

# **Health and Safety**

# Generator Sets and Associated Equipment

Safety Information

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# Foreword

The purpose of this manual is to provide the users with sound, general information. It is for guidance and assistance with recommendations for correct and safe procedures. Cummins Power Generation (CPG) cannot accept any liability whatsoever for problems arising as a result of following recommendations in this manual.

The information contained within the manual is based on information available at the time of going to print. In line with Cummins Power Generation policy of continuous development and improvement, information may change at any time without notice. The users should therefore ensure that before commencing any work, they have the latest information available.

Users are respectfully advised that it is their responsibility to employ competent persons to carry out any installation work in the interests of good practice and safety. Consult your authorized distributor for further installation information. It is essential that the utmost care is taken with the application, installation and operation of all products due to their potentially hazardous nature. Careful reference should also be made to other Cummins Power Generation literature. All equipment must be operated and maintained properly if you are to expect safe and reliable operation.

Should you require further assistance, contact your authorized distributor.

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# 1 Introduction

# 1.1 General Information

Personnel engaged in the installation, commissioning, operation and maintenance of generator sets must be competent and experienced in these fields. They must also comply with all relevant and current statutory requirements and regulations regarding health and safety at work, and any modification and amendment that may subsequently become a legal requirement, together with any local requirements/regulations.

Before operating the generator set or associated equipment, read this manual and become familiar with the equipment and its operation (including all controls, manually operated valves and shutdown devices). Correct operation and maintenance is essential for safe and efficient operation of this set.

Read and become familiar with the Safety Precautions listed in this manual and within any other manuals related to the equipment. Many accidents result from a failure to observe fundamental safety rules and precautions.

There are many potential hazards that can occur during the operation of a generator set, which cannot always be anticipated. Therefore a warning cannot be included in the manual for every possible circumstance that might involve a potential hazard.

Should a procedure be used that has not been specifically recommended, then the personnel involved must be satisfied that it is safe and will not damage the generator set.

# 1.2 Safety Precautions

Keep all relevant documentation with the equipment for ease of reference. Copy and post safety information in potentially hazardous areas.

# **1.2.1** Warning, Caution and Note Styles Used in this Manual

The following safety styles found throughout this manual indicate potentially hazardous conditions to the operator, service personnel or the equipment.

#### \Lambda DANGER

*Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.* 

#### **⚠ WARNING**

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

#### 

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

#### NOTICE

Indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

# 1.2.2 Safety Symbols

Safety information signs are displayed where equipment has been installed. Become familiar with all signage and the sign meaning before operating the equipment. Sample safety symbols are shown below; observe and comply with the warning labels particular to your product installation.

Safety Symbol		$\bigcirc$	
Message	Warning	Prohibition	Mandatory Action

# 1.3 Product Safety Code

Before operating your product, read all associated product manuals and become familiar with them and the equipment. Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

Only suitably trained authorized personnel should operate and maintain this equipment. Liaise with the site safety coordinator(s) for authorization and access to the equipment.

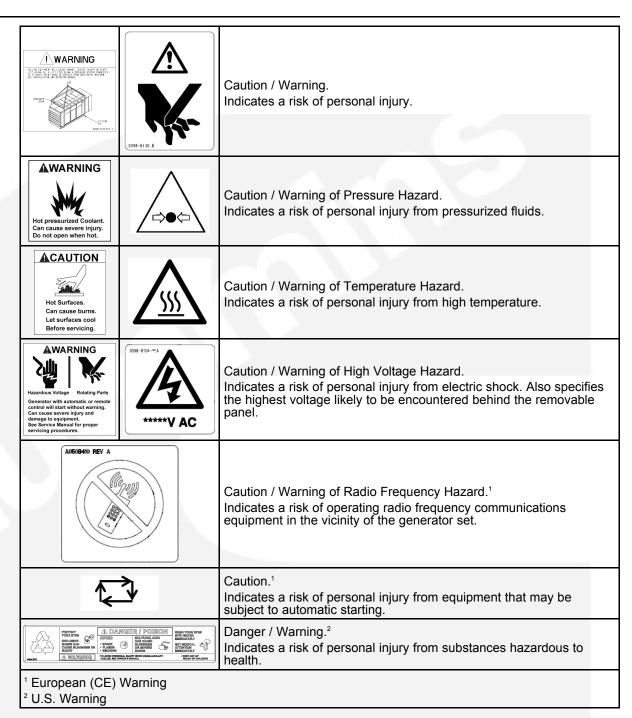
Be aware of and comply with site safety procedures. Only operate/maintain the equipment when permission has been granted to do so.

When working in isolation, provisions for communication with the site coordinator(s) should be made.

# 1.3.1 Warning Labels

Warning signs are provided on the equipment at the point of risk. Become familiar with the product labeling and the label meaning before operating the equipment. To avoid injury, always take the necessary precautions. Sample signs are shown below; observe and comply with the warning labels particular to your product.

U.S. Warnings European ( Warning	E) Explanation of Symbol
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# 1.4 Standards

# 1.4.1 Radio Frequency

Cummins Power Generation products have been tested to make sure they achieve essential requirements of the limits of radio frequency immunity and emissions. Specific standards are dependent on the product origin. For more information contact your authorized distributor.

From tests, the manufacturer has established that, as a precaution against undue effects, no radio frequency communications equipment should be operated at a distance of less than three meters from any part of the apparatus. For example, when a generator set could, or is relied upon to, provide power.

The effective separation distance should be increased if the radio frequency communications equipment is found to interfere with the apparatus; the onus lies with the customer to effectively test for adverse effects on the apparatus before usage of the equipment.



NO RADIO FREQUENCY COMMUNICATIONS EQUIPMENT MAY BE OPERATED IN THE VICINTY OF THIS APPARATUS FIGURE 1. RADIO FREQUENCY WARNING

# 1.4.2 Standards, Codes and Regulations

The products accompanying this manual are manufactured under registered quality control systems, to the high standards you expect from Cummins Power Generation.

For more information relating to the quality control systems observed, contact your authorized distributor.

# 1.4.3 Build Standards

The products accompanying this manual have been designed, constructed and tested in accordance with the high standards you expect from Cummins Power Generation.

For more information relating to the specific build standards applicable, contact your authorized distributor.

