INSTALLATION, SERVICE, MAINTENANCE AND REPAIR MANUAL

RADIATOR PART No BE5758500000 REV0

QSK95 G5 ENGINE
Contents

1. INTRODUCTION. 3
   1.1. GENERAL DESCRIPTION. 3
   1.2. ABOUT THIS DOCUMENT. 3
   1.3. SAFETY. 4
   1.4. CONTACT DETAILS. 5

2. INSTALLATION. 7
   2.1. GENERAL INSTALLATION 7

3. SERVICE REQUIREMENTS 9
   3.1. CHECKING COOLANT CONDITION AND LEVEL. 9
   3.2. FILLING RADIATOR WITH COOLANT. 10

4. GENERAL MAINTENANCE 12
   4.1. CLEANING CORES. 12
   4.2. CLEANING INTERVAL. 13
   4.3. CLEANING THE FAN/IMPELLER. 13
   4.4. CLEANING THE CORE MATRIX “AIR ON” OR OUTER FACE OF THE LTA SECTION. 13
   4.5. PRE-WASHING. 17
   4.6. WASHING. 18
   4.7. RINSING 19
   4.8. POST CLEANING. 19
   4.9. CHECKING FAN AND MOTOR UNIT CONDITION. 20
   4.10. REPLACING HOSES, CLIPS AND GROMMET SEALS. 21

5. REPAIR 22
   5.1. CORE REMOVAL AND REPLACEMENT. 22
   5.2. FILL LINE COOLER REMOVAL AND REPLACEMENT. 47
   5.3. COOLING FAN AND MOTOR UNIT REMOVAL AND REPLACEMENT. 48

6. SPECIFICATIONS 52
   6.1. WEIGHTS. 52
   6.2. DIMENSIONS. 52
   6.3. CAPACITIES. 52
   6.4. FASTENER MAXIMUM RECOMMENDED TIGHTENING TORQUES. 52

7. SPARE PARTS AND SERVICE / MAINTENANCE TOOLS 53
   7.1. SPARE PARTS LISTING. 53
   7.2. TOOLS REQUIRED FOR SERVICE AND MAINTENANCE. 54

8. FAULT FINDING 55
   8.1. ENGINE OVERHEATING. 55
   8.2. FUEL COOLER LEAKING 55
   8.3. RADIATOR VIBRATING 55
   8.4. FAN FAILURE 55

9. ELECTRICAL CONTROL EQUIPMENT 56
   9.1. DRAWINGS AND CIRCUIT DIAGRAMS 56
   9.2. SPARE PARTS LISTING. 68
1. INTRODUCTION.

1.1. General Description.
This radiator is designed to provide engine and secondary water cooling specifically for the QSK95 G5 Engines. It consists of main modules which are linked together across which two fluid circuits (Jacket water and LTA) are cooled. Cooling airflow is provided by four electrically driven cooling fans (Fig.2). Refer to chapter 6. Specification for overall dimensions and weights.

The radiator should not be used for anything other than the application described above. The radiator is specifically designed for this engine and application and as such may not perform as expected on other engines resulting in potential damage or loss of performance.

1.2. About this document.
Safe and efficient operation of the radiator can only be achieved if the equipment is properly operated and maintained. Perceived poor performance or failure of the radiator can often be caused by a failure to follow fundamental rules and precautions.

The purpose of these instructions is to provide the user with information specific to the use and operation of the radiator.
It is important to read all instructions fully before proceeding with any Service, Maintenance or Repair tasks. If in doubt please contact the manufacturer, see Section 1.4.

Note that original radiator installation to the Genset is covered in the Genset manufacturer’s assembly literature.

The information contained within this document is based upon information available at the time of issue, however the manufacturers policy of continuous product improvement may mean that the product could change at any time. The user should make sure before commencing any work that they have the latest information available, please contact the manufacturer if in doubt, see Section 1.5.
1.3. Safety.

It is the operator’s responsibility to ensure that only competent persons are employed to carry out any tasks on the radiator.

Important safety points are:

- Isolate Genset electrically before attempting any tasks. Ensure battery pack is disconnected.
- Before lifting components check the area and route and use 2 persons to lift heavy or large components when lifting aids are unavailable.
- Working at heights. Radiator parts should not be used to stand on. Use harnesses when working on top of radiator.
- Be aware of potentially sharp edges on some steel components.
- Radiator pipework and cooling surfaces are very hot during operation. Care should be taken at all times when the machine is running. Ensure radiator is cooled before starting work.
- Beware coolant and/or fuel oil contact. Risk of skin irritation if hands and/or clothing become contaminated.
- Genset environments will be noisy when running and will be above 85dBA. Wear suitable hearing protection.
- The radiator fan alone when running without inclusion of the generator noise is above 87dBA at 1m. Suitable hearing protection must be worn when engine is running.
- Operating pressure of the Genset is 16 psi (g) for both Jacket Water and LTA circuits.
1.4. Contact details.
Bearward Engineering
Main Rd
Far Cotton
Northampton
England
NN4 8HJ
Tel: +44 (0)1604 762851
General Web Enquiries: www.bearward.com
For Sales Enquiries: Sales@bearward.com
For Service Enquiries: BEN_Service@Wabtec.com
For Spare parts Enquiries: BEN_Spares@Wabtec.com
Figure 2 Front ¾ view on 5758500001 radiator showing general arrangement.
2. INSTALLATION.

This section should be read in conjunction with the installation drawings provided as part of the documentation pack and the Genset manufacturers installation literature.

