INSTALLATION, SERVICE, MAINTENANCE AND REPAIR MANUAL

RADIATOR BEARWARD PART No. BE5741500001

CUMMINS PART No. A053J035

CUMMINS QSK78-G15 ENGINES
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1 INTRODUCTION.

1.1 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 installation, use and operation of the radiator.

It is important to read all instructions fully before proceeding with any Installation, 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 detail in the Genset manufacturer’s assembly literature, however, section 2 of this instruction provides an overview of the installation also.

The information contained within this document is based upon information available at the time of issue; however the manufacturer’s 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 1.3.

1.2 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.
• Locally isolate the fan and motor units and ensure a Lock off, Tag Out (LOTO) procedure is followed.
• 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. An appropriate platform should be constructed to access the upper fan and motor units. 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 fans (x4) when running without the generator are recorded above 80dB(A). Thus, the following values are given:
  \[ L_{Wad} = 91 \text{ dB} \text{ (re 10-12W)} \]
  \[ L_{pAd} = 78 \text{ dB} \]
• 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.
During operation: **Emergency shutdown can be initiated via the fan control panel isolator.**

![Safety and Mandatory Signs](image)

**Fig.1. Safe operating practice risk notifications**

1.3 **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 5741500001 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 in two halves both secured individually to transport pallets. Remove any ancillary components that are secured to the radiator for transport purposes and carefully put to one side.

2.1.2 Check all the loose accessories supplied against drawing 5741500000_INSTALL.

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

2.1.4 Lift and position the units using the method described in the accompanying instruction: PI-00-10-00-02

2.1.5 Site constraints may determine which half of the unit to position first.

2.1.6 Once both halves are in position all connections can be made as per the installation drawings: 5741500000_CUS SHT 1 & 2.

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 Electrical fan Control panel installation

The start / stop signal control is sent by the generator control so there is no start / stop on the fan control panel.

E-Stop and safety control is linked in to the Genset safety circuit. Emergency shutdown can be initiated via the fan control panel isolator. The fan control panel should be suitably mounted near the Main Genset control panel and allowing for the cabling running from panel to fans to be between 9 and 12m in length to ensure EMC compliance.

2.2.1 When installing the cabling, ensure that it is routed in suitable trunking in accordance with EN60241 Clause 13.3 and that it does not form a trip hazard.

2.2.2 Panel installation drawings (6400029300 sheets 1 – 9) detail the electrical layout of the panel and the connections necessary.

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.

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.
Fig.4. Coolant level inspection points. Murphy gauge and fill level sight glass on both expansion tanks, LTA tank to the left of view.

3.1.1 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 fill level gauges mounted in the expansion tanks at the top of the radiator.
A Murphy gauge low coolant level sensor is also incorporated into the radiator and connected to the engine control panel.

3.1.2 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 fill level gauges mounted in the expansion tanks at the top of the radiator.
A Murphy gauge 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 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.

**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 the first paragraph above.

4.1.1 **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.

4.1.2 **Cleaning the fan/impeller.**
- **4.1.2.1** Remove any fan guarding to gain access to the fan.
- **4.1.2.2** 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.
4.1.2.3 Visually inspect and clean the motor cooling fins.
4.1.2.4 Dry the fan blades after cleaning.

4.1.3 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.
4.1.3.1 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.
4.1.3.2 If considered necessary use a soft bristled hand brush to loosen any adherent debris prior to using the vacuum cleaner.
4.1.3.3 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.
4.1.3.4 It should be noted that allowance needs to be made for drainage and collection of the used cleaning fluids from the local work area.
4.1.3.5 Any commercially available pressure washer rated for a pressure range of 1,500 psi to 2,000 psi is recommended.
4.1.3.6 Any commercially available non-caustic engine cleaner suitable for use in pressure washers should be adequate. Bearward Engineering recommends the use of Autosmart G101Multi Purpose Non Caustic cleaner.

4.1.4 Pre-washing.
4.1.4.1 Carefully remove all the cores from the J/W 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.
4.1.4.2 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.
4.1.4.3 Apply cleaning agent preferably using a low pressure spray or mist dispenser as per manufacturers recommendations and allow to soak into the surface dirt.
4.1.5 Washing
4.1.5.1 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.
4.1.5.2 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.