# 2.1 Safety Notices

#### **▲ WARNING**

It is important to read and understand all safety notices provided in this manual. Improper operation or maintenance could result in a serious accident or damage to the equipment causing injury or death.

# 2.1.1 Engines

#### **▲ WARNING**

Do not operate an engine where there are, or can be, combustible vapors. These vapors can be sucked through the air intake system and cause engine acceleration and overspeeding, which can result in a fire, or an explosion, which could result in severe personal injury or death.

Where an engine, due to its application, might operate in a combustible environment, suitable overspeed shutdown devices must be fitted.

The equipment owner and operator are responsible for safe operation in a hostile environment. Consult your authorized dealer for further information.

# 2.1.2 Electricity

#### **⚠ WARNING**

*Electricity can cause severe personal injury or death. Lethal voltages may be present in much of the equipment referred to in this manual.* 

# 2.1.3 High Pressures

#### 🗥 WARNING

Liquids or gases that are highly pressurized can pass through the skin and into the body, causing severe personal injury or death. Pressurized liquids and gases can also cause damage to equipment.

### 2.1.4 Maintenance

#### 🗥 WARNING

Contact with a moving part could cause severe personal injury or death. Use extreme caution around hot manifolds, moving parts, etc,. To prevent serious burns, avoid contact with hot metal parts such as the radiator, the turbocharger, and the exhaust system.

#### **⚠ WARNING**

To complete maintenance tasks at height, suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation. Failure to follow these guidelines and legislation could result in severe personal injury or death.

#### NOTICE

Only authorized and competent personnel who are familiar with the equipment and its operation should carry out maintenance.

#### NOTICE

Dependent upon the control system fitted, this unit may operate automatically and could start without warning.

# 2.1.5 Supply Isolation

**⚠ WARNING** 

If the engine has been running recently, or if the optional battery charger has been switched on, explosive gases (given off during battery charging) may be present in the vicinity of the batteries. Ensure the area is well ventilated before disconnecting batteries.

NOTICE

Before carrying out any maintenance, isolate all supplies to the generator set, control panels, or associated equipment. Render the equipment inoperative by disconnecting the plant battery. Follow lockout/tagout procedures.

#### NOTICE

Remove AC power to all associated heaters (for example: panel heater, coolant heater, oil pan heater, alternator heater), before disconnecting battery leads. Heaters will run continuously without DC power and can overheat and damage equipment.

#### NOTICE

Shut down the equipment as described in the operator manual supplied. As an additional precaution, activate the emergency stop.

### 2.1.5.1 Lockout/Tagout

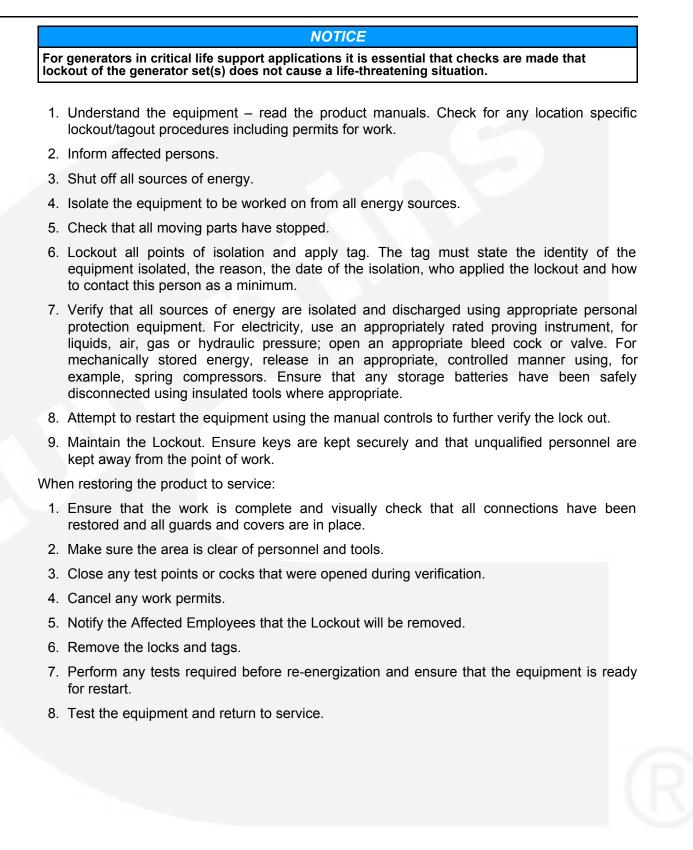
Lockout/tagout is intended to prevent injury due to exposure to hazardous parts, unexpected start-up of equipment or the release of stored energy. Only those trained in Cummins Lockout/Tagout Procedure or equivalent procedures are able to perform lockout/tagout.

Operators must observe all signs indicating a lockout/tagout is in operation. Do not attempt to energize the equipment. Cordinate with the site controller to for information regarding the lockout/tagout reason/duration.

A lockout/tagout will adhere to the following instructions as a minimum:

#### NOTICE

For equipment rated at medium or high voltage (e.g. over 1000 volts AC or 1500 volts DC), refer to specific procedures for isolation, grounding and permits to work.



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# 3.1 General

#### **WARNING**

Maintaining or installing a generator set can expose operators to risks/hazards that can cause severe personal injury or death. Wear personal protective equipment (PPE) when working on equipment. PPE includes, but is not limited to: safety glasses, protective gloves, hard hats, steel-toed boots, and protective clothing.

#### 

Electrical shocks and Arc Flashes can cause severe personal injury or death. Wear appropriate PPE as designated for the task and hazard severity. Specific arc flash PPE (for example: arc flash coveralls, head gear, hard hat, safety glasses, gloves) must be worn.

#### **▲ WARNING**

To complete maintenance tasks at height refer to local legislative requirements. Suitable equipment for performing these tasks must be used in accordance with the local guidelines and legislation. Failure to follow these instructions can result in severe personal injury or death.

#### 

Lifting and repositioning of the generator set must only be carried out using suitable lifting equipment, shackles and spreader bars in accordance with local guidelines and legislation by suitably trained and experienced personnel. Incorrect lifting can result in severe personal injury, death and/or equipment damage. For more information contact your authorized distributor.

