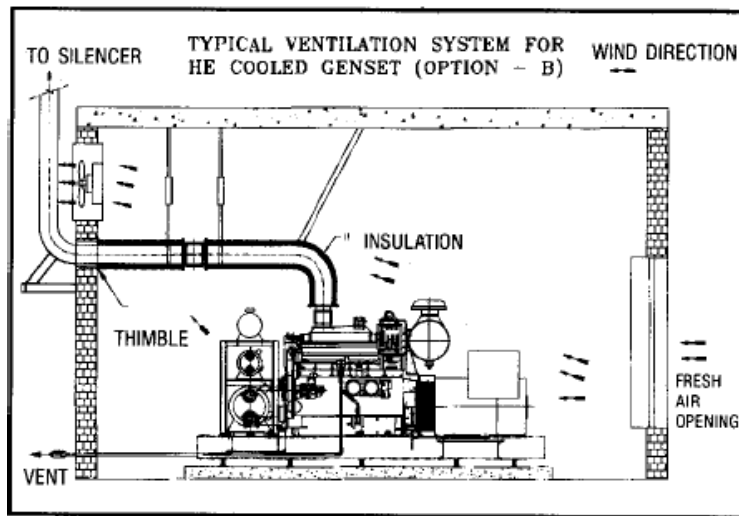


figure 4-5 (B)

4.3. Cooling System

4.3.1. Cooling System Checklist

- A. Has noise been considered?
- B. Has system piping been properly sized?
- C. Has system been properly protected from freeze up and corrosion?
- D. Have standby equipment heaters been specified?
- E. Have all electrically driven devices been connected to load side of EPS connection points?
- F. Have system drain valves and air eliminators been installed?

The system consists of the cooling medium which is generally a solution of water and ethylene glycol, a method of rejecting engine produced heat, and a means to transport cooling medium between the engine and heat rejection system. The first determination is the type of cooling system to use radiator cooling or heat exchanger cooling.

4.3.2. Engine Mounted Radiator Cooling

Engine Mounted Radiator Cooling The most simple is the engine mounted radiator shown in Figure 4-6. The radiator, water circulating pump, fan and fan drive are mounted to the Generator Set base rails by the factory. This method of engine cooling is the most economical, but may require large ventilation vents and ducts. An added advantage of this arrangement is that the cooling air removes radiated heat from the engine, generator, and other equipment located in the emergency power system room. The only remaining design work with the engine mounted radiator is arranging a method of providing air to the room, and exhausting it from the radiator.

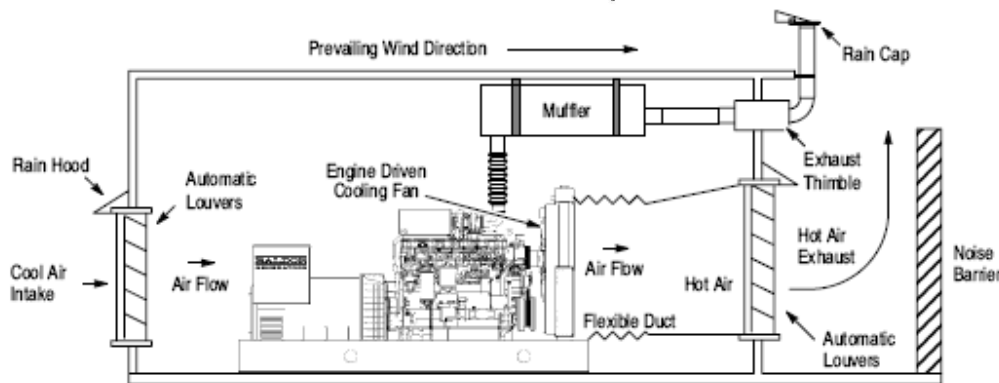


Figure 4-6

Engine Mounted Radiator Cooled System With Wind/Noise Barrier

The ideal setup for cooling air would be to arrange the inlet or inlets such that relatively clean, cool, dry air is drawn across the electrical switchgear, generator, and engine. The air is then drawn into the radiator fan, and is blown through the radiator and exhausted by duct work outside the building. Air inlets must be sized to minimize air restriction and provide the quantity of air required by the radiator fan, engine combustion air, and any other air exhausts which might be used in the room. On engine mounted radiator cooled systems, the engine mounted fan will handle 0.25 of water column. This is combined intake and exhaust restriction. The room air intakes must be located so as to minimize drawing exhaust fumes and other outside contaminants into the room. Be very cautious about the location of the engine exhausts in relation to room air intakes. Also, when locating the inlet and outlet, the consultant should consider prevailing winds and noise. Motor operated louvers or properly designed and sized gravity louvers should be used on the air intake and exhaust to minimize static pressure drop.