2.1. General installation

2.1.1. Refer to BI-05-05-00-18 for site installation considerations and requirements. Available upon request.

2.1.2. The radiator will be shipped in two main parts consisting of a left-hand and right-hand section. Both are shipped laying on the “air off” face, secured to a transport pallet. Remove any ancillary components that are secured to the radiator for transport purposes and carefully put to one side.

2.1.3. Remove fixings securing the radiator to the transport pallet and discard.

2.1.4. Ensure appropriate lifting equipment is available to lift and position the radiator in place. Unit information including mass and overall dimensions can be found in Chapter 6. Specifications section of this document and the accompanying installation drawings.

2.1.5. Accompanying instruction PI-00-10-00-02 provides additional generic information regarding labelling, lifting and turning.

2.1.6. Ensure the radiator sections are placed onto an appropriate concrete base

2.1.7. Position the first radiator section (it does not matter which side is positioned first) in front of the engine base frame.

2.1.8. Using the installation drawing, ensure the radiator is positioned to the dimensions given using the front face of the engine block as a reference point for front-to-back positioning.

2.1.9. Side-to-side positioning can be determined from the pipe centres on the installation drawing and their stated distance to the centreline of the radiator (Noting the 200mm gap between radiator sections). The radiator position can then be marked using the pipe connection centres on the engine and measuring the distance obtained from the drawing.

2.1.10. Secure with M16 (grade 8.8) floor anchors of an appropriate specification for the concrete.

2.1.11. Position the second radiator section parallel to the first leaving a 200mm gap between the returns on the side members.
2.1.12. Secure the second section to the ground as in 2.1.10.

2.1.13. Once in position, fit all the joining plates to lock the two sections together. All connections can then be made as per the installation drawings:

5758500001_CUS SHT 1 - 4.

Hose clips are to be fitted according to: PI-15-00-00-02
Torque applied as per: BPS-20-35-10-02

2.1.14. Ensure that the unit is adequately earth bonded in accordance with EN60204-1:2006 +A1 2009, clause 8.2.1.
3. SERVICE REQUIREMENTS

<table>
<thead>
<tr>
<th>Application</th>
<th>No. of runs/year</th>
<th>Run hours/year</th>
<th>Recommended coolant level check interval</th>
<th>Recommended core clean interval</th>
<th>Expected radiator life (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial standby</td>
<td>52</td>
<td>200</td>
<td>each use</td>
<td>As required *</td>
<td>20</td>
</tr>
<tr>
<td>Commercial prime (limited)</td>
<td>200</td>
<td>750</td>
<td>each use</td>
<td>As required *</td>
<td>20</td>
</tr>
<tr>
<td>Commercial prime (unlimited)</td>
<td>360</td>
<td>3000</td>
<td>each use</td>
<td>As required *</td>
<td>5</td>
</tr>
<tr>
<td>Commercial continuous</td>
<td>360</td>
<td>8280</td>
<td>each use</td>
<td>As required *</td>
<td>4</td>
</tr>
</tbody>
</table>

* Core clean interval is dependent upon visible degree of fouling of the core. This will very much depend upon local environment and Genset usage but as a general rule it is best to ensure a visible core fin edge profile and also unobstructed view through the core matrix. However the maximum effective period between core cleaning cycles will be determined by radiator cooling performance and its effect upon Genset engine overheating.

3.1. Checking coolant condition and level.

Important note. Ensure coolant temperature is at ambient room temperature before checking level; this check will usually be done prior to starting the Genset. This will avoid problems associated with apparent high coolant levels due to coolant expansion and will also avoid the risks of hot coolant scalds. Never check coolant level when engine is running.
3.2. Filling radiator with coolant.

3.2.1. Ensure fill return pipe shut-off valve is fully open before filling the radiator to allow complete filling of the fill line coolers.

3.2.2. Close fill return pipe shut-off valve after filling and before radiator operation.
3.2.3. Ethylene glycol coolant (anti-freeze)

Use Cummins preferred Fleetgard ES coolant mixed to the concentration specified for the site conditions. If possible use pre-mixed bulk supply. Maintain coolant as per supplier’s recommendation. A visual check on coolant level can be made using the Murphy and fill level gauges mounted in the expansion tanks at the top of the radiator. A low coolant level sensor is also incorporated into the radiator and connected to the engine control panel.

3.2.4. Water plus supplemental coolant additives (SCA)

Use Cummins preferred product DCA4. Maintain coolant as per supplier’s recommendation. Coolant test kits for water pH and Molybdate and Phosphate levels are available from Cummins. Please follow manufacturer’s instructions included with kit.
A visual check on coolant level can be made using the Murphy and fill level gauges mounted in the expansion tanks at the top of the radiator.
A low coolant level sensor is also incorporated into the radiator and connected to the engine control panel.
4. GENERAL MAINTENANCE

4.1. Cleaning cores.

During Genset operation significant quantities of atmospheric fume, dust and debris can be drawn into the radiator.
This will contaminate the surface of the core matrix and lead to restriction of the air flow through the radiator and consequent deterioration in cooling performance.
Routine cleaning of the core matrix will help to maintain cooling efficiency; however it should be noted that the method of cleaning employed needs to be appropriate for the type of contamination seen.
Core matrix contaminants basically break down into 3 main types.

Oil fumes.

These will coalesce on the core surface and cause any dust or debris to adhere to the core. Oil fumes can penetrate deeply into the core matrix and will be difficult to remove without the assistance of specialist cleaning chemicals and pressure washing equipment.
Cleaning must be performed in the opposite direction to the normal operating air flow to ensure thorough cleaning of the internal features of the core.

