Addendum to
Operation and Maintenance Manuals

Our energy working for you.™

Cummins Power Generation

Radiator Information

Publication. No. 0908-0107
Issue 04-01-2013

To be read in conjunction with:

PowerCommand® Control Operation and Maintenance manuals

Note: *Observe all health and safety notices, together with all Cautions and Warnings that are contained within the documentation for the generator set.*

Please take note of the following:

The tasks in this manual are to be undertaken by suitably trained and qualified service personnel **only**.

The following information on cleaning the radiator and the updated information regarding bearings has been provided by our supplier to enable efficient and prolonged life of the equipment.

The following information regarding the correct choice and fitting of Hose Clips has been provided by our supplier to assist and guide the user.

This is a Blank Page

CONTENTS

This is a Blank Page

SECTION 1 – HOSE CLIP INSTALLATION

1 Hose Clip Installation

Note: *This task is to be undertaken by suitably trained and qualified service personnel **only**.*

1.1 Installation Guidelines

This section provides general installation guidelines for the correct positioning, orientation and torque figures required when fitting hose clips. Recommended hose and clip combinations are also included.

1.1.1 Choosing the Right Hose Size

The recommended fit for hose to pipe is a 0.5mm interference fit, i.e. the inner diameter of the hose should be 0.5mm smaller than the overall diameter of the pipe.

1.1.2 Choosing the Right Clip

Recommended Hose and Clip Combinations	
HOSE TYPE	**RECOMMENDED CLIP TYPE**
EPDM BRAIDED RUBBER (Black with white braiding).	Worm drive clip, or T-clip.
SILICONE NOMEX (Can be red or blue).	T-clip.
APT THICK WALLED RUBBER (EXTRUDED POLYMER, black in colour).	Constant torque clips either worm drive, or T-clip.

It is important that the correct clip is selected. The ideal fit is for the clip, when fully opened, to slide over the hose and swage without excessive play or interference. When the clip is torqued up to the required installation torque, the free band end should protrude as little as possible. In the case of T-clips, the bolt should protrude as little as possible after installation.

1.1.3 Fitting the Hose Clip

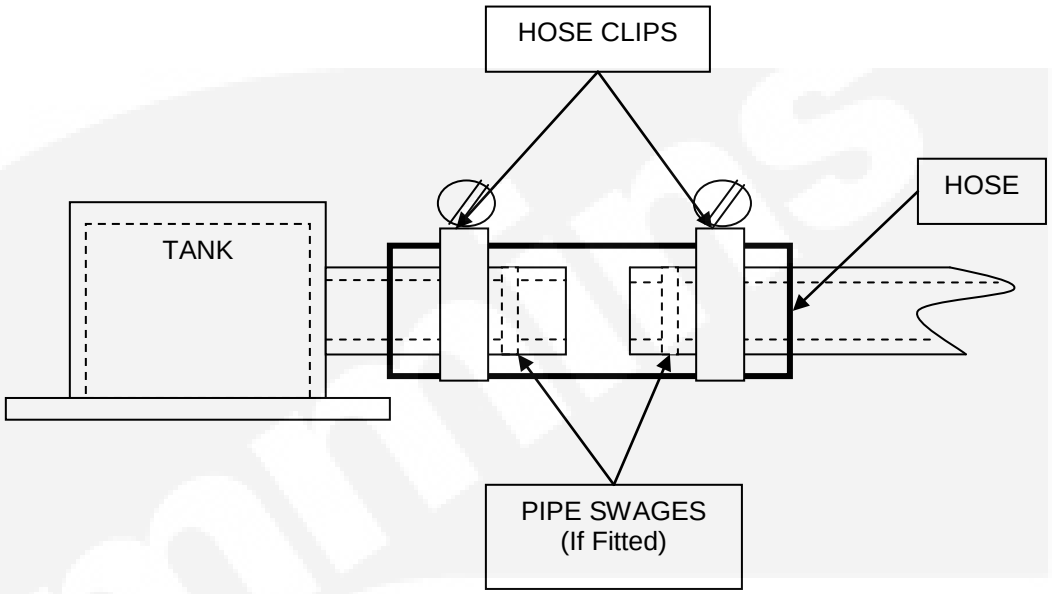
WARNING:	**CONTACT WITH HOT COOLANT CAN RESULT IN SERIOUS BURNS.**

Caution:	*Incorrect fitting can cause leaks resulting in risk of burning or scalding to personnel, and cause severe damage to the engine through overheating.*

- It is important that the clips are fitted as part of the pipe assembly and not fully opened as shown here.