#### 

**Risk of Injury** 

On generator sets that can be started automatically or from a remote location, a warning plate should be displayed prominently indicating, pictorially, to personnel that the generator set may start automatically without warning.

Appropriate personal protective equipment should be worn when working on the generator set or on any associated equipment.

Information on first aid procedures and facilities should be displayed near the equipment.

The area around the equipment should be clear of obstructions. In addition, the floor should be kept clean, dry, and clear of oil deposits. Store all service materials according to local legislative guidelines.

All maintenance tasks must be assessed for health and safety risks; the preventative measures identified must be actioned. Accompaniment is required for tasks where the presence of someone else will add significantly to the safety of the task.

Never lift the generator set using the engine or alternator lifting lugs. Refer to the lifting recommendation drawings and/or Installation Manual for further details.

#### 

Wear hearing protection when going near an operating generator set. Operating generator sets emit noise which may cause hearing damage.

#### NOTICE

If fork-lift pockets have been provided to re-position the generator set, ensure that the forks of the fork-lift truck are at right angles to the bedframe before inserting them into the pockets provided.

Only lifting devices of suitable capacity should be used.

For specific details of the materials used in the generator set, contact your authorized distributor/dealer. Record and keep this information with the documentation supplied with the generator set.

Before operating or performing authorized maintenance tasks on the equipment, be aware of the risks. Only authorized, suitably trained personnel should operate/maintain the equipment.

Before performing any maintenance tasks on the equipment, where appropriate follow the lockout/tagout procedure.

Be aware of the product environment. Other equipment may be in operation or energized in the surrounding area and may produce (as a by-product) exhaust gases, flammable vapors, liquids under pressure, noise etc,. Make sure you are authorized to operate or maintain the equipment. Coordinate with the site controller and, if required, make provisions for communication if operating/maintaining the equipment in isolation.

Before operating the equipment, ensure the equipment/system is complete, compliant, all product guarding is in place, and has been tested/certified.

# **3.2 Electrical Hazards**

#### ▲ DANGER

#### **Risk from Electric Shock**

Before carrying out any maintenance, isolate all supplies to the generator set and any control panels. Render the set inoperative by disconnecting the plant battery. For more information reference the Operation and Maintenance Manuals supplied with the set.

Only suitably trained and qualified engineers, who are authorized to do so, should connect the generator set load, operate or perform maintenance on the set. Connection must also be in compliance with relevant codes and standards.

The generator set should only be connected to loads compatible with its electrical characteristics and rated output.

Medium or high voltage acts differently than low voltage. Special equipment and training is required to work on, or around, medium or high voltage equipment. Do not work on energized equipment. Due to the nature of medium or high voltage electrical equipment, induced or residual voltage remains even after the equipment is disconnected from the power source.

The metalwork of the generating set, bed frame and other exposed parts must be bonded to an effective earth point.

Any electrical measurements to be performed on energized equipment shall be performed by qualified and authorized personnel who must use appropriately fused test equipment rated for the voltage and current to be measured.

Ensure that all connections are insulated.

Ensure that all electrical equipment and connections are kept clean and dry.

Replace any defective terminal covers and wiring immediately and ensure that all terminations are secure.

Reinstate all protective devices removed or disconnected during maintenance or overhaul, before putting the generator set back into service.

The appropriate neutral earthing requirements must be complied with, or adequate means incorporated to ensure that an isolated neutral system is adequately protected against voltage rises and undetected earth faults. In the situation where the generator set is operated in parallel with a network supply, the user must be satisfied that the neutral earthing switch gear (where fitted), is operational and that the associated protection devices are fully functional. Permission must have been obtained from the local electricity supply utility, before parallel operation is considered.

Do not connect generator set directly to any building electrical system. Hazardous voltages can flow from the set into the utility line. This creates a potential for electrocution, or property damage. Connect only through an approved isolation switch or an approved paralleling device.

#### NOTICE

To prevent damage to the battery charging system:

- Never disconnect the battery while the generator set is running
- Never disconnect the charging leads while the generator set is running
- Disconnect the battery and charge alternator before electric arc welding on the generator set.

#### NOTICE

The charge alternator output lead is live at all times.

Follow all applicable electrical safety codes.

Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

### 3.2.1 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death

#### \Lambda DANGER

Any work with exposed energized circuits with potentials of 50 volts A.C. or 75 volts D.C. or higher pose a significant risk of electrical shock and electrical arc flash. Unless properly controlled, these hazards will cause severe injury or death. Refer to standard NFPA 70E or equivalent safety standards in corresponding regions for details of the dangers involved and for the safety requirements. Refer to your product's service manual for more information.

Guidelines to follow when working on de-energized electrical systems:

- Use proper PPE. Do not wear jewelry and ensure that any conductive items are removed from pockets as these items can fall into equipment and the resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE standards.
- De-energize and Lockout/Tagout electrical systems prior to working on them. Lockout/Tagout is intended to prevent injury due to unexpected start-up of equipment or the release of stored energy. Please refer to the Lockout/Tagout section for more information.
- De-energize and Lockout/Tagout ALL circuits and devices before removing any protective shields or making any measurements on electrical equipment.
- · Follow all applicable regional electrical and safety codes.

Guidelines to follow when working on energized electrical systems:

#### NOTICE

It is the policy of Cummins Inc., to perform ALL ELECTRICAL WORK IN A DEENERGIZED STATE. However, employees or suppliers may be permitted to occasionally perform work on energized electrical equipment ONLY when qualified and authorized to do so and when troubleshooting, or if de-energizing the equipment would create a greater risk or make the task impossible AND all other alternatives have been exhausted.

#### NOTICE

Exposed energized electrical work is ONLY allowed as per the relevant procedures and MUST be undertaken by a Cummins authorized person with any appropriate energized work permit for the work to be performed while using proper PPE, tools and equipment. In summary:

- DO NOT tamper with or bypass interlocks unless you are authorized to do so.
- Understand and assess the risks use proper PPE. Do not wear jewelry and ensure that any
  conductive items are removed from pockets as these items can fall into equipment and the
  resulting short circuit can cause shock or burning. Refer to standard NFPA 70E for PPE
  standards.
- Ensure that an accompanying person who can undertake a rescue is nearby.
- Follow the job plan. If something unexpected happens, reassess the situation before continuing. Do not allow a testing/troubleshooting or voltage measurement job to become energized electrical work even if the task appears straightforward.