4.1.6 Rinsing
4.1.6.1 Final rinsing of the cores may be required to remove any residual cleaning fluids.

4.1.7 Post cleaning.
4.1.7.1 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.
4.1.7.2 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.
4.1.7.3 Return the radiator to on-line function
4.1.7.4 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.

4.2 Checking fan and motor unit condition.
4.2.1 Look for damaged blades
4.2.2 Look for loose, failed and missing fasteners around fan ring mounting flange and fan motor mounting stool.
4.2.3 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.
4.2.4 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.
4.2.5 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;
4.2.5.1 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 40C) and re-checked before running the motor.
4.2.5.2 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.
4.2.5.3 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.
4.3 **Replacing hoses, clips and grommet seals.**

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

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

4.3.3 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 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.

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**Fig.8.** Typical visible hose deterioration.

**Fig.9.** 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.

Fig. 10. 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.

Fig. 11. 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.

Fig.12. View on JW section top collector tank balance pipe and hoses (arrowed).

5.1.3.5 Remove fasteners holding all of the horizontal duct closers in position and lift away from radiator.

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

![Fig.21. View on JW section vertical fill pipe (arrowed).]

5.1.3.7 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.

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

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5.1.3.6 Loosen the top and bottom hose clips on the vertical fill pipe hoses and remove the fill pipe.

Fig.21. View on JW section vertical fill pipe (arrowed).

5.1.3.7 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.

Fig.22. View showing fasteners in top collector tank end plate. Remove screws indicated by arrows, loosen remaining screws.
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5.1.3.8  Raise collector tank in slots in tank end plate to 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.

Fig.23. View showing fasteners locations (arrowed) with top JW collector tank in Service position.

5.1.3.9  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.

Fig.24. Service tool in position lifting bottom of core. Apply load in direction of arrow.
5.1.3.10 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.

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

5.1.3.12 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.

Fig.26. View showing Service tool being used to lower core. Apply load in direction of arrow.

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.

Fig.28. View showing JW section bottom collector tank coolant hose connections (arrowed).

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

Fig.29. 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.

Fig.30. 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 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.
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.
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.

Fig.33. View showing Service packers in position on top of bottom tank.

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

5.1.4.12 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.

Fig.34. View showing Service tool being used to lower core. Apply load in direction of arrow.
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 4.1.3.

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.

Fig.36. View showing radiator with JW cores and internal duct closer plates exposed (arrowed).
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.

Fig.37. 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

Fig.38. 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.
Fig.39. View showing fasteners in LTA section top collector tank end plate. Remove screws indicated by arrows, loosen remaining screws.

Fig.40. View showing fasteners in LTA top collector tank in Service position.
5.1.5.7  Raise LTA cores.
5.1.5.8  Insert 14mm thick spacers under bonnets.
5.1.5.9  Remove spacers and drop cores.
5.1.5.10 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 hoses from the bottom collector tanks.

Fig.45. View showing LTA bottom collector tank coolant hose connections (arrowed).
5.1.6.5 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.

Fig.47. View showing fasteners to be removed from LTA bottom collector tank end plate.

5.1.6.6 Lower collector tank in slots in tank end plate to 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.

Fig.48. View showing fasteners (arrowed) with LTA bottom collector tank in Service position.

5.1.6.7 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.

![Service tool in position lifting bottom of core.](image)

**Fig.49. Service tool in position lifting bottom of core.**

5.1.6.8 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

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

5.1.6.10 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.

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.

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.

Fig.55. Core nozzle inserted into grommet seal in bottom collector tank.

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.

Fig.56. Chamfering core side shield to aid core replacement.
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.

Fig.58. 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.

Fig.59. 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.

5.1.9 Cooling fan and motor unit removal and replacement.
5.1.9.1 Ensure Genset is electrically isolated and Main control panel locked.
5.1.9.2 Remove any coolant pipework that may obstruct fan and motor unit during removal.
Fig.62. Illustration showing general arrangement of pipework.

5.1.9.3 Disconnect fan and motor unit at fan cowl ring electrical junction box.
5.1.9.4 Undo fasteners and remove mains isolator switch plus brackets and motor cable from radiator support plate.