CAUTION !

IN COLD CLIMATES, THE HIGH VOLUME OF OUTSIDE AIR DRAWN INTO THE GENSET ROOM CAN QUICKLY REDUCE TEMPERATURES IN THE ROOM TO FREEZING. ANY WATER PIPING OR OTHER EQUIPMENT SUSCEPTIBLE TO FREEZE DAMAGE SHOULD BE PROPERLY INSULATED OR LOCATED ELSEWHERE.

4.3.3. Remote Mounted Radiator Cooling

The radiator can be mounted remotely (not mounted directly at the engine). The remote/close system uses the same radiator type except it is mounted in another room or outside the building, but within close proximity to the Genset. See Figure 4-7. The remote radiator may be mounted either vertically or horizontally. In general, the radiator will have an electric fan to provide cooling air and may be able to utilize the engine mounted coolant pump to provide coolant flow.

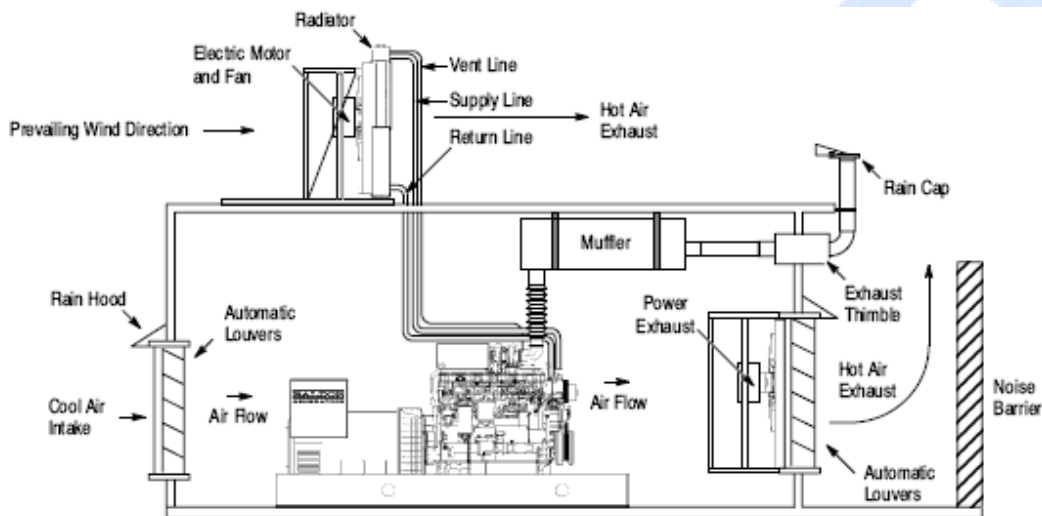


Figure 4-7

Remote Radiator Cooled System

The piping system friction and head loss between engine and radiator must be calculated and not exceed the capacity of the engine pump. If the maximum coolant friction head loss external to the engine is exceeded a hot well system must be used. Before designing the piping system using an auxiliary pump and hot well, the consultant should look very closely at increasing the system's pipe size. Electric motorized Power Exhaust louvers should be connected to the standby Genset and controlled to open whenever the Genset is running. Operable outlet louvers should be temperature actuated on remote radiator or heat exchanger cooled units. Louvers have resistance to air flow. Openings with louvers should be twice the area of an unobstructed opening to provide proper air flow. At times duct work is necessary to provide cooling air for the room. Duct work must be sized and installed according to SMACNA Standards. The electric fan and auxiliary pump, if used, must be connected to the emergency power system. Radiator and cooling fan must be sized to provide the cooling capacity required at an acceptable sound level.