### 3.2.1.1 NFPA Equivalent Standards

BS EN 12601:2010 Reciprocating internal combustion engine driven generating sets — Safety. International Relationships EN 12601:2010 Identical BS EN 60204-1:2006+A1:2009 Safety of machinery. Electrical equipment of machines. General requirements. International Relationships EN 60204-1:2006 Identical, IEC 60204-1:2005 Modified.

# 3.3 Environment

Regular operation and maintenance inspections are required to ensure the equipment is operating safely and efficiently within the parameters designated in the product specifications.

Special consideration must be taken to prevent contamination of the environment, especially sewers, and waterways. Ensure that all waste products are disposed of in accordance with local legislation to a licensed site. When spill containment is not included in the design of the product, a separate engineering solution should be in operation.

# 3.3.1 Engine Waste

**⚠ WARNING** 

Incorrect disposal of engine waste is environmentally harmful and presents a health risk. Some engine waste is combustible and is therefore a fire risk.

Dispose of unwanted or absorbed substances through an authorized contractor who will transport and correctly dispose of the waste to a licensed site. For further information, refer to the Substances Hazardous to Health chapter (<u>Chapter 4 on page 19</u>).

# 3.4 Exhaust Gas Hazards

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#### **Risk from Toxic Fumes**

Exhaust fumes are toxic and all necessary measures must be taken to ensure that they do not escape into, or re-circulate within, the plant room or associated buildings. Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms include: dizziness, nausea, headache, sleepiness, and the inability to think coherently. Persons affected should seek fresh air immediately and be kept active. If symptoms persist, seek medical attention. Shut down the generator set and do not operate until it has been inspected and repaired.

#### **▲ WARNING**

Should repeated attempts to start the engine fail, unburnt fuel gas may build up in the exhaust system creating a potentially hazardous situation. Allow these gases to disperse before carrying out further attempts to start.

#### 

Do not use exhaust gases to heat a compartment. Exhaust gases are toxic and can cause unconciousness and death.

#### **⚠ WARNING**

Ensure that the generator set is kept well ventilated. Thoroughly ventilate the plant room to remove all fumes and explosive vapors before disconnecting or connecting battery cables thus reducing the possibility of accidental sparks causing an explosion.

#### NOTICE

Visually and audibly inspect the exhaust system. Ensure that all exhaust components are secured and the correct gaskets and fasteners are used. Ensure that the exhaust outlet is kept free from obstruction.

# 3.5 Natural Gas

#### **⚠ WARNING**

#### Risk of Asphyxiation and Explosion

Natural gas is hazardous if leakage occurs. Relatively low levels of gas leakage in confined areas can cause explosions if ignited.

Inhalation of large volumes of natural gas can cause asphyxiation and death. If leakage occurs, isolate the gas supply, do not operate any equipment (electrical or otherwise) that may cause a spark or may be a source of ignition, evacuate the building and fully ventilate the area. Only suitably qualified personnel who are fully trained to handle natural gas emergencies are to be allowed near the plant room or generator set(s) in such emergencies.

Modifications to any component within the gas train must be accomplished by a qualified gas fitter who has been certified and authorized to work with the gas and pressure to be encountered.

Ensure that gas pipes and gas trains are installed in compliance with relevant codes, standards and local requirements.

Welding equipment, blowlamps, and any other source of ignition that may cause natural gas to ignite should not be used in the Plant Room unless all gas pipes have been purged.

Incomplete or unsealed gasways should never be left unattended without all reasonable precautions being taken to inform others of the disconnection and potential danger (i.e. Warning Signs etc). Metal pipes should always be sealed with metal pipe fittings.

Electrical earth bonding on all gas pipes and gas components should be regularly checked for security and good electrical contact.

If a gas leak is suspected:

- Do not operate any electrical equipment or switches in the plant room, these can cause sparks.
- Immediately evacuate all personnel from the plant room and then ventilate the building.
- Shutdown the generator set(s) by fully shutting the gas train shut-off valve(s).
- Fully shut all external gas supply valves to the generator set(s).
- Alert the emergency services and local gas supplier.

# 3.6 Fire Hazards

#### ▲ DANGER

#### **Risk of Fire**

With the use of fuel, lubricating oils, and batteries, there is a fire hazard. Open flames or sparks should not be allowed near the generator set, fuel tank and batteries. Explosive fuel and oil vapors are always present in the vicinity of a generator set, while a battery on charge can produce inflammable hydrogen gas.

Leakage of natural gas, at relatively low levels and in confined areas, can cause explosions and fires if ignited.

An area in the vicinity of the generator set should be designated a NO SMOKING area and one that is prohibited to unauthorized persons.

Ensure that adequate ventilation is maintained within the plant room at all times. Thoroughly ventilate the plant room to remove all fumes and explosive vapors before disconnecting or connecting battery cables thus reducing the possibility of accidental sparks causing an explosion.

Providing suitable bunding to contain any spillage or leakage from the generator set is the responsibility of others. The volumes of fluids involved can be established from the data supplied with the set.

No loose items of equipment or combustible material should be left on or near any part of the generator set. Remove all unnecessary oil and grease from the unit and clean up fuel and oil spills immediately.

In the event of a fuel or oil leak, the spillage should be absorbed using a proprietary material (e.g. Fuller's Earth granules, or similar). Sawdust should not be used, as this will create a fire hazard. Appropriate fire fighting equipment should be readily available - (class A, B and C [dry powder] type fire extinguishers are recommended).

Inspect the fuel system before each operation and periodically while running.

Do not refill the fuel tank while the generator set is running, unless the tanks are outside the engine compartment. Fuel contact with a hot engine or exhaust is a potential fire hazard.

Keep a fire extinguisher available in or near the plant room and in other areas throughout the site. Use the correct extinguisher for the area.

#### NOTICE

Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquid fuels and gaseous fuels. Class C fires involve live electrical equipment. (Refer to NFPA No. 10 in applicable region.)