5.1.9.5 Remove fan and motor unit outer support plates from cowl ring flange.
Fig.65. Illustration showing fan and motor unit outer support plates (arrowed).

5.1.9.6 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.

5.1.9.7 Attach Service tool to cowl ring flange.

Fig.66. Illustration showing fan and motor unit outer cowl ring flange ready for Service tool attachment.
5.1.9.8 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.
5.1.9.9 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>Left Hand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Hand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2525 kg</td>
<td>62.4 kg</td>
<td>62.1 kg</td>
<td>Assembly</td>
</tr>
<tr>
<td>2525 kg</td>
<td>8.1 kg</td>
<td>10.6 kg</td>
<td></td>
</tr>
</tbody>
</table>

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>3.63m</td>
</tr>
</tbody>
</table>

6.3 Capacities.

<table>
<thead>
<tr>
<th>JW SECTION</th>
<th>LTA CIRCUIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>162 litres</td>
<td>133 Litres</td>
</tr>
</tbody>
</table>

6.4 Fastener maximum recommended tightening torques.

<table>
<thead>
<tr>
<th>M5</th>
<th>8.8 Grade Screw</th>
<th>6 Nm</th>
<th>Norma Work Drive Hose Clamp BE36001</th>
<th>3 Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>8.8 Grade SEM Screw</td>
<td>7 Nm</td>
<td>Norma Work Drive Hose Clamp BE36001</td>
<td>7 Nm</td>
</tr>
<tr>
<td></td>
<td>8.8 Grade Set Screw</td>
<td>12 Nm</td>
<td>Norma T Clip BE32200/04</td>
<td>4 Nm</td>
</tr>
<tr>
<td>M8</td>
<td>8.8 Grade SEM Screw</td>
<td>29 Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.8 Grade Set Screw</td>
<td>29 Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>8.8 Grade Set Screw</td>
<td>55 Nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M12</td>
<td>8.8 Grade Bolt</td>
<td>55 Nm</td>
<td></td>
<td></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 BE5741500001.

<table>
<thead>
<tr>
<th>Part description</th>
<th>Bearward part No</th>
<th>Cummins part No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure cap 15lb RC15</td>
<td>BE64055</td>
<td>0130-7110</td>
</tr>
<tr>
<td>LTA core, painted black</td>
<td>BE1400000399</td>
<td>NA</td>
</tr>
<tr>
<td>JW core, painted black</td>
<td>BE1400000370</td>
<td>NA</td>
</tr>
<tr>
<td>Large grommet seal</td>
<td>BE6400003300</td>
<td>0130-7113</td>
</tr>
<tr>
<td>Coolant level sight glass</td>
<td>BE64336</td>
<td>0130-6749</td>
</tr>
<tr>
<td>Coolant level Murphy gauge EL150KI</td>
<td>BE64035</td>
<td>NA</td>
</tr>
<tr>
<td>1/4 “ vent line x 219mm long assembly</td>
<td>BE9800120207</td>
<td>NA</td>
</tr>
<tr>
<td>3/8 “ vent line x 390mm long assembly</td>
<td>BE04229/31</td>
<td>NA</td>
</tr>
<tr>
<td>1/2 “ bleed line x 224mm long assembly</td>
<td>BE9800190111</td>
<td>NA</td>
</tr>
<tr>
<td>Hose 12.7mm ID X 80mm long</td>
<td>BE36185/0080</td>
<td>NA</td>
</tr>
<tr>
<td>Hose clamp, worm drive 8-16mm</td>
<td>BE36001</td>
<td>NA</td>
</tr>
<tr>
<td>Hose clamp, worm drive 12-20mm</td>
<td>BE36005</td>
<td>0503-2762</td>
</tr>
<tr>
<td>Hose clamp, T clip 44-47mm</td>
<td>BE32200/04</td>
<td>NA</td>
</tr>
<tr>
<td>Fuel cooler AV mount</td>
<td>BE64503</td>
<td>0130-5340</td>
</tr>
<tr>
<td>Fuel cooler</td>
<td>BE24556</td>
<td>0130-5339</td>
</tr>
<tr>
<td>Fan and motor unit 125JM/40/4/9/14</td>
<td>BE7600000082</td>
<td>NA</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
- Service tool, fan and motor unit lifting bracket, Bearward part BEXXXXXXXXXX
- Pressure washer and attachments
8 Fault finding.
8.1 Engine overheating.
8.1.1 Check that fan rotates and runs at correct speed
Check direction of fan rotation is correct (clockwise when viewed from the “air on” face).