Dust.

Dry dust will penetrate the core matrix but can also pass directly through it leaving only the larger particles trapped within the matrix. Dry dust however may also absorb moisture and if allowed to dry out can create a hard cement like deposit. It can also absorb atmospheric contaminants such as those present in chemical processing plants or marine environments which will lead to premature core failure linked to the formation of corrosion products.
Dry dust can be removed using a vacuum cleaner from the outer surface however any hard deposits may be difficult to remove without the assistance of clean water (maybe with added surfactants) and pressure washing equipment. Cleaning must be performed in the opposite direction to the normal operating air flow.

Vegetation and insect debris.

This type of debris does not ordinarily penetrate the core matrix and can usually be removed adequately by the use of vacuum cleaning from the outer surface. If combined with oil fume contamination however it may form a hard-matted surface layer which will not vacuum clean off but will need to be treated as for oil fume contamination in the first paragraph above.
4.2. Cleaning interval.

Under normal operating conditions it would be advisable to check and if necessary clean the radiator cores on a regular basis before the Genset engine is affected. This schedule must be reviewed for the particular environment under which the Genset is operating, certain types of local environmental conditions can significantly shorten the cleaning schedule interval, see Section 2.0 Service requirements table, Fig.3. A good guideline would be to monitor the engine operating conditions, especially with respect to coolant temperature, to ensure that the radiator is still operating effectively.

4.3. Cleaning the fan/impeller.

4.3.1. Remove any fan guarding to gain access to the fan.

4.3.2. Visually inspect the blades for evidence of damage and then clean them using a brush and cloth. The cloth may be dipped in water or a suitable solvent if the contaminant is hard to remove. Do not use any harsh abrasives as this could damage the fan or create fatigue crack initiation points.

4.3.3. Visually inspect and clean the motor cooling fins.

4.3.4. Dry the fan blades after cleaning.

4.4. Cleaning the core matrix “air on” or outer face of the LTA section.

It is usually only advisable for vacuum cleaning of dry dust or vegetation/insect debris from the outer surface of the LTA core.

4.4.1. To gain access to the radiator LTA “air on” surfaces, in the three sections with fuel coolers and auxiliary coolers, remove the access panels in the fan plenum section side panels. You will need to disconnect the auxiliary cooler flexible hoses and remove the coolers from the plenum section.

One of the sections cannot be accessed in this way. Access can only be gained to this section through the fan and motor unit by removing the guard and passing the vacuum nozzle through the fan blades.
Figure 6 View on left side plenum fuel cooler access panels.

Figure 7 View on right side plenum access panels showing fill line cooler connections.
4.4.2. Ensure that the nuts on the fuel cooler connections are correctly supported by spanners when undoing them.

![Figure 8 View showing spanners on fuel cooler connections.](image)

4.4.3. Undo and remove the fasteners on the fuel cooler AV mounts and remove cooler through access panel.

![Figure 9 View showing cooler inside fan plenum.](image)
4.4.4. Using the vacuum cleaner hose remove all the loose dust and debris from the core surface taking care not to damage the cooling fins and tubes in the matrix. If considered necessary, use a soft bristled hand brush to loosen any adherent debris prior to using the vacuum cleaner.

4.4.5. Due to the construction of the radiator it is not practical to attempt to wet clean the cores in situ. Cores should be removed following the procedures in Section 4.1 Core removal and replacement. It should be noted that allowance needs to be made for drainage and collection of the used cleaning fluids from the local work area.

4.4.6. Any commercially available pressure washer rated for a pressure range of 1,500 psi to 2,000 psi is recommended.

4.4.7. Any commercially available non-caustic engine cleaner suitable for use in pressure washers should be adequate. Bearward Engineering recommends the use of Autosmart G101 Multi Purpose Non Caustic cleaner.

Figure 10 View showing AV mount fasteners.

Figure 11 Bearward recommended cleaning fluid.
4.5. Pre-washing.

4.5.1. Car should be taken to label cores once removed form radiator to ensure the correct cores are replaced into the correct circuit. Failure to do so will result in poor cooling performance.

4.5.2. Carefully remove all the cores from the J/W sections (Chapter 5) and place “air on” face down on a smooth, flat surface free from dirt, loose stone chippings or gravel. A slight fall or slope on the surface may be helpful in allowing used cleaning fluids to drain away from the work area.

4.5.3. Carefully remove all the cores from the LTA sections and place “air on” face down on a smooth, flat surface free from dirt, loose stone chippings or gravel. A slight fall or slope on the surface may be helpful in allowing used cleaning fluids to drain away from the work area.

4.5.4. Apply cleaning agent preferably using a low pressure spray or mist dispenser as per manufacturers recommendations and allow to soak into the surface dirt.

![Figure 12 Cores laid out in preparation for washing.](image)
4.6. Washing.

4.6.1. Using pressure washer apply cleaning spray fan jet at right angles to the core surface from a minimum distance of 100mm. Avoid applying the high-pressure jet too close to or at an acute angle to the core surfaces as it will damage the cooling fins in the core matrix.

4.6.2. Note that the cleaning jet should be applied from the reverse side of the core to the "air on" face. This will ensure that dirt and contaminants are pushed back through the core matrix rather than compacted into it.

Figure 13 Core being washed. Note distance and angle of spray nozzle from core top surface
4.7. Rinsing

4.7.1. Final rinsing of the cores may be required to remove any residual cleaning fluids.

4.8. Post cleaning.

4.8.1. Replace all the cores into the radiator ensuring that the correct cores are installed into the correct sections i.e. LTA cores into LTA section and JW cores into JW section.

