INSTALLATION, SERVICE, MAINTENANCE AND REPAIR MANUAL

RADIATOR PART No BE5759200000 REV0

QSK60 G22 ENGINE
1. **INTRODUCTION.**
   1.1. **GENERAL DESCRIPTION.**
   1.2. **ABOUT THIS DOCUMENT.**
   1.3. **SAFETY.**
   1.4. **GUARDING.**
   1.5. **CONTACT DETAILS.**
2. **INSTALLATION.**
   2.1. **GENERAL INSTALLATION**
   2.2. **PULLEY AND BELT ALIGNMENT.**
   2.3. **FILLING:**
3. **SERVICE REQUIREMENTS.**
   3.1. **CHECKING COOLANT CONDITION AND LEVEL.**
   3.2. **LUBRICATING FAN SHAFT BEARINGS.**
4. **GENERAL MAINTENANCE.**
   4.1. **CLEANING CORES.**
   4.2. **CLEANING INTERVAL.**
   4.3. **CLEANING THE FAN/IMPELLER.**
   4.4. **DRY CLEANING THE CORE MATRIX.**
   4.5. **WET CLEANING**
   4.7. **POST CLEANING.**
   4.8. **CHECKING PULLEY ALIGNMENT AND DRIVE BELT CONDITION.**
   4.9. **REPLACING HOSES, CLIPS AND GROMMET SEALS.**
5. **REPAIR**
   5.1. **CORE REPLACEMENT.**
   5.2. **LIFTING THE EXPANSION TANKS.**
   5.3. **PREPARING JW SECTION.**
   5.4. **JW SECTION.**
   5.5. **PREPARING LTA SECTION.**
   5.6. **PREPARING LTA SECTION FOR CORE REMOVAL.**
   5.7. **REPLACING CORES.**
   5.8. **RADIATOR REASSEMBLY.**
   5.9. **FAN REMOVAL AND REPLACEMENT.**
   5.10. **FAN SHAFT AND BEARING REMOVAL AND REPLACEMENT.**
   5.11. **FAN AND DRIVE SYSTEM GUARD REMOVAL AND REPLACEMENT.**
   5.12. **FUEL COOLER REMOVAL AND REPLACEMENT.**
6. **SPECIFICATIONS.**
   6.1. **WEIGHTS.**
   6.2. **DIMENSIONS.**
   6.3. **CAPACITIES.**
   6.4. **FASTENER TIGHTENING TORQUES.**
7. **SPARE PARTS AND SERVICE/MAINTENANCE TOOLS.**
   7.1. **SPARE PARTS LISTING.**
   7.2. **TOOLS REQUIRED FOR SERVICE AND MAINTENANCE.**
8. **FAULT FINDING.**
   8.1. **ENGINE OVERHEATING.**
   8.2. **FUEL COOLER LEAKING.**
   8.3. **RADIATOR VIBRATING.**
   8.4. **FAN FAILURE**
1. INTRODUCTION.

1.1. General Description.
This radiator is designed to provide engine and secondary water cooling specifically for the QSK60 G22 Engines. It consists of two fluid circuits and a mechanically driven cooling fan coupled to the output pulley of the engine (Fig.2). Refer to chapter 5. 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 1.3.

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** 87dB(A) at 1m. Suitable hearing protection must be worn when engine is running.
- Beware of trapping fingers, long hair and clothing in rotatable parts of the Genset even when it is not running i.e. fan drive belts and pulleys when turning the fan by hand.
- Operating pressure of the Genset is 16 psi (g) for both Jacket Water and LTA circuits.

1.4. Guarding.
The guarding on this radiator has been designed to accommodate the QSK60 G22 engine only.

It is the installers responsibility to ensure the appropriate guarding standards are applied as Bearward Engineering have no control over the design of the Genset and any modifications the may be made to it. If this radiator is fitted to any engine that isn’t covered in this instruction, then it is the installers responsibility to ensure the guarding conforms to the abovementioned standards.

The removable guarding has been designed with key-hole slots to allow the controlled removal of the guard. When the fixings all loosened the guard will drop to the bottom of the slot and then can be removed.

When refitting the guard, ensure it is lifted to the top of the slots before tightening the fixings.