8.1.2 Radiator core matrix obscured
Remove obstructions.
   Clean radiator cores.

8.1.3 Low coolant level
Check coolant level sensor operates correctly.
Check pressure cap is correct and seated properly.
Check hoses for damage
Check hose clips for tightness
Check cores for leaks from damage
Check cores for leaks from potentially corroded areas
Check coolant condition
   Review local operating environment within Genset facility
   Review general environment outside Genset facility
Check cores for leaks from potentially vibration induced damage
Tube to header joint failures
Tube fractures

8.2 Radiator vibrating.
8.2.1 Fan failure
Check fan and motor unit mounting on radiator plenum section.
Check fan direction of rotation.
Review airflow conditions, especially for obstructions internal and external to Genset facility.
9 ELECTRICAL CONTROL EQUIPMENT

9.1 Circuit diagrams – See panel installation drawings 6400029300 sheets 1-9).

Fig.67. 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 isolator switch</td>
<td></td>
<td>BE6400020200</td>
<td></td>
</tr>
<tr>
<td>Radiator cooling fans control / isolator cable</td>
<td>Stratos</td>
<td>BE6400020300</td>
<td></td>
</tr>
<tr>
<td>Radiator cooling fans control panel</td>
<td>Stratos</td>
<td>BE6400019400</td>
<td></td>
</tr>
<tr>
<td>Fuse*, 200M250</td>
<td>Lawson</td>
<td>BE6400022201</td>
<td>0.24kg</td>
</tr>
</tbody>
</table>

* Note fuses are recommended to be replaced as sets of 3.
# Declaration of Incorporation of Partly Completed Machinery

According to Directive 2006/42/EC, Annex II Part 1 B

This machinery must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the (2006/42/EC) Directives and its amendments.

<table>
<thead>
<tr>
<th>Name of manufacturer or supplier</th>
<th>Bearward Engineering (Wabtec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full postal address including country of origin</td>
<td>Main Road, Far Cotton Northampton NN4 8HJ, England</td>
</tr>
<tr>
<td>Description of Product.</td>
<td>Radiator fan; designed to be integrated to a generator for cooling. Consisting of 4 fans units and control panel for sequential start-up.</td>
</tr>
<tr>
<td>Name:</td>
<td>Radiator</td>
</tr>
<tr>
<td>Standards used, including number, title, issue date and other relative documents</td>
<td>BS EN ISO 12100:2010 Safety of machinery – General principles for design - Risk assessment and risk reduction</td>
</tr>
<tr>
<td></td>
<td>BS EN ISO 13849-1:2015 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design</td>
</tr>
<tr>
<td>Name of Authorised Representative</td>
<td>J Spreckley</td>
</tr>
<tr>
<td>Position of Authorised Representative</td>
<td>Engineering Manager</td>
</tr>
<tr>
<td>Full Postal Address (If different from above.)</td>
<td>As Above</td>
</tr>
</tbody>
</table>

The Technical Construction File required by this Directive is maintained by:  
Name: J Spreckley  
I declare that I will maintain the Technical Construction file and ensure its full and compliant content. The technical documents have been compiled according to Annex VII Chapter B and we commit to deliver these documents to a Market Surveillance Authority on demand.  
Signature of Representative | [Signature]  
Date | 2/8/18 |

**Declaration**  
We hereby declare that the products mentioned above comply with the following basic requirements of the Machinery Directive (2006/42/EC). Annex I, Clauses 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.2.2.3, 1.2.2.4, 1.2.4.4, 1.2.6, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.9, 1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.5.14, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 1.7 |

Signature of Authorised Representative | [Signature]  
Date | 17/9/18 |

Place of Issue | Bearward Engineering UK |