4.8.2. Re-assemble the radiator and re-fit all panels back into the radiator structure.

Check that there are no foreign bodies or debris in the plenums that could be picked up by the fan and projected into the core face.

4.8.3. Return the radiator to on-line function.

4.8.4. Care must be taken on first Genset start up to ensure that residual rinsing fluid in the core matrix does not cause any contamination problems when the fans are started.
4.9. Checking fan and motor unit condition.

4.9.1. Look for damaged blades.

4.9.2. Look for loose, failed and missing fasteners around fan ring mounting flange and fan motor mounting stool.

4.9.3. Check condition and security of any electrical cables attached to the motor. Look for cracks and fraying in the outer insulation, cable separation at the connecting glands and loose cabling. Repair and/or replace the cables if there is any evidence of damage.

4.9.4. Motors are fitted with a drain hole in each end cover and in the terminal box. The motor drain hole should be at the lowest point of the motor when installed. Plugs that cover the drain holes should either be removed entirely if condensation is likely to occur due to large variations in operating temperature or removed periodically to allow any general build-up of condensation to drain away. The frequency of plug removal will be dictated by environmental conditions and a record should be kept.

4.9.5. If the fan assembly is to be used less frequently than once a month, or for emergency use only, the following additional maintenance procedures should be observed:

4.9.5.1. The resistance of the motor windings to earth should be measured (at 500V d.c.) each month. If the reading is less than 10 megohms the motor should be dried in a warm airflow (typically 40°C) and re-checked before running the motor.

4.9.5.2. The fan should be run each month to ensure correct lubricant condition in the bearings. The lubricant will need to achieve correct working temperature to remove any condensate absorbed during the idle period. Running time will be dependent upon site installation conditions but is recommended to be at least ½ hour.

4.9.6. It is recommended that the motor shaft seals and bearings are replaced after 20,000 hours or 5 years of normal operation whichever comes first, and the motor rewound to its original specification after 40,000 hours of operation.
4.10. Replacing hoses, clips and grommet seals.

4.10.1. Check hoses for signs of deterioration such as surface cuts, splits, cracks and/or bulges, at regular intervals.

4.10.2. Replace hoses and clips at major engine service intervals or at 10,000 hours / 2 years run time, whichever comes first.

4.10.3. Replace grommet seals whenever cores have been removed (either for cleaning or replacement) or at 10,000 hours / 2 years run time, whichever comes first.

*Figure 14 Typical visible hose deterioration*
5. REPAIR

5.1. Core removal and replacement.

5.1.1. Isolate Genset.

5.1.2. Drain radiator slab.

5.1.2.1. Whenever possible to save time only drain the radiator slab (L/H or R/H) containing the cores that need replacing.

Figure 15 Illustration showing radiator drain tap locations (circled in red).
5.1.3. Removing cores from JW slab, top section.

5.1.3.1. Disconnect and remove flexible downstream air outlet ducting.

5.1.3.2. Disconnect the connection hoses from the expansion tank to the top collector tank.

Figure 16 View showing expansion tank connection hoses (arrowed).

5.1.3.3. Disconnect the engine circuit coolant hose from the top collector tank. It is possible to leave the tank stub pipe to expansion tank connection hoses attached.

Figure 17 View on JW top collector tank coolant hose connections (arrowed).
5.1.3.4. Loosen the hose clips on the left and right-side collector tank balance pipe and disconnect the pipe.

Figure 18 View on JW section top collector tank balance pipe and hoses (arrowed).

5.1.3.5. Undo and remove the fasteners holding left and right side vertical duct closer plate and lift plate away from radiator.

Figure 19 View on JW section vertical duct closer plate (highlighted).
5.1.3.6. Remove fasteners holding all of the horizontal duct closers in position and lift away from radiator.

*Figure 20 View on JW section horizontal duct closers (arrowed).*
5.1.3.7. Loosen the top and bottom hose clips on the vertical fill pipe hoses and remove the fill pipe.

Figure 21 View on JW section vertical fill pipe (arrowed).
5.1.3.8. Undo and remove the top and middle position fasteners from the top collector tank and loosen the lower fasteners to allow them to slide in the elongated slotted holes.

![Figure 22 View showing fasteners in top collector tank end plate. Remove screws indicated by arrows, loosen remaining screws.](image)

5.1.3.9. Raise collector tank in slots in tank end plate to intermediate Service position. Use Service tool between the top of the core and the bottom of the collector tank if necessary to overcome any stiction between the core nozzles and the tank seals. Replace middle fasteners to secure collector tank in service position.

![Figure 23 View showing fasteners locations (arrowed) with top JW tank in Service position.](image)
5.1.3.10. Raise individual cores from intermediate collector tank using Bearward Service tool. Place tool under the bottom bonnet to avoid damaging the bonnet profile. The top nozzle of the core should still be engaged in the top collector tank seal, so the core should slide upwards without too much effort.

![Figure 24 Service tool in position lifting bottom of core. Apply load in direction of arrow.](image)

5.1.3.11. Place 14mm thick nylon strip Service packers under bottom of bottom bonnet on core. Position the packers at the outer edges of the bonnet to avoid damaging the bonnet profile. Repeat for all cores in the JW slab.

5.1.3.12. Further raise the tank to the top service position and secure.

5.1.3.13. Remove the nylon packers from under the bottom bonnet of the core to be removed.
5.1.3.14. Carefully lower core down until the top bonnet nozzle is disengaged from the grommet seal. Use Service pry bar if necessary. Lift core out of section taking care not to damage adjacent cores.