Once all guarding is refitted, check all gaps and edges to ensure it is fitted correctly and not sitting at the bottom of the slots.
Fig. 1. Safe operating practice risk notifications

1.5. 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
Fig. 2. Front ¾ view on 5759200001 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. The radiator will be shipped standing vertically and secured to the base frame. Remove any ancillary components that are secured to the radiator for transport purposes and carefully put to one side.

2.1.2. 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 5. Specifications section of this document and the accompanying installation drawings.

2.1.3. This radiator can be positioned by attaching lifting hooks to the angled brackets circled in Fig.2. or using the forklift channels in the base frame.

Secure to the engine bedframe by following the genset manufactures instructions / guidelines.

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

2.1.5. Follow genset manufacturer’s instructions regarding vibration reduction. However, it is recommended that anti-vibration mountings are used to reduce vibration at the radiator.

2.1.6. Once in position all connections can be made as per the installation drawings: 5759200001_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

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

2.2. Pulley and belt alignment.

2.2.1. Follow the accompanying instructions for final pulley alignment and belt tensioning.

For this work the recommended tools are: Laser + conti tensioner.

Pulley alignment using TKBA40 laser alignment tool: PI-10-25-00-31
Belt tension using ContiTech tension gauge: PI-10-25-00-30
2.3. Filling:

2.3.1. Fill radiator using the coolant recommended by the engine manufacturer.
2.3.2. DO NOT OVERFILL this radiator. Only fill to the mid-way point of the sight glass “bullseye” socket on both circuits (See fig.4).
2.3.3. Run engine to clear any potential airlocks. Shut down and allow to cool before checking the level gauges and topping up if required.

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. 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.

Fig.3. Table listing service intervals.
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.

3.1.1. Ethylene glycol coolant (anti-freeze)
Use coolant mixed to the concentration specified by engine manufacturer 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 “bullseye” coolant level sight glass mounted in the expansion tanks at the top of the radiator. Visible coolant should half fill the sight glass.
A low coolant level sensor is also incorporated into the radiator and connected to the engine control panel.
3.2. Lubricating fan shaft bearings.

3.2.1. Use Bearward recommended grease Mobil Polyrex EM. If this is not available locally a generic polyurea soap based grease conforming to standard DIN 51825 (2004-06) K2P-20 manufactured by a reputable company should be used.

Recommended lubrication interval is 250 hours run time.

Grease nipple profile conforms to BS 1486 & DIN 71412.

Fig.5. Bearing greasing label affixed to fan shaft support cross beam.
4. GENERAL MAINTENANCE.

4.1. Cleaning cores.

During Genset operation significant quantities of atmospheric fumes, 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.

4.1.1. 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.

4.1.2. Dust.
Dry dust will penetrate into 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 by the use of vacuum cleaning 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.

4.1.3. Vegetation and insect debris.
This type of debris does not ordinarily penetrate into 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 paragraph 1 above.
4.2. Cleaning interval.

Under normal operating conditions it would be advisable to check and if necessary clean the radiator core every 500 hours Genset operation. 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 frequency. 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. Dry the fan blades after cleaning.

4.4. Dry cleaning the core matrix.

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

4.4.2. The cores will need to be removed from the radiator to clean by following the procedure in section 5.

4.4.3. 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.
4.4.4. Cleaning the core matrix “air off” or inner face of the core sections.

4.5. Wet cleaning
Before starting the cleaning process it is essential that the fan, motor and drive system are protected from any cleaning spray and chemicals. It is advised to cover them with waterproof sheeting secured tightly in place. It should be noted that allowance needs to be made for drainage and collection of the used cleaning fluids from the local work area.

Disposal of all cleaning chemicals and contaminated equipment should be done so according to local environmental laws.
Any commercially available pressure washer rated for a pressure range of 1,500 psi to 2,000 psi is recommended.

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.

Fig. 7. Bearward recommended cleaning fluid.

4.5.1. Carefully remove all the cores from the J/W section and place “air on” face down on a smooth, flat surface free from 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.

4.5.2. Carefully remove all the cores from the LTA section and place “air on” face down on a smooth, flat surface free from 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. Apply cleaning agent preferably using a low pressure spray or mist dispenser as per manufacturers recommendations and allow to soak into the surface dirt.

Fig. 8. Cores laid out in preparation for washing.

4.5.4. 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.
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.

4.5.5. Final rinsing of the cores will be required to remove any residual cleaning fluids.

4.5.6. 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.

4.5.7. 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 plenum that could be picked up by the fan and projected into the core face.