- If the clips are opened up during installation this will cause the band top to become distorted and will reduce the effectiveness of the clip.

- It is essential for the clip's performance that it is correctly positioned and orientated on the hose. The clip should be assembled to sit perpendicular to the pipe, and should be positioned just behind the pipe swage (if fitted), but not in contact with it.



Note: *Pipes may not contain the swage feature.*

1.2 Types of Hose Clips

1.2.1 Constant Torque Clips

DIA. RANGE (mm)	BOLT SIZE	PIPE DIA. (mm)	HOSE TYPE	INSTALLATION TORQUE
25.4 – 44.4	3/8”	25.4	EPDM RUBBER	8 Nm
31.7 – 54.1	3/8”	38.1	APT THICK WALL	14 Nm
31.7 – 54.1	3/8”	38.1	EPDM RUBBER	14 Nm
31.7 – 54.1	3/8”	38.1	SILICONE NOMEX	14 Nm
57.1 – 79.5	3/8”	57.1	EPDM RUBBER	14 Nm
57.1 – 79.5	3/8”	57.1	APT THICK WALL	14 Nm
69.8 – 92.2	3/8”	76.2	APT THICK WALL	14 Nm
69.8 – 92.2	3/8”	76.2	SILICONE NOMEX	14 Nm
69.8 – 92.2	3/8”	76.2	EPDM RUBBER	14 Nm
82.5 – 104.9	3/8”	88.9	APT THICK WALL	14 Nm
95.2 – 117.65	3/8”	101.6	APT THICK WALL	14 Nm
95.2 – 117.65	3/8”	101.6	SILICONE NOMEX	14 Nm
95.2 – 117.65	3/8”	101.6	EPDM RUBBER	14 Nm
133.3 – 155.7	3/8”	127	APT THICK WALL	14 Nm

1.2.2 T-Clips

DIA. RANGE (mm)	BOLT SIZE	PIPE DIA. (mm)	HOSE TYPE	INSTALLATION TORQUE
43 – 47	M6 X 50	38.1	SILICONE NOMEX	4 Nm
63 – 68	M7 X 60	57.1	EPDM RUBBER	4 Nm
68 – 73	M8 X 80	63.5	EPDM RUBBER	12 Nm
97 -104	M8 X 80	88.9	SILICONE NOMEX	12 Nm
121 – 130	M8 X 80	114.3	EPDM RUBBER	12 Nm
121 – 130	M8 X 80	114.3	SILICONE NOMEX	12 Nm
130 – 140	M8 X 80	127	EPDM RUBBER	12 Nm
130 – 140	M8 X 80	127	SILICONE NOMEX	12 Nm
162 - 174	M10 X 110	152.4	SILICONE NOMEX	30 Nm

1.2.3 Worm Drive Clips

DIA. RANGE (mm)	INSTALLATION TORQUE	SOCKET REQUIRED	HOSE TYPE
8 - 16	3 Nm	7mm	EPDM Rubber
12 - 20	3 Nm	7mm	EPDM Rubber
16 - 25	4.5 Nm	7mm	EPDM Rubber
25 - 40	4.5 Nm	7mm	EPDM Rubber
20 - 32	4.5 Nm	7mm	EPDM Rubber
32 - 50	4.5 Nm	7mm	EPDM Rubber
40 - 60	4.5 Nm	7mm	EPDM Rubber
50 - 70	4.5 Nm	7mm	EPDM Rubber
60 - 80	4.5 Nm	7mm	EPDM Rubber
70 - 90	4.5 Nm	7mm	EPDM Rubber
80 - 100	4.5 Nm	7mm	EPDM Rubber
90 - 110	4.5 Nm	7mm	EPDM Rubber
100 - 120	4.5 Nm	7mm	EPDM Rubber
120 - 140	4.5 Nm	7mm	EPDM Rubber

SECTION 2 - CLEANING

2 Cleaning

Note: *This task is to be undertaken by suitably trained and qualified service personnel **only**.*

2.1 Dust Laden Environments

Specific Instructions for the Cleaning of Radiator Cores Working in an Environment Subjected to Crushed Aggregate or Ceramic Dust Contamination.

Inspect the exterior of the radiator for obstructions. During the service life of a radiator a build up of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To ensure the continued efficiency of the radiator the core will require cleaning.

Unless the radiator can be dismantled and the core treated in a professional caustic immersion cleaning system, the radiator should not be “wet” cleaned. This is because of the tendency of this type of contamination to coalesce and become extremely difficult to remove.