![Figure 25 View showing Service tool being used to lower core. Apply load in direction of arrow.](image)

Take care when handling cores to avoid damaging the cooling fins in the core matrix. Take special care when lowering the cores to the floor to avoid heavy impacts on the end of the core which can cause significant damage to the core tubes which may be hard to detect without close inspection.
5.1.4. Removing cores from JW slab, bottom section.

5.1.4.1. Disconnect and remove flexible downstream air outlet ducting.

5.1.4.2. Disconnect the engine circuit coolant hoses from the bottom collector tank.

5.1.4.3. Loosen the hose clips on the left and right-side collector tank balance pipe and disconnect the pipe.

Figure 26 View showing JW section bottom collector tank coolant hose connections (arrowed).

Figure 27 View on JW section bottom collector tank balance pipe and hoses (arrowed).
5.1.4.4. Undo and remove fasteners holding vertical duct closer plate between the left side radiator slab and the right-side radiator slab, see Fig.18.

5.1.4.5. Remove fasteners holding horizontal duct closers in position and lift away from radiator, see Fig.19.

5.1.4.6. Loosen the hose clips on the vertical fill pipe hoses and remove the fill Pipe, see Fig.20.

5.1.4.7. Undo and remove the middle and bottom position fasteners from the bottom collector tank and loosen the top fasteners to allow them to slide in the elongated slotted holes.

Figure 28 View showing fasteners to be removed from bottom JW collector tank end plate.
5.1.4.8. Lower collector tank in slots in tank end plate to intermediate Service position. Use Service tool between the bottom of the core and the top of the bottom collector tank if necessary to overcome any stiction between the core nozzles and the tank seals. Replace middle fasteners to secure collector tank in Service position.

Figure 29 View showing fasteners (arrowed) with bottom JW collector tank in Service position

5.1.4.9. Raise individual cores from bottom collector tank using Bearward Service tool. Place tool under the bottom bonnet to avoid damaging the bonnet profile. The top nozzle of the core should still be engaged in the Intermediate collector tank seal so the core should slide upwards without too much effort.

Figure 30 Service tool in position lifting bottom of core. Apply load in direction of arrow.
5.1.4.10. Place 14mm thick nylon strip Service packers under bottom of bottom bonnet on core. Position the packers at the outer edges of the bonnet to avoid damaging the bonnet profile. Repeat for all cores in the JW slab.

Figure 31 View showing Service packers in position on top of bottom tank.

5.1.4.11. Further lower the tank to the bottom service position and secure.

5.1.4.12. Remove the nylon packers from under the bottom bonnet of the core to be removed.
5.1.4.13. Carefully lower core down until the top bonnet nozzle is disengaged from the grommet seal. Use Service pry bar if necessary. Lift core out of section taking care not to damage adjacent cores.

Take care when handling cores to avoid damaging the cooling fins in the core matrix.

Take special care when lowering the cores to the floor to avoid heavy impacts on the end of the core which can cause significant damage to the core tubes which may be hard to detect without close inspection.
5.1.5. Removing cores from LTA slab, top section.

5.1.5.1. To gain access to the LTA slab top section cores the corresponding JW cores must first be removed as per preceding paragraph 5.1.3.

5.1.5.2. Before starting work ensure that all the exposed grommet seal holes in the JW Intermediate collector tank are covered to prevent stray fasteners falling into the tank.

5.1.5.3. Remove internal duct closer plates. Note location and orientation of all closer plates and hose clips for later reassembly.

Figure 33 View showing radiator with JW cores and internal duct closer plates removed.
5.1.5.4. Disconnect the LTA circuit coolant hose from the top collector tank. Note that this is only required for the left hand (L/H) side of the radiator.

Figure 34 View showing LTA L/H section top collector tank coolant hose connection (arrowed).

5.1.5.5. Disconnect the LTA section top collector tank balance pipes

Figure 35 View showing LTA section top balance pipe and hoses (arrowed).
5.1.5.6. Remove LTA top collector tank fasteners and raise tank as per method described for JW section collector tank.

5.1.5.7. Raise LTA cores.

5.1.5.8. Insert 14mm thick spacers under bonnets.

5.1.5.9. Raise tank to top position.

5.1.5.10. Remove spacers and drop cores.

Remove cores - Take care when handling cores to avoid damaging the cooling fins in the core matrix. Take special care when lowering the cores to the floor to avoid heavy impacts on the end of the core which can cause significant damage to the core tubes which may be hard to detect without close inspection.
5.1.6. Removing cores from LTA slab, bottom section.

5.1.6.1. To gain access to the LTA slab bottom section cores the corresponding JW cores must first be removed as per preceding paragraph 4.1.4.

5.1.6.2. Before starting work ensure that all the exposed grommet seal holes in the JW bottom collector tank are covered to prevent stray fasteners falling into the tank.

5.1.6.3. Remove internal duct closers and fill pipe closer plates. Note location and orientation of all closer plates and hose clips for later reassembly.

5.1.6.4. Disconnect the LTA circuit coolant hose from the bottom collector tank. Note that this is only required for the right hand (R/H) side of the radiator.

Figure 38 View showing LTA R/H side bottom collector tank coolant hose connection (arrowed).
5.1.6.5. Loosen the hose clips on the left and right side collector tank connection pipes and disconnect the pipe.

![Figure 39 View on LTA bottom collector tank connection pipes (arrowed).](image1)

5.1.6.6. Undo and remove the middle and bottom position fasteners from the bottom collector tank and loosen the top fasteners to allow them to slide in the elongated slotted holes.