4.6. Post cleaning.

4.6.1. Remove the protective waterproof sheeting from the fan, motor and drive system.

4.6.2. After the cleaning has taken place you must remove any dirt and debris that may have collected in the bottom of the cowl plenum. You can remove the fasteners holding the bottom plate in position and slide it back out of place to ensure good drainage of wash water and debris.

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

4.6.4. Return the radiator to on-line function.

4.6.5. Care must be taken on first Genset start up to ensure that residual cleaning fluid in the core matrix does not cause any contamination problems when blown out.
4.7. Checking pulley alignment and drive belt condition.
Refer to PI-10-20-00-31 for pulley alignment.
4.7.1. Visually check pulley for evidence of damage or corrosion at regular intervals.
4.7.2. Visually check drive belt for signs of damage or deterioration, such as exposed fibre reinforcement and surface splits or cracks, at regular intervals.

Fig.9. Typical visible wear with exposed reinforcing fabric on drive belt.

4.7.3. Worn or loose drive belts may indicate a pulley misalignment issue.
4.7.4. Replace drive belt at major engine service intervals or at 10,000 hours / 2 years run time, whichever comes first.

4.8. Replacing hoses, clips and grommet seals.

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

Fig.10. Typical visible hose deterioration.

4.8.2. Replace hoses and clips at major engine service intervals or at 10,000 hours / 2 years run time, whichever comes first.
4.8.3. 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.
5. REPAIR

5.1. Core replacement.

LTA cores can only be accessed after the JW cores have been removed.

5.1.1. Isolate Genset.
5.1.2. Drain radiator slab.
5.1.3. If possible only drain the radiator slab containing the cores that need replacing.

Fig.11. Illustration showing radiator drain tap locations.

5.2. Lifting the expansion tanks.

5.2.1. Remove bolts securing the expansion tank to the lifting channel. Disconnect rubber connector hoses and lift top expansion tanks. Secure tanks onto top of sidemembers using long bolts and packing pieces to prevent tanks from falling from radiator.

Fig.12. View showing packers and securing bolts in place under LTA expansion tank.
5.3. Preparing JW section.

5.3.1. Disconnect and remove flexible downstream outlet ducting. Remove access panels in side members to expose cross braces between LTA and JW sections (see Fig.13).

5.4. JW section.

5.4.1. Remove fasteners securing vertical brace to "air off" horizontal core brace and lift vertical brace from the core face.

5.4.2. Remove the fasteners from the top of the vertical brace on the "air on" side of the JW cores.

5.4.3. Loosen the hose clips and disconnect the LTA circuit coolant hoses from the top collector tank.

5.4.4. Remove fasteners from top collector tank and raise tank to intermediate Service position. Use pry bar if necessary to overcome any friction between the core nozzles and the tank seals.

5.4.5. Replace fasteners in intermediate Service holes in tank end plate/sidemembers.

5.4.6. Loosen horizontal core brace fasteners on both "air on" and "air off" faces of the section being worked on but do not remove yet as it will prevent the cores from falling out of the slab during subsequent operations. These can be accessed via the removable panels Fig. 13.

Fig.13. Cross brace access panels
5.4.7. Raise individual cores from bottom collector tank using large pry bar. Place pry bar under the outer edges of 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.

5.4.8. Place 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.

5.4.9. Remove fasteners from top collector tank intermediate position and raise tank further to the top Service position. Use pry bar if necessary to overcome any friction between the core nozzles and the tank seals.

5.4.10. Replace fasteners in top Service holes in tank end plate/sidemembers.

5.4.11. Remove the horizontal core brace to allow cores to be removed.

5.4.12. Replace fasteners in top Service holes in tank end plate/sidemembers.

5.4.13. Pull bottom bonnet of core to be removed away from the bottom collector tank ensuring that it does not snag on the grommet seal.

5.4.14. Carefully lower core down until the top bonnet nozzle is disengaged from the grommet seal. Lift core out taking care not to damage adjacent cores.

5.4.15. This core can be replaced or cleaned or continue to remove more cores to access the LTA cores.

5.4.16. LTA cores can now be accessed.

5.5. Preparing LTA section.

5.5.1. Loosen and remove screws securing bottom duct closer plate and slide plate away from the core faces. Refit screws to hold plate in place away from the cores.