# 3.7 Fluids

#### **MARNING**

#### **Risk of Toxic Chemicals**

There is a health risk associated with exposure to fuel, lubricating oils, coolant additives and battery electrolyte. Avoid contact with these fluids and always wear the appropriate personal protective equipment. Reference should be made to <u>Chapter 4 on page 19</u> for general information and to the Material Safety Data Sheets (MSDS) obtainable from the relevant suppliers/manufacturers.

Benzene and lead, found in some diesel oils, have been identified as causing cancer or reproductive toxicity. When checking, draining or adding diesel, take care not to ingest, breathe the fumes, or contact the diesel.

Used engine oils have been identified as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes or contact used oil.

Avoid fluid spillage and discard clothing contaminated by fuel oil, coolant, lubricants or battery electrolyte.

Ensure that remote fuel storage systems are installed in compliance with relevant codes, standards and local requirements.

Fuel lines must be adequately secured and free of leaks. Fuel connection to the engine should be made with an approved flexible line. Do not use zinc coated or copper fuel lines with diesel fuel. Ensure all fuel supplies have a positive shut-off valve.

The user should also contact their supplier of fluids used in the generator set for Manufacturers' recommendations on Health and Safety.

Any materials used for this product, for example: lubricating oil, coolant; must be stored in accordance with the manufacturers recommendations in a secure storage area away from operating equipment.

Containment vessels may fill will rainwater which must be emptied. This rainwater may be contaminated and must be disposed of in accordance with local environmental regulations.

#### **⚠ WARNING**

#### **Toxic Hazard**

Ethylene glycol, used as an engine coolant, is toxic to humans and animals. Wear appropriate PPE. Clean up coolant spills and dispose of used coolant in accordance with local environmental regulations.

# 3.7.1 Fluid Containment

NOTICE

Where spillage containment is not part of a Cummins supply, it is the responsibility of the installer to provide the necessary containment to prevent contamination of the environment, especially water courses and sources.

If fluid containment is incorporated into the bedframe, it must be inspected at regular intervals. Any liquid present should be drained out and disposed of in line with local health and safety regulations. Failure to perform this action may result in spillage of liquids which could contaminate the surrounding area.

Any other fluid containment area must also be checked and emptied, as described above.

# 3.8 High Temperature Hazards

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#### Risk of Burning and Scalding

While the generator set is running, and for a period following shutdown, avoid contact with exhaust, radiator, and other components that are likely to become hot. At all times, avoid contact with hot oil, hot coolant, and hot exhaust gases.

Hot coolant is under pressure. DO NOT attempt to remove a radiator or heat exchanger pressure cap while the generator set is running. Always allow the set to cool completely before doing so. DO NOT drain coolant or lubricating oil until the generator set has cooled completely.

# **3.9 Moving Part Hazards**

#### **WARNING**

#### **Risk of Injury**

Safety guards and covers must be securely fitted and all cubicle doors, cover-plates, etc, should be firmly in place while the generator set is in operation.

Keep hands and loose clothing away from moving parts. Do not wear jewelry while servicing any part of the generator set.

Never step on the generator set unless access has been incorporated into the generator set design. It can stress and break unit components, possibly resulting in dangerous operating conditions – from leaking fuel, leaking exhaust fumes, etc. Do not use guards as steps or working platforms.

Before performing any maintenance on the generator set, disconnect its batteries to prevent accidental starting. Thoroughly ventilate the plant room to remove all fumes and explosive vapors before disconnecting or connecting battery cables, thus reducing the possibility of accidental sparks causing an explosion.

Avoid contact with any moving part.

# 3.10 Noise

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#### Risk of Damage to Hearing.

Generator sets emit noise. Ensure that the doors of any enclosure, or room that contains a generator set, display a suitable pictogram warning that hearing protection must be worn. It is the responsibility of personnel exposed to noise to ensure that they are provided with suitable ear protection, (e.g. ear defenders).

While there is a correlation between the emission and exposure levels, this cannot be used reliably to determine whether or not further precautions are required. Factors that influence the actual level of exposure of work-force include the characteristics of the work room, the other sources of noise, etc. i.e. the number of machines and other adjacent processes, and the length of time for which an operator is exposed to the noise. Also the permissible exposure level can vary from country to country.

Information on noise emissions can be found in the literature supplied with the generator set. This information will enable the user of the generator set to make an evaluation of the hazard and risk associated. The figures quoted are emission levels and are not necessarily safe working levels.

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# 4 Substances Hazardous to Health

The generator set(s) covered by this manual contains several substances that require special consideration when handling to avoid becoming hazardous to health and safety.

Operators of generating plant and machinery must obtain the relevant suppliers' Material Safety Data Sheets, and information/instructions therein should take precedent over the information provided within this document. In the absence of the suppliers' information, the following information may be used on a temporary basis only. In addition to preventing hazards to personal health, these instructions are designed to minimize environmental damage and pollution.

The information contained herein is based on the data available at the time of publication and may not be applicable to substances used in a specific product. Not all products contain all of the substances listed. It is the responsibility of the user to comply with any relevant laws and regulations that may exist.

# 4.1 Antifreeze - Fleetguard ES Compleat/EG Premix

Also known as an ethylene glycol based coolant; summer coolant; coolant additive. It is a purple colored, viscous liquid, with a mild chemical odor, is soluble in water and harmful. It contains ethylene glycol, and diethylene glycol. Ethylene glycol is a potentially hazardous constituent.

Boiling point: 107 °C (224 °F). Flash point: 121 °C (249 °F).

Used as an engine coolant additive and can be found in engine cooling systems and heat exchangers. Installers, operators, and maintainers are likely to encounter this substance.

# 4.1.1 Hazardous Reactions

Ethylene glycol is combustible when exposed to heat or flame and can react vigorously with oxidants. Moderate explosive hazard in form of vapor when exposed to heat or flame. Hazardous products resulting from combustion or decomposition include carbon monoxide, carbon dioxide and acrid smoke. Self-contained breathing apparatus must be worn in the event of fume build up.

Avoid strong oxidizing agents – incompatible with sulphuric acid, nitric acid, caustics and aliphatic amines.

It may cause neurological signs and symptoms, and kidney damage. It is also a skin and eye irritant.

Very toxic in particulate form upon inhalation. Harmful if swallowed, a lethal dose for humans is reported to be 100 ml.