The correct procedure is to regularly blow through the entire core area with low pressure compressed air (against the direction of cooling airflow). It is very important to ensure that resultant debris blown from the core is subsequently removed and disposed of before engine start-up. An industrial vacuum cleaner will achieve this requirement. In most installations it will necessary to remove cowls and guarding.

To prevent damage to fins and resultant loss of cooling, it is important to ensure that the air gun used is maintained at right angles to the core face.

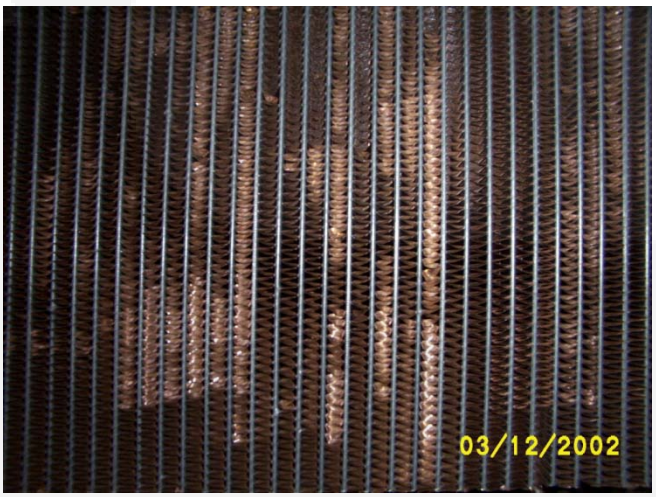


Figure 2-1 Fins damaged by compressed air at acute angles to core face

Immediately after this procedure has been effectively carried out, with only the lightest of dust, remaining, if deemed essential, it may be followed by procedure in the following Section 1.2. (This section covers the Cleaning of Radiator Cores Using Pressurised Water Equipment).

Caution:	*It is vitally important that the core is thoroughly dried before start-up.*

2.2 General Cleaning

The Cleaning Of Radiator Cores Using Pressurised Water Equipment

Note: *In specific dust laden environments this procedure should not be used as the initial cleaning operation, it should follow Section 2.1 - Dust Laden Environments.*

Inspect the exterior of the radiator for obstructions. During the service life of a radiator a build up of foreign matter can obstruct the flow of air through the radiator cores, reducing the cooling capability. To ensure the continued efficiency of the radiator the core will require cleaning.

To ensure thorough cleaning, pressure wash in the opposite direction to the airflow. A suitable proprietary degreasing additive (as recommended by the manufacturer of the pressure washer) should be applied via the pressure washer but this must not contain ammonia as it will corrode the core.

The recommended equipment for cleaning a radiator core is an industrial pressure washer but it must be used in the correct manner as misuse can reduce the performance of the core. Protect the generator set from any over spray during this procedure.

To be effective it is recommended that a hot water washer be used.

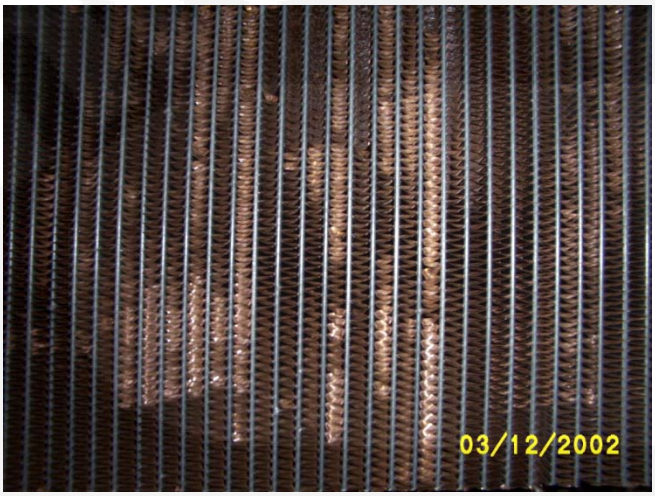
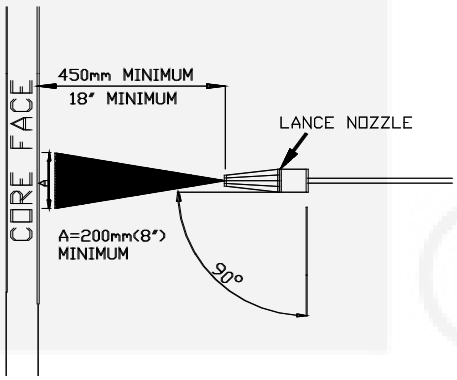