Remote radiator and heat exchanger cooled engine cooling systems will not have an engine driven fan. As a result, the consultant must provide a means of supplying air to the room, and exhausting it. The air movement must be provided by an electrically driven fan. This fan may be located in the air inlet or exhaust opening. If the fan is located on the exhaust side, care must be taken to not create a high negative pressure in the room and starve the engine of combustion air.

5. OTHER CONSIDERATIONS

1. Deaeration of the coolant. This can be accomplished through the use of the system deaerators in very large systems, or simply ensuring the radiator top tank or surge tank is at the highest point in the piping system. Unvented piping systems can create air pockets which reduce coolant flow and can lead to engine overheating. Panoto furnished radiators are equipped with deaerating top tanks.
2. Flexible hoses must be installed at all engine connections and to the radiator to isolate vibration and allow for thermal expansion.
3. Drain valves must be installed at the lowest point of the cooling system to facilitate system cleaning and flushing.
4. Water treatment and antifreeze must be added to system coolant. (%70 pure water without lime , %30 antifreeze and Supplemental Coolant Additive,SCA (meeting engine manufacturer requirements)must be used in the coolant system.)
5. Coolant friction head external to the engine (pressure loss due to pipe, fitting, and radiator friction) and coolant static head (height of liquid column measured from crankshaft centerline) must not exceed the maximum values recommended by the engine manufacturer.
6. If total piping system pressure exceeds the allowable Maximum Coolant Friction Head External to the engine as listed on the Engine Data Sheet, the coolant piping size should be increased and/or a radiator with less restriction must be used.
7. Please do not use the same fan for Normal Operation (room ventilation) for a long time , you should use other fan in a periodic time , recommended period is 3 Months.(FOR UPS APLICATIONS)
8. Please place the radiator suitable for maintenance, repair and service operations.
9. PLEASE CONTACT WITH US WHEN YOU GOT ANY PROBLEM WITH OUR COOLING SYSTEM AND RADIATOR . DO NOT TRY TO FIX WITHOUT OUR KNOWLADGE.

6. INSTALLATION PROSEDURE

6.1. Engine mounted and belt driven radiator

1. Make sure the generator set is disabled
2. Remove the shipping container from the radiator assembly.
3. Remove the hardware securing the radiator to the shipping pallet.
4. Before installing the radiator the belt tension must be set.
5. Prepare the radiator for installation
 - Remove all radiator bungs
 - Attach a hoist to the lifting points or lift it from shown lifting areas by using a lifting device.




THE RADIATOR COOLING SYSTEM IS HEAVY! DROPPING THE RADIATOR ASSEMBLY CAN CAUSE SEVERE PERSONEL INJURY OR DEATH. USE A HOIST OF SUFFICIENT CAPASITY, DO NOT STAND UNDER A RISED RADIATOR AND KEEP HANDS AND FEET CLEAR OF THE PERIMETER OF THE RADIATOR WHILE MANEUVERING IT!

6. Install the radiator assembly, use a crane or similar device to lift and position the radiator.
7. Lower the radiator on to the bearer and loosely install the radiator.
8. When satisfied with the radiator position, tighten the radiator assembly hold-down bolts
9. Install the hose couplings, hose clamps to connect the radiator to the engine. Tighten the hose clamps to make sure the connections are watertight.
10. Before the radiator can be completely installed, the engine pulleys must be properly aligned.
11. Align the drive belt and the fan belt. Use a spirit level to check the horizontal alignment of the fan drive pulley.


NOTE: The installation must be level and the radiator perpendicular or the spirit level will not give correct adjustment readings.

12. Make sure that all pulleys, driver and driven are align above/below each other.
13. Install the fan, pulley and alternator guarding kit items.

	DO NOT OPERATE THE SYSTEM WITHOUT FAN,PULLEY AND ALTERNATOR GUARD KIT!
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6.2. Radiators for fan mounted to crank or water pump pulley

1. Make sure the generator set is disabled
2. Remove the shipping container from the radiator assembly.
3. Remove the hardware securing the radiator to the shipping pallet.
4. Before installing the radiator the belt tension must be set.
5. Prepare the radiator for installation
 - Remove all radiator bungs
 - Attach a hoist to the lifting points or lift it from shown lifting areas by using a lifting device.