![Figure 40 View showing fasteners to be removed from LTA bottom collector tank end plate.](image2)
5.1.6.7. Lower collector tank in slots in tank end plate to intermediate Service position. Use Service tool between the top of the core and the bottom of the intermediate collector tank if necessary to overcome any stiction between the core nozzles and the tank seals. Replace middle fasteners to secure collector tank in Service position.

![Figure 41 View showing fasteners (arrowed) with LTA bottom collector tank in service position](image1)

5.1.6.8. Raise individual cores from LTA bottom collector tank using Bearward Service tool. Place tool under the bottom bonnet to avoid damaging the bonnet profile. The top nozzle of the core should still be engaged in the Intermediate collector tank seal so the core should slide upwards without too much effort.

![Figure 42 Service tool in position lifting bottom of core](image2)
5.1.6.9. Place 14mm thick nylon strip Service packers under bottom of bottom bonnet on core. Position the packers at the outer edges of the bonnet to avoid damaging the bonnet profile. Repeat for all cores in the LTA slab and secure.

5.1.6.10. Further raise the tank to the top service position.

5.1.6.11. Remove the nylon packers from under the bottom bonnet of the core to be removed.

5.1.6.12. Carefully lower core down until the top bonnet nozzle is disengaged from the grommet seal. Use Service pry bar if necessary. Lift core out of section taking care not to damage adjacent cores.

Take care when handling cores to avoid damaging the cooling fins in the core matrix. Take special care when lowering the cores to the floor to avoid heavy impacts on the end of the core which can cause significant damage to the core tubes which may be hard to detect without close inspection.

5.1.7. Replacing cores (generic for JW and LTA, top or bottom sections).

5.1.7.1. Remove grommet seals from collector tanks. Note that when removing top tank or underneath of intermediate tank grommet seals a quantity of residual coolant will spill out from the tank.

![Figure 43 Top collector tank grommet seal being removed](image-url)
5.1.7.2. Inspect seal location holes for damage or corrosion. Clean and, if necessary, dress the holes in preparation for new seals.

5.1.7.3. Always replace grommet seals with new items. Ensure seals are engaged correctly in the collector tank holes and lubricate evenly with Molykote 111 assembly lubricant.

Figure 44 Grommet seal being replaced and greased.
5.1.7.4. Core replacement is the reverse of core removal starting with insertion of the bottom bonnet nozzle into the bottom collector tank seal.

5.1.7.5. Carefully fit the bottom section of the core into the available space and guide the bottom bonnet nozzle into the grommet seal. Take care when handling cores to avoid damaging the cooling fins in the core matrix. Take special care when handling cores in the vertical orientation to avoid heavy impacts on the end of the core which can cause significant damage to the core tubes which may be hard to detect without close inspection.

5.1.7.6. Cores are designed to have a close clearance fit however manufacturing tolerances can allow core side shields to contact with adjacent cores, therefore care should be taken when fitting new cores to ensure that the side shields do not become engaged with the side shields of adjacent cores. This can be difficult to see and will make core installation impossible without causing significant damage to both cores.

5.1.7.7. It has been found that brushing a slight chamfer along the leading edges of the side shields with a flat bar can ease core installation if they are a tight fit.

Figure 45 Core nozzle inserted into grommet seal in bottom collector tank.
5.1.7.8. The use of Molykote 111 assembly lubricant lightly smeared on the side shields can also be of help.

5.1.7.9. With the bottom bonnet nozzle engaged in the seal firmly press the face of the core with the palm of the hand into the core slab working your way up the core length until the top bonnet nozzle is positioned directly below the top grommet seal. Take care not to damage the core face or snag the top seal.

5.1.7.10. Using the service tool between the underside of the bottom bonnet and the top of the bottom collector tank gently ease the core up until the top bonnet nozzle engages in the top seal.

5.1.7.11. Place a 6mm thick spacer under the bottom bonnet and use the Service tool to bring the core down until the bottom bonnet is firmly seated on the spacer. The top bonnet should still be engaged in the top seal.

5.1.7.12. Inspect grommet seals for signs of deformation or being drawn into the collector tank. If the seals are damaged or deformed the core will have to be removed and the seals replaced.

Figure 46 Chamfering core side shield to aid core replacement.
Figure 47 View on top grommet seal showing incorrect seating. This grommet should be removed and replaced correctly.
5.1.8. Radiator reassembly (generic for JW and LTA, top or bottom sections).

5.1.8.1. Move the tank to the assembly position. Use a pry bar inserted into the punched slots in the tank end plates.

Figure 48 View showing pry bar in position for pulling top collector tank down.

5.1.8.2. Remove the nylon packers, adjust the tank fully to the final assembly position.

5.1.8.3. Replace and tighten all tank end plate fasteners.

5.1.8.4. Replace vertical fill pipes.

5.1.8.5. Reconnect all balance pipes and coolant circuit connections.

5.1.8.6. Replace and tighten all horizontal and vertical duct closers.

5.1.8.7. Close and fasten all ducting, replace inspection panels and perform a final inspection to ensure nothing has been left in the radiator that should not be there.
5.2. Fill line cooler removal and replacement.

5.2.1. Drain radiator.

5.2.2. Using 2 spanners undo the ring nut on the union. Use 1 spanner to support the threaded union on the fuel cooler and the other to undo the ring nut on the flexible hose.