Figure 2-2 Fins damaged by pressure washing at acute angles to core face

Caution:	*With the pressures involved it is important that the distance between the core face and the nozzle is a minimum of 450mm (18 inches) any closer and damage may occur.*



Caution:	*Most Industrial pressure washers work at pressures of around 1500psi to 3000 psi (103bar to 206bar). It is very important that when washing a core in this way the lance must be kept at a right angle to the core.*

Note: *If your pressure washer works above 3000 PSI then the gap between the nozzle and the core face must be increased or fin damage will occur.*

Note: *Always follow pressure washer Manufacturer's Health and Safety Guidelines.*

SECTION 3 – BEARING HEALTH CHECK

3 Bearing Health Check

Note: *This task is to be undertaken by suitably trained and qualified service personnel **only**.*

3.1 Relevant to Interference Fit and Non-Interference fit Bearings

Determine if there are any sounds emanating from the shaft/bearing assembly which may be indicative of failure, or imminent failure.

3.1.1 Visual

There should be no movement between shaft and inner ring. If any movement is apparent, the shaft/bearing assembly needs replacing.

3.1.2 Check inner ring set screws

Check for looseness. If screw rotates under light torque, re-check 2.1.1 above, then remove, clean off old Loctite residue, re-apply Loctite 243 (or equivalent strength thread lock) and replace with a torque of:

M8	9Nm	6.6lb/ft
M10	17Nm	12.5lb/ft
M12	27Nm	20lb/ft

With non interference fit bearings it is important to ensure that the screws line up with shaft dimples. For interference fit bearings this is not relevant because the shafts are not dimpled.

3.1.3 External conditions

If any of the following conditions exist, replacement may be necessary:

1. No evidence of any grease emission around outer shield.
2. Heavy contamination with abrasive particles, with potential to ingress the bearing.
3. Obvious signs of direct pressure washing (removing/contaminating the grease inside) with rusting evident on associated metal surfaces.

3.1.4 Maintenance

Check that this is being carried out at the specified intervals with the correct type and quantity of grease. If this is not the case, correct immediately and monitor the bearings more frequently.

1. Using a Contact Surface Pyrometer or a laser Pyrometer check pulley temperature whilst running under maximum load conditions (maximum permitted 80^{o}C [176^{o}F]). Check for any evidence of belt slip. A new belt is required if this is happening. Ensure correct belt tension and check integrity and function of idler.
2. Check for bearing vibration using vibration meter, or special purpose rotating machinery condition monitoring instrument, where possible.
3. Using a Contact Surface Pyrometer or a laser Pyrometer check bearing running temperatures as close as practicable to rolling elements, under maximum load conditions. Also, particularly relevant to containerised generator sets, check these temperatures over a period of fifteen minutes after shutdown. (Maximum permitted 100^{o}C [212^{o}F] with Shell Alvania 3 grease, or equivalent]).

This is a Blank Page

SECTION 4 – BEARING AND GREASE CHANGE

4 Change of Bearing

Note: *This task is to be undertaken by suitably trained and qualified service personnel **only**.*

The fan drive and design has been changed to improve serviceability of the bearing set-up both in terms of greasing and fitting.

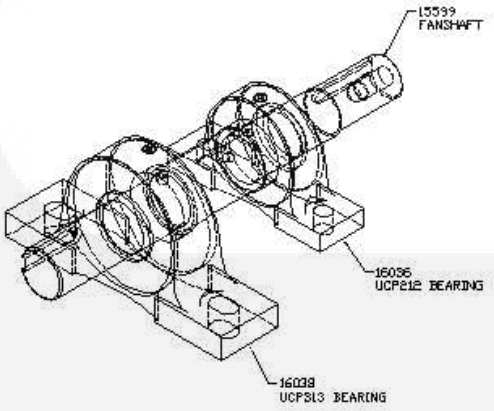
4.1 Implementation Date

Implementation was week 14, 2004 (i.e. all radiators manufactured after 25th March 2004).

4.2 Fitting (Belt Drive Radiator Bearings)

To ease the fitting of bearings both on the build lines and in the field, an interference fit for pulley, fan and idler bearing (non-pulley side) has been adopted.