### 4.1.2 **Protective Measures**

Refrain from eating, drinking, or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapor, or particulate, use a suitable organic vapor mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

# 4.1.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight, away from open flames and strong acids; do not freeze. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers and waterways.

Contain leak/spill with sand, earth or non-combustible, absorbent material to prevent entry of substance into drainage/sewerage system, waterways and land. Eliminate all ignition sources, use plastic shovel to transfer to suitable container and dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

# 4.1.4 Emergency Action

- Fire: Extinguishing media CO<sub>2</sub>, alcohol resistant foam, dry powder, or water spray. Fire fighters must use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains and drinking water supplies.
- Ingestion: Toxic by ingestion. If swallowed, induce vomiting <u>only</u> under the advice of a doctor or poison control center. Delayed treatment may result in fatality.
- Inhalation (of vapor): Remove from further exposure. In case of irritation to lungs or throat, seek medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Flush copiously with water or preferably eye-wash solution for at least five minutes. Seek medical attention.
- Skin: Wash thoroughly with soap and water, and seek medical attention if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage: Soak up using an absorbent material and dispose of this as directed under Storage/Transport.

# 4.2 Antifreeze - Valvoline Coolant Premix

A green, viscous liquid, which is practically odorless, and soluble in water. It contains ethylene glycol, and diethylene glycol. Ethylene glycol is a potentially hazardous constituent.

Boiling point: 171-203 °C (340-397 °F). Flash point: 118 °C (244 °F). Vapor pressure: 0.4mm Hg at 20 °C (0.0015 in at 68 °F).

Used as an engine coolant additive, it can be found in engine cooling systems, and heat exchangers. Installers, operators, and maintainers are likely to encounter this substance.

# 4.2.1 Hazardous Reactions

This product is considered stable but must be kept away from oxidizing agents.

In the event of a fire, or excessive heat, there is a risk of the containing drum bursting.

At elevated temperatures, vapor, or particulate, may irritate respiratory tract and continued exposure is reported to induce unconsciousness. Harmful, or fatal, if swallowed. Contact may cause skin sensitization.

### 4.2.2 **Protective Measures**

Refrain from eating, drinking, or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapor, or particulate, use a suitable organic vapor mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

# 4.2.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight, away from open flames and strong acids; do not freeze. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers and waterways.

Contain leak/spill with sand, earth or non-combustible, absorbent material to prevent entry of substance into drainage/sewerage system, waterways and land. Eliminate all ignition sources, use plastic shovel to transfer to suitable container and dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

# 4.2.4 Emergency Action

- Fire: Extinguishing media for large fires alcohol resistant foam or water fog. Small fires CO<sub>2</sub>, alcohol resistant foam, dry chemical, sand, earth, or water fog. Firefighters must use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains and drinking water supplies.
- Ingestion: Harmful or fatal if swallowed. Rinse mouth with water. If conscious, give water to drink and obtain medical advice.
- Inhalation (of vapor): Remove from further exposure. In case of irritation to lungs or throat, seek medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Flush copiously with water or preferably eye-wash solution for at least fifteen minutes. If irritation persists, seek medical attention.
- Skin: Wash thoroughly with soap and water, and seek medical attention if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage: Soak up using an absorbent material and dispose of this as directed under Storage/Transport.

# 4.3 Antifreeze - Valvoline MPG Coolant 50/50

Also known as a propylene glycol based coolant. It is a colorless liquid with a mild odor, and although soluble in water should be used undiluted. It contains 2-propane diol, ethylhexanoic acid (sodium salt), and aliphatic acid. 2-propane diol, and ethylhexanoic acid are considered to be potentially hazardous constituents.

Flash point: 112 °C min (233 °F min).

### 4.3.1 Hazardous Reactions

Considered stable but must be kept away from strong oxidizing agents, acids, and sources of ignition. Oxides of carbon, aldehydes, and ketones are products of decomposition.

Prolonged contact, as with clothing wetted with the substance, may cause more severe irritation and discomfort, seen as local redness and swelling.

If more than several mouthfuls are swallowed, abdominal discomfort, nausea and diarrhea may occur.

### 4.3.2 **Protective Measures**

Refrain from eating, drinking, or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapor, or particulate, use a suitable organic vapor mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

### 4.3.3 Storage / Transport

Store and transport only in correctly marked, tightly closed, containers. Keep cool, out of sunlight, and away from open flames. Keep away from incompatibles, such as oxidizing agents and acids. Water contamination should be avoided.

Absorb any leak/spill with an inert material and put the spilled material in an appropriate waste disposal container. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

# 4.3.4 Emergency Action

- Fire: Extinguishing media use water fog, dry powder, foam, or carbon dioxide. Water or foam may cause frothing. If a leak or spill has not ignited, use water fog to disperse the vapors. Do not use a water jet. Firefighters must use self contained breathing apparatus. Keep fire-exposed containers cool. Prevent large quantities from entering waterways, drains and drinking water supplies.
- Ingestion: If patient is conscious and can swallow, give two glasses of water (500ml). Induce vomiting as directed by medical personnel.
- Inhalation (of vapor): If irritation, headache, nausea, or drowsiness occurs, remove to fresh air. Get medical attention if breathing becomes difficult or symptoms persist.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Flush eyes with plenty of water for several minutes. Get medical attention if eye irritation persists.
- Skin: Wash thoroughly with soap and water for several minutes. Get medical attention if skin irritation develops or persists.

• Spillage: Contain spill if possible, and dispose of as directed under Storage/Transport.

# 4.4 Antifreeze - Valvoline MPG Coolant 67/33

Also known as a propylene glycol based coolant. It is a colorless liquid with a slight characteristic odor, easily soluble in cold water. It contains 2-propane diol, ethylhexanoic acid (sodium salt), and aliphatic acid. 2-propane diol, and ethylhexanoic acid are considered to be potentially hazardous constituents.

Boiling point: +120 °C (+248 °F). Flash point closed cup: +115 °C (+239 °F).

Used as an engine coolant, suitable for open and closed cooling systems, and can be found in the engine cooling systems. Installers, operators, and maintainers are likely to encounter this substance.