5.2.3. Temporarily support the loose fill lines at high level to reduce coolant spillage in work area.

5.2.4. Undo the nuts on the AV mountings and lift the cooler away. Note; be aware of potential spillage of coolant remnants held within the cooler.
5.3. Cooling fan and motor unit removal and replacement.

5.3.1. Ensure Genset is electrically isolated and Main control panel locked.

5.3.2. Remove any coolant pipework that may obstruct fan and motor unit during removal.

Figure 51 Illustration showing general arrangement of pipework.
5.3.3. Disconnect fan and motor unit at fan cowl ring electrical junction box.

Figure 52 Illustration showing fan cowl ring electrical junction box (arrowed).

5.3.4. Undo fasteners and remove mains isolator switch plus brackets and motor cable from radiator support plate.

Figure 53 Illustration showing mains isolator switch (arrowed).
5.3.5. Remove fan and motor unit outer support plates from cowl ring flange.

5.3.6. Remove fan guard from cowl ring flange. Fan assemblies can be heavy (between 200kg and 300kg depending on fan and motor size), are sometimes unwieldy and should be lifted slowly to prevent damage and distortion. Proper precautions must be taken and certified lifting equipment used to ensure that the fan is well supported and stable before lifting into position. Flange holes should be used for attaching any lifting frames.

5.3.7. Attach appropriate lifting equipment to cowl ring flange.
5.3.8. Connect lifting equipment to Service tool and lift fan and motor unit away from radiator.

Note: To remove lower cooling fan and motor units it may be necessary to remove the upper ones first to create access for lifting equipment.

5.3.9. Fan and motor unit replacement is the reverse of removal.
6. SPECIFICATIONS

6.1. Weights.

<table>
<thead>
<tr>
<th>Assembly Dry Weight</th>
<th>JW</th>
<th>LTA</th>
<th>Fan &amp; Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Circuit Expansion Tank</td>
<td>Circuit Core Section</td>
<td>Circuit Expansion Tank</td>
</tr>
<tr>
<td>Left Hand</td>
<td>1665 kg</td>
<td>20.8 kg</td>
<td>20.8 kg</td>
</tr>
<tr>
<td>Right Hand</td>
<td>1626 kg</td>
<td>12.3 kg</td>
<td>9 kg</td>
</tr>
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6.2. Dimensions.

<table>
<thead>
<tr>
<th>Overall Radiator (right hand or Left Hand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEIGHT</td>
</tr>
<tr>
<td>3.48</td>
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</tbody>
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6.3. Capacities.

<table>
<thead>
<tr>
<th>JW SECTION (Inc pipework)</th>
<th>LTA CIRCUIT (Inc pipework)</th>
</tr>
</thead>
<tbody>
<tr>
<td>382.3 litres</td>
<td>276.4 Litres</td>
</tr>
</tbody>
</table>

6.4. Fastener maximum recommended tightening torques.

<table>
<thead>
<tr>
<th>Fastener Type</th>
<th>Grade</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5</td>
<td>8.8 Grade Screw</td>
<td>6 Nm</td>
</tr>
<tr>
<td>M6</td>
<td>8.8 Grade SEM Screw</td>
<td>7 Nm</td>
</tr>
<tr>
<td></td>
<td>8.8 Grade Set Screw</td>
<td>12 Nm</td>
</tr>
<tr>
<td>M8</td>
<td>8.8 Grade SEM Screw</td>
<td>29 Nm</td>
</tr>
<tr>
<td></td>
<td>8.8 Grade Set Screw</td>
<td>29 Nm</td>
</tr>
<tr>
<td>M10</td>
<td>8.8 Grade Set Screw</td>
<td>55 Nm</td>
</tr>
<tr>
<td>M12</td>
<td>8.8 Grade Bolt</td>
<td>55 Nm</td>
</tr>
<tr>
<td></td>
<td>Norma Work Drive Hose Clamp BE36001</td>
<td>3 Nm</td>
</tr>
<tr>
<td></td>
<td>Norma Work Drive Hose Clamp BE36001</td>
<td>7 Nm</td>
</tr>
<tr>
<td></td>
<td>Norma T Clip BE32200/04</td>
<td>4 Nm</td>
</tr>
</tbody>
</table>
7. SPARE PARTS AND SERVICE / MAINTENANCE TOOLS

7.1. Spare parts listing.

The following parts are considered normal service replaceable items. For a full listing of parts please refer to exploded drawing BE5758500001.