5.6. Preparing LTA section for core removal.

5.6.1. Remove fasteners holding vertical braces to top and bottom collector tank support brackets.

5.6.2. Loosen the hose clips and disconnect the LTA circuit coolant hoses from the top collector tank.

5.6.3. Remove fasteners from top collector tank and raise tank to intermediate Service position. Use pry bar if necessary to overcome any friction between the core nozzles and the tank seals.

5.6.4. Replace fasteners in intermediate Service holes in tank end plate/sidemembers.
5.6.5. Loosen horizontal core brace fasteners on both “air on” and “air off” faces of the section being worked on but do not remove yet as it will prevent the cores from falling out of the slab during subsequent operations. These can be accessed via the removable panels Fig. 13.

5.6.6. Raise individual cores from bottom collector tank using large pry bar. Place pry bar under the outer edges of 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.

5.6.7. Place 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.

5.6.8. Remove fasteners from top collector tank intermediate position and raise tank further to the top Service position. Use pry bar if necessary to overcome any friction between the core nozzles and the tank seals.

5.6.9. Replace fasteners in top Service holes in tank end plate/sidemembers.

5.6.10. Raise cores to be removed from bottom collector tank using large pry bar. Place pry bar under the outer edges of the bottom bonnet to avoid damaging the bonnet profile. Remove the nylon packers from under the bottom bonnet. Check that bottom bonnet nozzle is disengaged from the bottom grommet seal.

5.6.11. Pull bottom bonnet of core to be removed away from the bottom collector tank ensuring that it does not snag on the grommet seal.

5.6.12. Carefully lower core down until the top bonnet nozzle is disengaged from the grommet seal. Lift core out of plenum section taking care not to damage adjacent cores.
5.7. **Replacing cores.**

5.7.1. Remove grommet seals from both top and bottom collector tanks.

*caution* - when removing top grommet seals a quantity of residual coolant will spill out from the tank.

![Image of top collector tank grommet seal being removed](image)

**Fig. 14. Top collector tank grommet seal being removed**

5.7.2. Inspect seal location holes for damage or corrosion. Clean and, if necessary, dress the holes to remove corrosion and debris in preparation for new seals.

5.7.3. 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.

![Image of grommet seal being replaced and greased](image)

**Fig. 15. Grommet seal being replaced and greased.**

5.7.4. Core replacement is the reverse of core removal starting with insertion of the bottom bonnet nozzle into the bottom collector tank seal.
5.7.5. 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.

Jig.16. Core nozzle inserted into grommet seal in bottom collector tank.

5.7.6. 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 difficult without causing significant damage to both cores.

5.7.7. 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.
5.7.8. The use of Molykote 111 assembly lubricant lightly smeared on the side shields can also be of help.

5.7.9. 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.
5.7.10. 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.

5.7.11. 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.

5.7.12. 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.

Fig.18. Core being pushed back into position.

Fig.19. View on top grommet seal showing incorrect seating. This grommet should be removed and replaced correctly.
5.8. **Radiator reassembly.**

5.8.1. Bring down the top tank to the assembly position. Use a pry bar inserted into the punched slots in the top tank end plates.

Fig. 20. View showing pry bar in position for pulling top collector tank down.

5.8.2. Remove the nylon packers, bring the top tank down fully to the final assembly position.

5.8.3. Replace and tighten all the tank end plates, horizontal and vertical braces.

5.8.4. 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.

5.9. **Fan removal and replacement.**

5.9.1. It is recommended that the fan is removed and replaced by Bearward approved / trained personnel only. Therefore, the following is a brief overview of the steps required:

- Split the plenum section away from the first core slab.
- Protect core face
- Undo M16 securing bolt from end of fan shaft
- Fit lifting sling around fan hub
- Attach lifting sling to suitable overhead lifting device e.g A frame
- Support fan
- Fit fan puller
- Draw fan off shaft taking care not to drop it.
- Replacement is the reverse of removal.
5.10. Fan shaft and bearing removal and replacement.
5.10.1. Remove fan as per Section 5.9. Fan removal and replacement.
5.10.2. Remove drive system guarding.
5.10.3. Release tension from drive belt loosening the idler arm bolts and adjusting rod and swing the arm out of the way.
5.10.4. Remove drive belt.
5.10.5. Loosen fan shaft pulley taper lock bush.

Fig's. 21a and 21b. View showing fan pulley taper lock bush being loosened and drawn from pulley.