### 4.4.1 Hazardous Reactions

Considered stable but must be kept away from strong oxidizing agents, acids, and sources of ignition. Carbon oxides (CO,  $CO_2$ ) and water, and some metallic oxides are products of decomposition.

Prolonged contact, as with clothing wetted with the substance, may cause more severe irritation and discomfort, seen as local redness and swelling.

If more than several mouthfuls are swallowed, abdominal discomfort, nausea and diarrhea may occur.

Contains material which may cause birth defects based on animal data.

### 4.4.2 **Protective Measures**

Refrain from eating, drinking, or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapor, or particulate, use a suitable organic vapor mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

### 4.4.3 Storage / Transport

Store and transport only in correctly marked, tightly closed, containers. Keep cool, out of sunlight, and away from open flames. Keep away from incompatibles, such as oxidizing agents and acids. Water contamination should be avoided.

Absorb any leak/spill with an inert material and put the spilled material in an appropriate waste disposal container. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

### 4.4.4 Emergency Action

- Fire: Extinguishing media for small fire dry chemical powder, or CO<sub>2</sub>. Large fire water spray, fog, or foam. Do not use a water jet. Firefighters must use self contained breathing apparatus. Keep fire-exposed containers cool. Prevent large quantities from entering waterways, drains, and drinking water supplies.
- Ingestion: Do not induce vomiting unless directed to do so by medical personnel. Loosen tight clothing such as a collar, tie, belt, or waistband. Get medical attention if symptoms appear.
- Inhalation (of vapor): If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Obtain medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Flush eyes with plenty of water for minimum of fifteen minutes. Cold water may be used. Obtain medical attention.
- Skin: Wash thoroughly with soap and water for several minutes. Get medical attention if skin irritation develops. Cold water may be used.
- Spillage: Contain spill if possible, and dispose of as directed under Storage/Transport.

# 4.5 Coolant Treatment - Fleetguard DCA-4 Water Filter

Fleetguard DCA-4/powder/paste/pellet is also known as a coolant additive, or engine coolant treatment. It is a white solid (powder or pellet) or blue paste inside a filter container, having a mild chemical odor, and soluble in water. It contains dipotassium phosphate, potassium nitrate, sodium molybdate, sodium nitrite, mercaptobenzo thiazole, and sodium silicate. Potentially hazardous constituents are alkaline salts, nitrates, and nitrites, etc.

For industrial use only, it is used as an engine coolant additive in engine cooling systems, heat exchangers, and radiators. Installers, operators, and maintainers are likely to encounter these substances.

# 4.5.1 Hazardous Reactions

Incompatible with strong acids and oxidizing materials. In contact with strong acids, may form nitrous oxide gas.

Contact of sodium nitrate with combustible materials and organic matter may cause fire. Sodium nitrite intensifies fires of other materials. When heated to decomposition,  $No_x$  and  $K_2O$  are emitted.

Dust may irritate nasal passages. Prolonged or repeated contact with the skin will cause irritation. It will irritate eyes on contact. It is harmful if swallowed.

### 4.5.2 **Protective Measures**

Adopt a high standard of personal hygiene. In case of skin contact wash immediately with soap and water.

Make sure there is good ventilation and avoid heat sources.

Use eye protection, dust mask, PVC gloves, overalls, and plastic aprons. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. Use a respirator to avoid inhalation of dust.

# 4.5.3 Storage / Transport

Store and transport only in correctly marked containers. Keep cool, out of sunlight, and away from openflames. Keep product dry and container closed when not in use. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers, and waterways.

Sweep up and return to container for use if not contaminated. Prevent entry of substance into drainage/sewers, waterways and land. Dispose of unwanted substance through n authorized contractor to a licensed chemical disposal service.

### 4.5.4 Emergency Action

- Fire: Extinguishing media CO<sub>2</sub>, dry powder, water. Firefighters must use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains, and drinking water supplies.
- · Ingestion: Toxic by ingestion. Seek medical advice immediately.
- Inhalation (of vapor): Remove from further exposure. In case of irritation to lungs or throat, seek medical attention.
- Eyes: Flush copiously with water for at least fifteen minutes. Seek medical attention immediately.
- Skin: Wash immediately with soap and water. Seek medical attention if irritation develops or persists. Change clothing if necessary and wash before re-use.
- Spillage: Sweep up and return to container if not contaminated. Discard contaminated product as directed under Storage/Transport.

# 4.6 Coolant Treatment - Fleetguard DCA-4 Liquid Additive

Also known as a coolant additive, or liquid cooling conditioner. It is a pale blue liquid with a mild chemical odor. It contains potassium phosphate, potassium nitrate, sodium molybdate, sodium nitrite, and adipic acid. The potentially hazardous constituents being alkaline salts, nitrates, and nitrites, etc.

Boiling point: 100 °C (212 °F). Vapor pressure: 760mm Hg at 100 °C (30 inches Hg at 212 °F). It is soluble in water.

Used as an engine coolant additive, and can be found in engine cooling systems, heat exchangers, and radiators. Installers, operators, and maintainers are likely to encounter this product.

# 4.6.1 Hazardous Reactions

Sodium nitrite/potassium nitrate are strong oxidizers. Avoid organic matter (including wood), cyanides, strong acids, salts, and urea. This product may ignite with heat or friction. When heated to decomposition,  $No_x$ ,  $K_2O$ , sodium monoxide, carbon monoxide, and carbon dioxide are emitted.

Contact will cause irritation to both skin and eyes. Inhalation may cause nasal passage and upper respiratory tract irritation. Ingestion can cause severe vomiting, shock, and death. Ingestion of sodium nitrite can result in motor activity changes, coma, and decreased blood pressure.

### 4.6.2 Protective Measures

Adopt a high standard of personal hygiene. In case of skin contact irrigate with copious quantities of clean water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist. Observance of good housekeeping rules will ensure general safety.

Use eye protection goggles, PVC gloves, overalls, impervious apron. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. No special respiratory precautions are necessary in normal use.

# 4.6.3 Storage / Transport

Store and transport only in correctly marked containers. Keep cool (but do not freeze), out of sunlight, and away from open flames and strong acids. Keep product container closed when not in use. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers and water-courses.

Prevent entry of liquid into drainage/sewerage system, waterways and land. Use industrial absorbent and place in suitable container. Dispose of unwanted liquid through an authorized contractor to a licensed chemical disposal service.