<table>
<thead>
<tr>
<th>Part description</th>
<th>Bearward part No</th>
<th>Cummins part No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure cap 110kPa</td>
<td>BE64057</td>
<td></td>
</tr>
<tr>
<td>LTA core, painted black</td>
<td>BE1400000561</td>
<td></td>
</tr>
<tr>
<td>JW core, painted black</td>
<td>BE1400000460</td>
<td></td>
</tr>
<tr>
<td>Large grommet seal</td>
<td>BE6400003300</td>
<td></td>
</tr>
<tr>
<td>Coolant level gauge UC FL 69 213</td>
<td>BE64177</td>
<td></td>
</tr>
<tr>
<td>Coolant level Murphy gauge EL150KI</td>
<td>BE64035</td>
<td></td>
</tr>
<tr>
<td>JW pipe gasket 280mm Dia x 1.6mm thick</td>
<td>BE1200006600</td>
<td></td>
</tr>
<tr>
<td>LTA pipe gasket 190.5mm Dia x 1.6mm thick</td>
<td>BE1200006700</td>
<td></td>
</tr>
<tr>
<td>Hose 3/8” ID SAE 100R6</td>
<td>BE36180</td>
<td></td>
</tr>
<tr>
<td>Hose 3/8” ID x 365 long</td>
<td>BE 36180/0365</td>
<td></td>
</tr>
<tr>
<td>Hose 3/8” ID x 375 long</td>
<td>BE36180/0375</td>
<td></td>
</tr>
<tr>
<td>Hose 12.7mm ID SAE 100R6</td>
<td>BE 36185</td>
<td></td>
</tr>
<tr>
<td>Hose 12.7mm ID X 205mm long</td>
<td>BE36185/0205</td>
<td></td>
</tr>
<tr>
<td>Hose 12.7mm ID x 235mm long</td>
<td>BE36185/0235</td>
<td></td>
</tr>
<tr>
<td>Hose 38.1mm ID x 122mm long</td>
<td>BE32016</td>
<td></td>
</tr>
<tr>
<td>Hose 76.2 ID convoluted</td>
<td>BE6400013200</td>
<td></td>
</tr>
<tr>
<td>Hose 101.6mm ID convoluted</td>
<td>BE3200005400</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, worm drive 8-16mm</td>
<td>BE36001</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, constant torque CT350L 69.8-92.2mm</td>
<td>BE32229/05</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, constant torque CT450L 95.2-117.6mm</td>
<td>BE32229/07</td>
<td></td>
</tr>
<tr>
<td>Fill line cooler AV mount</td>
<td>BE64503</td>
<td></td>
</tr>
<tr>
<td>Fill line / Fuel cooler</td>
<td>BE24556</td>
<td></td>
</tr>
<tr>
<td>Fan and motor unit 80JM/31/2/9/16</td>
<td>BE7600000113</td>
<td></td>
</tr>
<tr>
<td>Vent line assembly 1</td>
<td>BE9800190114</td>
<td></td>
</tr>
<tr>
<td>Vent line assembly 2</td>
<td>BE9800400051</td>
<td></td>
</tr>
<tr>
<td>Vent line assembly 3</td>
<td>BE4000391500</td>
<td></td>
</tr>
<tr>
<td>Vent line assembly 4</td>
<td>BE9800400050</td>
<td></td>
</tr>
<tr>
<td>Fill line assembly 1 – Engine to cooler</td>
<td>BE4000391400</td>
<td></td>
</tr>
<tr>
<td>Fill line assembly 2 – Cooler to tank</td>
<td>BE9800310036</td>
<td></td>
</tr>
<tr>
<td>Fill line assembly 3 – Engine to connector</td>
<td>BE4000374500</td>
<td></td>
</tr>
<tr>
<td>Fill line assembly 4 – Connector to tank</td>
<td>BE4000374300</td>
<td></td>
</tr>
</tbody>
</table>
7.2. Tools required for Service and Maintenance.

7mm AF socket and flexible drive
3/8" AF spanner and socket
10mm AF spanners and sockets
13mm AF spanners and sockets
19mm AF spanners and sockets
500mm long pry bar
Service pry bar, Bearward part BE6200998300
Torque wrench 0 to 50Nm
Torque wrench 80 to 400Nm
Molykote 111 assembly lubricant
6mm thick site build spacer, Bearward part BE2900286100
14mm thick site build spacer, Bearward part BE2900286200
Pressure washer and attachments
8. FAULT FINDING

8.1. Engine overheating.

8.1.1. Check that fan rotates and runs at correct speed
8.1.2. Check direction of fan rotation is correct (clockwise when viewed from the “air on” face).
8.1.3. Radiator core matrix obscured
8.1.4. Remove obstructions.
8.1.5. Clean radiator cores.
8.1.6. Low coolant level
8.1.7. Check coolant level sensor operates correctly.
8.1.8. Check pressure cap is correct and seated properly.
8.1.9. Check hoses for damage
8.1.10. Check hose clips for tightness
8.1.11. Check cores for leaks from damage
8.1.12. Check cores for leaks from potentially corroded areas
8.1.13. Check coolant condition
8.1.14. Review local operating environment within Genset facility
8.1.15. Review general environment outside Genset facility
8.1.16. Check cores for leaks from potentially vibration induced damage
8.1.17. Tube to header joint failures
8.1.18. Tube fractures

8.2. Fuel cooler leaking

8.2.1. Loose connections. Check connections are seated correctly and tightened.
8.2.2. Impact damage on cooler matrix.
8.2.3. Tube to header joint damage
8.2.4. Look for end tank misalignment caused by unsupported tightening of unions
8.2.5. Check for fractured mountings due to vibration induced fatigue.

8.3. Radiator vibrating

Fan bearing failure
Check for incorrect lubricant in bearing
Check for insufficient / excessive lubricant in bearing

8.4. Fan failure

8.4.1. Check fan and motor unit mounting on radiator plenum section.
8.4.2. Check fan direction of rotation.
8.4.3. Review airflow conditions, especially for obstructions internal and external to Genset facility.
9. ELECTRICAL CONTROL EQUIPMENT

9.1. Drawings and Circuit diagrams

Figure 56 Radiator cooling fans control isolator / motor cable 27kW.
### 9.2. Spare parts listing.

<table>
<thead>
<tr>
<th>Part description</th>
<th>Manufacturer</th>
<th>Part number</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiator cooling fans control /</td>
<td>Stratos</td>
<td>BE6400037000</td>
<td></td>
</tr>
<tr>
<td>isolator cable &amp; Switch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiator cooling fans control panel</td>
<td>Stratos</td>
<td>BE6400036000</td>
<td></td>
</tr>
</tbody>
</table>