5.10.6. Remove fan shaft pulley and bush together. Caution: the pulley and taper lock bush will be heavy!

Fig. 22. View showing pulley and taper lock bush being removed from fan shaft.
5.10.7. Check condition of drive key in shaft.
5.10.8. Disconnect bearing grease lines. Loosen and remove bolts on bearings. Lift fan shaft assembly off of cross beam. Caution: the fan shaft and bearing assembly will be very heavy!

Fig.23. View showing fan shaft assembly lifted off of cross beam.

5.10.9. Note position of any spacer plates under the bearings, these will require replacement in the same order.

Fig.24. View showing spacer arrangement under bearings.

5.10.10. Replace new assembly keeping bearing spacer plates in correct positions and bolt into place. Reconnect bearing grease lines. Do not fully tighten yet, just sufficient to allow later adjustment of fan position.
5.10.11. Fit fan as per Section 5.9 Fan removal and replacement.
5.10.12. Adjust bearings to set fan in correct position as follows.
5.10.13. Fan penetration. This should be set with the fan secured to the end of the shaft and the bearings adjusted within their slots. Fan penetration should be 14mm, e.g. the fan blade tip should extend 14mm out of the cowl ring into the plenum section (in the Z axis). Check fan penetration is equal for all fan blades. The 14mm dimension is set as a compensation factor to allow for fan deformation whilst running. A tape measure with 1mm increments is considered adequate for measuring penetration.

Fig.25. View showing fan penetration being measured with tape measure.

5.10.14. Fan clearance. Fan clearance should be set such that there is an equal gap between the fan tip and the cowl ring around the circumference of the cowl ring. This is designed to be 6mm +/- 2mm. A simple 6mm spacer or tapered gap gauge can be used to set the gap. Fan clearance is designed to give optimal fan efficiency and ensure that the fan does not contact the cowl ring when running. Clearance is adjusted by moving the bearings and, in extreme circumstances, changing the spacers under the bearings. It is not recommended to change the spacers unless absolutely necessary however because the bearing shaft assembly and cross beam are designed to give the correct range of adjustment “as supplied”. Difficulties in obtaining the correct fan clearance may indicate a problem somewhere else in the fan drive system which should be resolved first.
5.10.15. Fan alignment. Fan alignment should be set such that the fan blade penetration is equal around the fan cowl ring in both X (side to side) and Y (top to bottom) axes. A tape measure with 1mm increments is considered adequate for measuring penetration and setting alignment. Alignment is adjusted by moving the bearings and, in extreme circumstances in the Y axis, changing the spacers under the bearings. It is not recommended to change the spacers unless absolutely necessary however because the bearing shaft assembly and cross beam are designed to give the correct range of adjustment “as supplied”. Difficulties in obtaining the correct fan alignment may indicate a problem somewhere else in the fan drive system which should be resolved first.

5.10.16. Fully tighten bearing bolts to recommended torque as per section 5.

5.10.17. Fit fan drive pulley.

5.10.18. Fit fan drive belts and adjust pulley as per PI-10-25-00-30 – available upon request.

5.10.19. Replace all guarding.

5.11. Fan and drive system guard removal and replacement.

5.11.1. Support the guard section to be removed and loosen all the fasteners. Remove fasteners on the lower part of the section first so that the guard is still secured by the top fasteners. Note some guarding is located by “keyhole” slots to prevent the guard falling if it becomes loose.

5.11.2. Remove upper fasteners and lift guard section away.
Fig. 27. View showing top right segment of guarding being lifted away. Note drive system guarding has already been removed.

5.11.3. Replacement is the reverse of removal. Loose fit all fasteners first to aid alignment of guard sections with adjacent guarding.

5.11.4. When guard section is correctly aligned tighten all fasteners to the correct torque.

5.12. **Fuel cooler removal and replacement.**
5.12.1. Isolate fuel supply

Fig. 28. Loosening connection on fuel cooler. Note use of 2 spanners.

5.12.2. 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.
5.12.3. Temporarily support the loose fuel hoses at high level to reduce fuel oil spillage in work area.

Fig.29. Undoing nuts on fuel cooler AV mounts.

5.12.4. Undo the nuts on the AV mountings and lift the fuel cooler away. Note be aware of potential spillage of fuel remnants held within the fuel cooler.