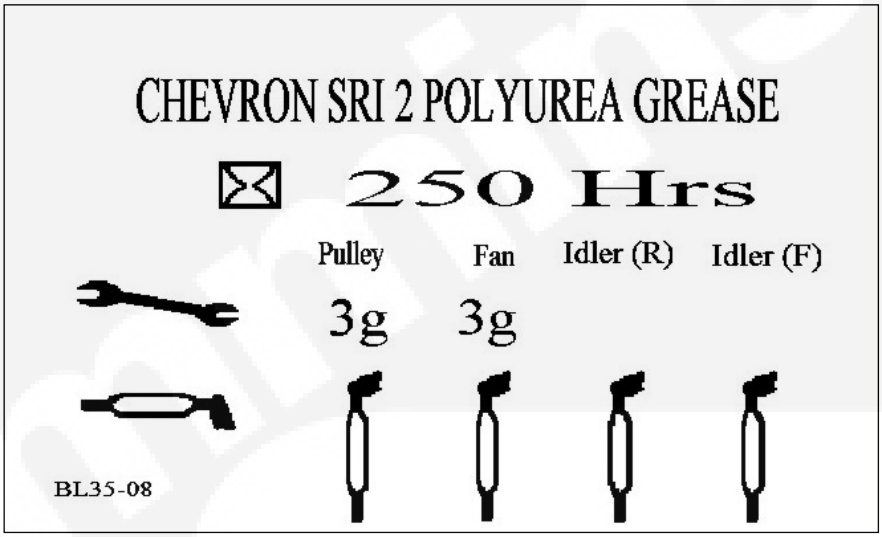
The new design can be fitted to existing product without altering form, fit or function. Spares will be provided as complete kits – bearing and shaft assemblies (see example) for the main fan drive and (where applicable) an idler assembly complete with idler arm. Nuts, bolts, lube kits, grease labels and fitting work instruction will also be included.



4.3 Grease and Grease Intervals

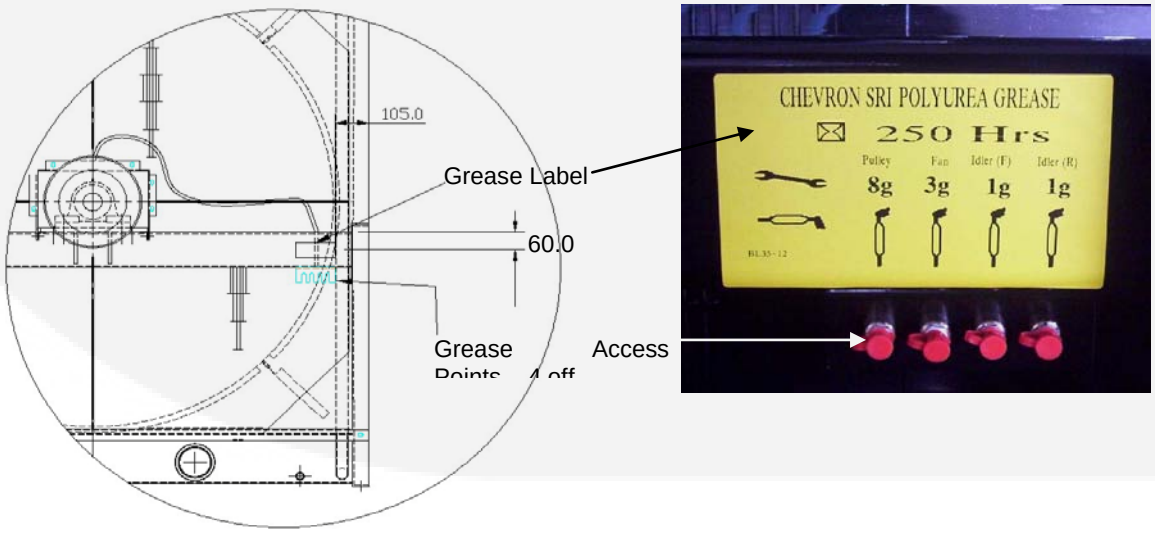
WARNING: **LITHIUM AND POLYUREA GREASES ARE NOT COMPATIBLE AND MUST NOT BE MIXED.**

Improved grease decals, clearly indicating grease type, amount and intervals, have been developed.



Note: *All current belt drive radiator bearings are filled with lithium-based grease.* ***All belt drive radiators fitted with the new fan drive system will be filled with polyurea grease as clearly shown on the label****.*

Note: *All current direct belt drive fan hubs are fitted with sealed for life bearings. For further information refer to the relevant service manual*.



Grease quantity and greasing intervals have been designed to coincide with engine service intervals. This will prevent over greasing (it is possible to hydraulically lock a bearing by over greasing a stationary bearing).