	THE RADIATOR COOLING SYSTEM IS HEAVY! DROPPING THE RADIATOR ASSEMBLY CAN CAUSE SEVERE PERSONEL INJURY OR DEATH. USE A HOIST OF SUFFICIENT CAPASITY, DO NOT STAND UNDER A RISED RADIATOR AND KEEP HANDS AND FEET CLEAR OF THE PERIMETER OF THE RADIATOR WHILE MANEUVERING IT!
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6. Install the radiator assembly, use a crane or similar device to lift and position the radiator.
7. Lower the radiator on to the bearer and loosely install the radiator.

8. When satisfied with the radiator position, tighten the radiator assembly hold-down bolts
9. Install the hose couplings, hose clamps to connect the radiator to the engine. Tighten the hose clamps to make sure the connections are watertight.
10. Before the radiator can be completely installed, the engine pulleys must be properly aligned.
11. Align the drive belt and the fan belt. Use a spirit level to check the horizontal alignment of the fan drive pulley.

NOTE: The installation must be level and the radiator perpendicular or the spirit level will not give correct adjustment readings.

12. Make sure that all pulleys, driver and driven are align above/below each other.
13. The fan case on the radiator and the fan has to be on the same centerline. Be sure that they all at the same centerline.
14. Install the fan, pulley and alternator guarding kit items.



DO NOT OPERATE THE SYSTEM WITHOUT FAN,PULLEY AND ALTERNATOR GUARD KIT!

6.3. Remote Mounted Radiators

1. Make sure the generator set is disabled
2. Remove the shipping container from the radiator assembly.
3. Remove the hardware securing the radiator to the shipping pallet.
4. Prepare the radiator for installation
 - Remove all radiator bungs
 - Attach a hoist to the lifting points or lift it from shown lifting areas by using a lifting device.



THE RADIATOR COOLING SYSTEM IS HEAVY! DROPPING THE RADIATOR ASSEMBLY CAN CAUSE SEVERE PERSONEL INJURY OR DEATH. USE A HOIST OF SUFFICIENT CAPASITY, DO NOT STAND UNDER A RISED RADIATOR AND KEEP HANDS AND FEET CLEAR OF THE PERIMETER OF THE RADIATOR WHILE MANEUVERING IT!

5. Install the radiator assembly, use a crane or similar device to lift and position the radiator.
6. Lower the radiator on to the bearer and loosely install the radiator.
7. When satisfied with the radiator position, tighten the radiator assembly hold-down bolts
8. Install the hose couplings, hose clamps to connect the radiator to the engine. Tighten the hose clamps to make sure the connections are watertight.
9. Remote radiators are produced with electric motor driven fan. Make sure that all electrical connections are correct and also all cables are isolated.

NOTE: Do not use direct electrical connection for electrical motors! PANOTO recommends using a soft starter device or similar one to drive electrical motors.

10. Make sure that the turning direction of fan is correct.



DO NOT OPERATE THE SYSTEM WITHOUT FAN,PULLEY AND ALTERNATOR GUARD KIT!

7. MAINTENANCE

Maintenance	Period (Day)	Period (Hour)
Control the coolant level	1 week	20
Control the radiator if there is leakage	1 week	20
Control the radiator core if it's clean. If not; clean the radiator core with 1,5 - 2 bar pressured air from the opposite side of air flow.	6 mounts	250
Control the fan if there is any damage and unbalanced rotation (for models including fan)	6 mounts	250
Control the electrical motor cables and connections (for remote models)	6 mounts	250
Control the belt and belt tension (for belt driven models)	6 mounts	250
Control the cooling system generally	1 year	600
Re-lubricate the bearings and control the mounting bolts. If necessary re-tighten the holding bolts. (Lubricant grease thickener type : Lithium Complex (Lubricant base oil : Mineral) (for belt driven models)	1 year	600
Exhaust the coolant from the radiator. Clean the system. Refresh the system cooling liquid (water and antifreeze)	2 year	1200



DO NOT USE ANY HARD TOOLS TO CLEAN THE RADIATOR CORE!

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