6. SPECIFICATIONS.

6.1. Weights.

<table>
<thead>
<tr>
<th>Assembly Dry Weight</th>
<th>JW Circuit Expansion Tank</th>
<th>JW Circuit Core Section</th>
<th>LTA Circuit Expansion Tank</th>
<th>LTA Circuit Core Section</th>
<th>Cast aluminium fan</th>
<th>Fan shaft and Bearing assy</th>
<th>Fan driven pulley</th>
</tr>
</thead>
<tbody>
<tr>
<td>2392 kg</td>
<td>37 kg</td>
<td>12.3 kg</td>
<td>34 kg</td>
<td>16.6 kg</td>
<td>141 kg</td>
<td>30 kg</td>
<td>47 kg</td>
</tr>
</tbody>
</table>

6.2. Dimensions.

<table>
<thead>
<tr>
<th>Overall Radiator</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>DEPTH</th>
<th>Base to fan shaft centreline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.20 m</td>
<td>2.49 m</td>
<td>1.99 m approx</td>
<td>1.445 m</td>
</tr>
</tbody>
</table>

6.3. Capacities.

<table>
<thead>
<tr>
<th>JW SECTION</th>
<th>LTA CIRCUIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>385 litres</td>
<td>198 Litres</td>
</tr>
</tbody>
</table>
### 6.4. Fastener tightening torques.

<table>
<thead>
<tr>
<th>Size</th>
<th>Type Description</th>
<th>Torque (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>8.8 Grade SEM Screw</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>8.8 Grade Set Screw</td>
<td>12</td>
</tr>
<tr>
<td>M8</td>
<td>8.8 Grade SEM Screw</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>8.8 Grade Set Screw</td>
<td>29</td>
</tr>
<tr>
<td>M12</td>
<td>8.8 Grade Bolt</td>
<td>55</td>
</tr>
<tr>
<td>M20</td>
<td>8.8 Grade Bolt</td>
<td>350</td>
</tr>
<tr>
<td>M22</td>
<td>8.8 Grade Bolt</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Taper lock bush 5/8&quot; BSW socket screw</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Norma Work Drive Hose Clamp BE36001</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Norma Work Drive Hose Clamp BE36005</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Breeze CT hose clamp</td>
<td>14</td>
</tr>
</tbody>
</table>
# 7. SPARE PARTS AND SERVICE/MAINTENANCE TOOLS