Greasing Information – Refer to Label on Radiator

Cummins Part No.	Engine Type	Interval (hours)	Grease (Polyurea)	Fan Bearing (grams)	Pulley Bearing (grams)
0130-6109 037625	QST30G1/2	250	Chevron SRI 2	3	8
037648	QST30G8	250	Chevron SRI 2	3	3
037557 037610	KTA38 KTA50G1/2	250	Chevron SRI 2	3	3
037558	KTA50G3/4 KTTA50G2	250	Chevron SRI 2	3	3
037663	KTA50G9	250	Chevron SRI 2	3	8
037644	KTA50G8/9	250	Chevron SRI 2	3	8
037665	QST30G4	250	Chevron SRI 2	3	3
037676	QST30G4	250	Chevron SRI 2	3	8
037643 037678	KTA50G8/9 KTA50G9	250	Chevron SRI 2	3	8
0179-2921 0179-2862	QSK60	250	Chevron SRI 2	6	8
0179-3291	QSK60	250	Chevron SRI 2	6	8
0130-5997-05	QSK78	A Nema 284T frame has the following arrangement: 6311 C3 / 18gram Polyrex – EM /20,000h 6311 C3 / 11gram Polyrex – EM /20,000h			
The above information is based on the latest information available. Radiator label information should take precedence if it differs from the above.					

This is a Blank Page

SECTION 5 – LITHIUM-BASED GREASE

5 Lithium-based grease

Note: *This task is to be undertaken by suitably trained and qualified service personnel **only**.*

5.1 Greasing Schedule (pre 25th March 2004 manufacture)

WARNING: **LITHIUM AND POLYUREA GREASES ARE NOT COMPATIBLE AND MUST NOT BE MIXED.**

The information in the following tables has been supplied as a general re-lubrication guide to bearing assemblies manufactured before the change-over on 25th March 2004. Radiator label information should take precedence if it differs from the following.

The recommended lubricant is a lithium-based grease such as Mobilux EP2, Mobilith AW2 or Shell Alvania R3

Note: *Grease labels are based on 250 hours*

Bearing Description	Bearing Ref.	Temperature	Interval (hours)	Grease Amount (grams)
Pulley end bearing	UCP313	To 100°C	250 Hours	8
Fan end bearing	UCP212	To 100°C	250 Hours	3
Tension idler bearing	UCFL206	To 100°C	250 Hours	1
Pulley end bearing	UCP313	To 100°C	500 hours	10
Fan end bearing	UCP212	To 100°C	500 hours	5
Tension idler bearing	UCFL206	To 100°C	500 hours	1
Fan end bearing	UCP312	To 100°C	250 Hours	6
Fan end bearing	UCP312	To 100°C	500 hours	8

Note: *One gram of grease is approximately one shot from a normal grease gun.*

Bearing No.	Cummins Part No.
312/212	37564
312/212	37604
212	37558
212	37614
212	37627
313/312	0179-2921
313/312	0179-2988
312	0179-3291
312/212	130-5791
312/212	37644
312/212	37624
312/212	37625
212	37648
212	37643
212	37678
212	37665
312/212	37676
212	37610
313/212	37642

Cummins Power Generation
1400 73rd Avenue NE
Minneapolis
MN 55432
USA

Tel:+1 (763) 574-5000
Fax:+1 (763) 574-5298

e-mail: pgamail@cummins.com

Web: www.cumminspower.com

Cummins Power Generation
Columbus Avenue
Manston Park
Manston
Ramsgate
Kent CT12 5BF
United Kingdom

Tel:+44 (0) 1843 255000
Fax:+44 (0) 1843 255902

e-mail: cpgk.uk@cummins.com

Web: www.cumminspower.com

Cummins Power Generation
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838

Tel: (65) 6417 2388
Fax:(65) 6417 2399

e-mail: cpg.apmktg@cummins.com

Web: www.cumminspower.com

Cummins Power Generation
35A/1/2, Erandawana
Pune 411 038
India

Tel.: (91 020) 3024 8600
Fax: (91 020) 6602 8090

e-mail:
cpgiservicesupport@cummins.com

Web: www.cumminspower.com

Cummins Power Generation
Rua Jati, 310 - Cumbica
Guarulhos –SP
Brazil
CEP: 07180-900

Tel.: (55 11) 2186 4195
Fax: (55 11) 2186 4729

e-mail:
falecom@cumminspower.com.br

Web: www.cumminspower.com