## 7.1. Spare parts listing

<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:</td>
<td>BE1400000336</td>
<td></td>
</tr>
<tr>
<td>JW core:</td>
<td>BE1400000571</td>
<td></td>
</tr>
<tr>
<td>LTA Grommet seal:</td>
<td>BE6400003300</td>
<td></td>
</tr>
<tr>
<td>JW Grommet seal:</td>
<td>BE6400000500</td>
<td></td>
</tr>
<tr>
<td>Coolant sight glass</td>
<td>BE33001</td>
<td></td>
</tr>
<tr>
<td>Hose 76.2mm ID X 122mm long:</td>
<td>BE32004</td>
<td></td>
</tr>
<tr>
<td>Hose 101.6mm ID X 122mm long:</td>
<td>BE32006</td>
<td></td>
</tr>
<tr>
<td>Hose reducer 127mm / 101.6mm:</td>
<td>BE32204</td>
<td></td>
</tr>
<tr>
<td>Hose 38.1mm ID x 122mm long:</td>
<td>BE32016</td>
<td></td>
</tr>
<tr>
<td>Hose 1/2&quot; ID SAE 100R6:</td>
<td>BE36185</td>
<td></td>
</tr>
<tr>
<td>Hose 3/8&quot; ID SAE 100R6</td>
<td>BE36180</td>
<td></td>
</tr>
<tr>
<td>Hose 1/4&quot; ID SAE 100R6</td>
<td>BE36175</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, worm drive 8-16mm:</td>
<td>BE36001</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, worm drive 12-20mm:</td>
<td>BE36005</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, T-Clip 79-86:</td>
<td>BE32200/11</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, T-Clip 44-47 (DNP):</td>
<td>BE32200/04</td>
<td></td>
</tr>
<tr>
<td>Hose clamp, 31.7/54.1mm:</td>
<td>BE32229/02</td>
<td></td>
</tr>
<tr>
<td>Hose clamp 95.2/117.6mm:</td>
<td>BE32229/07</td>
<td></td>
</tr>
<tr>
<td>Hose clamp 133.3/155.7mm (DNP):</td>
<td>BE32229/10</td>
<td></td>
</tr>
<tr>
<td>Fan shaft bearing UCP212:</td>
<td>BE16038</td>
<td></td>
</tr>
<tr>
<td>Fan shaft bearing UCP313:</td>
<td>BE16036</td>
<td></td>
</tr>
<tr>
<td>Pulley, SPC, 6G 375mm PCD</td>
<td>BE2500004600</td>
<td></td>
</tr>
<tr>
<td>Bush, taper lock 3525 65mm:</td>
<td>BE653525-65</td>
<td></td>
</tr>
<tr>
<td>Idler shaft bearing, UCFL208D1 polyurea:</td>
<td>BE1600000300</td>
<td></td>
</tr>
<tr>
<td>Idler shaft bearing, UCFL212D1 polyurea:</td>
<td>BE1600000500</td>
<td></td>
</tr>
<tr>
<td>Pulley, SPC 6G 236mm PCD:</td>
<td>BE2536236</td>
<td></td>
</tr>
<tr>
<td>Bush, taper lock 3525 60mm:</td>
<td>BE63525-60</td>
<td></td>
</tr>
<tr>
<td>Fuel oil cooler:</td>
<td>BE24556</td>
<td></td>
</tr>
<tr>
<td>Fuel cooler AV mount:</td>
<td>BE64503</td>
<td></td>
</tr>
<tr>
<td>Matchbelt set 2240x6 SPC:</td>
<td>BE4900131900</td>
<td></td>
</tr>
</tbody>
</table>
### 7.2. Tools required for Service and Maintenance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7mm AF socket and flexible drive</td>
<td>3/8” AF spanner and socket</td>
</tr>
<tr>
<td>10mm AF spanners and sockets</td>
<td>13mm AF spanners and sockets</td>
</tr>
<tr>
<td>19mm AF spanners and sockets</td>
<td>24mm AF spanner and sockets</td>
</tr>
<tr>
<td>30mm AF spanners and sockets</td>
<td>32mm AF spanners and sockets</td>
</tr>
<tr>
<td>8mm AF hexagon wrench</td>
<td>Service pry bar, Bearward part No. 6200998300</td>
</tr>
<tr>
<td>18” Pry bars</td>
<td>Torque wrench 0 to 50Nm</td>
</tr>
<tr>
<td>Torque wrench 80 to 400Nm</td>
<td>Molykote 111 assembly lubricant</td>
</tr>
<tr>
<td>6mm thick site build spacer, Bearward part No. 2900286100</td>
<td>14mm thick site build spacer, Bearward part no. 2900286200</td>
</tr>
<tr>
<td>Hydraulic fan puller, Bearward part PE01420-1</td>
<td>Pressure washer and attachments</td>
</tr>
</tbody>
</table>
8. **FAULT FINDING.**

8.1. **Engine overheating.**

8.1.1. Check that fan rotates and runs at correct speed
8.1.2. Check for presence of key in joint
8.1.3. Check fan drive belt tension and condition
8.1.4. Check direction of fan rotation is correct (anti-clockwise when viewed from the “air on” face.
8.1.5. Radiator core matrix obscured
8.1.6. Remove obstructions.
8.1.7. Clean radiator cores.
8.1.8. Low coolant level
8.1.9. Check coolant level sensor operates correctly.
8.1.10. Check pressure cap is correct and seated properly.
8.1.11. Check hoses for damage
8.1.12. Check hose clips for tightness
8.1.13. Check cores for leaks from damage
8.1.14. Check cores for leaks from potentially corroded areas
8.1.15. Check coolant condition
8.1.16. Review local operating environment within Genset facility
8.1.17. Review general environment outside Genset facility
8.1.18. Check cores for leaks from potentially vibration induced damage
8.1.19. Tube to header joint failures
8.1.20. 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
     Look for signs of end tank misalignment and header plate convexity caused by over-pressurisation due to fuel return line closure.
8.2.5. Check for fractured mountings due to vibration induced fatigue.
8.2.6. Check for chaffing of the fuel lines on radiator/engine components.

8.3. **Radiator vibrating.**

8.3.1. Fan bearing failure
8.3.2. Check for incorrect lubricant in bearing
8.3.3. Check for insufficient/excessive lubricant in bearing

8.4. **Fan failure**

8.4.1. Check fan mounting on shaft.
8.4.2. Check fan direction of rotation.
8.4.3. Review airflow conditions, especially for obstructions internal and external to Genset facility