### 4.6.4 Emergency Action

- Fire: Extinguishing media water, carbon dioxide, dry powder. Firefighters must use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains and drinking water supplies.
- Ingestion: Toxic by ingestion. Ingestion can cause severe vomiting, shock, and death. Ingestion of sodium nitrite can result in motor activity changes, coma, and decreased blood pressure. Seek medical attention immediately.
- Inhalation (of vapor): Remove to fresh air. If symptoms persist seek medical attention.
- Eyes: Flush copiously with water for at least fifteen minutes. Seek medical attention immediately.
- Skin: Wash immediately with soap and water. If irritation develops or persists seek medical attention. Change clothing if necessary and wash before re-use.
- Spillage: Contain leak/spill and prevent entry of liquid into drainage/sewer system, waterways and land. Use industrial absorbent and dispose of as directed under Storage/Transport.

# 4.7 Gas Oil

Also known as Red Diesel, Fuel Oil, and type A1 or A2. It can be pale red or a clear liquid with a characteristic mild odor. It contains catalytically cracked oil, petroleum distillates, quinizarin, and gas oil marker dye red. The catalytically cracked oil and petroleum distillates are potentially hazardous constituents.

Boiling point: 180 °C (356 °F). Flash point: +56 °C (+132 °F). Vapor pressure less than 0.7 mm Hg at 20 °C (0.02 inches Hg at 68 °F). Negligible solubility in water.

It is used as a fuel for off-road diesel powered vehicles and stationary engines, and can be found in fuel tanks, pipes and injection systems. The substance should not be used for any other purpose without contacting the manufacturer or supplier. Installers, operators, and maintainers are likely to encounter this substance.

### 4.7.1 Hazardous Reactions

This liquid is flammable. Avoid smoking, heat sources, such as welding and open flames, sparks, and static electricity build-up. Thermal decomposition products are hazardous, containing  $CO_x$ ,  $NO_x$  and  $SO_x$  compounds.

The vapor is explosive. High vapor concentrations can cause respiratory irritation, dizziness, nausea, and loss of consciousness. Excessive and prolonged exposure to the mist can cause chronic inflammatory reaction of the lungs and a form of pulmonary fibrosis.

Avoid strong oxidizing agents, e.g. chlorates which may be use in agriculture.

Gas oil is slightly irritating to the skin and has a de-fatting action. Toxicity following single exposure to high level of gas oil is of low order. Prolonged, repeated skin contact may de-fat the skin resulting in possible skin irritation and dermatitis. In some cases, warty, cancerous growths have occurred.

### 4.7.2 **Protective Measures**

Ensure good ventilation and avoid heat sources. Observance of good housekeeping rules will ensure general safety. Do not smoke. Avoid breathing mist.

When working on, or testing, injection equipment, special care is required to avoid perforation of skin by high pressure fuel. Use eye protection in the event of a suspected high pressure leak.

Adopt a high standard of personal hygiene. In the case of skin contact, wash well with soap and water.

Use gloves and overalls, and eye protection goggles if there is risk of splashing. Use oil impervious gloves and avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. Contaminated clothing should be removed, soaked with water, and laundered before re-use.

No special respiratory precautions are necessary in normal use.

DO NOT use as a solvent for removing dirt/grease etc, from skin.

# 4.7.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight and away from open flames. Electrical continuity is required between the transport and storage vessels during product transfer.

Contain leak/spill with sand, earth or other suitable material, and prevent entry of substance into drainage/sewerage system, waterways and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

Inform local and fire authorities should the product reach waterways, drains etc.

### 4.7.4 Emergency Action

- Fire: Extinguishing media for large fire Foam/water fog. Never use water jet. Small fire foam/dry powder, AAAF, CO<sub>2</sub>, sand, earth. Avoid making sparks. Firefighters must use self-contained breathing apparatus. Keep fire exposed containers cool, using water fog/spray. Prevent run-off from entering waterways, drains, and drinking water supplies.
- Ingestion: Do not induce vomiting. Wash the mouth out with water, and obtain immediate medical attention.
- Inhalation (of vapor): Remove from further exposure. Obtain immediate medical attention.
- Aspiration (inhalation of liquid)

If, following ingestion of gas oil, vomiting occurs, there is danger of aspiration into the lungs. This would cause intense local irritation and chemical pneumonitis that can be fatal. Obtain immediate medical attention.

- Eyes: Irrigate copiously with water or preferably eye-wash solution for at least five minutes. If irritation persists seek medical attention.
- Skin: Wash thoroughly with soap and water. Change clothing if necessary. If high pressure injection has occurred prompt surgical attention is required. Obtain immediate medical attention.
- Spillage: Absorb using sand, earth, or other suitable material. Dispose of unwanted or absorbed flammable material as directed under Storage/Transport.

# 4.8 Gasoline

Also known as Petrol or Gas, it is a petroleum-derived clear liquid with a characteristic odor that is extremely flammable. It consists of organic compounds taken from petroleum distillates, and in some cases ethanol. The petroleum distillates are potentially hazardous constituents.

Boiling point: 26-221 °C (80-430 °F) range. Flash point: -42 °C (-45 °F). Autoignition: 495 °C (923 °F).

It is used as a fuel for internal combustion engines, and can be found in fuel tanks, pipes and injection systems. The substance should not be used for any other purpose without contacting the manufacturer or supplier. Installers, operators, and maintainers are likely to encounter this substance.

# 4.8.1 Hazardous Reactions

Extreme explosive hazard in form of vapor when exposed to heat or flame. Hazardous products resulting from combustion include carbon monoxide, carbon dioxide and acrid smoke. Inhalation of vapor concentrations causes headaches, drowsiness, and nausea, and may lead to unconsciousness or death. Harmful if swallowed/and or aspirated. Long term exposure to vapors has caused cancer in laboratory animals.

### 4.8.2 **Protective Measures**

Keep away from sources of ignition. Keep containers closed, ensure good ventilation, and avoid heat sources. Ensure all fuel lines, and fittings are tight and free from leaks. If leakage occurs isolate the supply, do not operate any electrical equipment which may cause a spark or become a source of ignition. Fully ventilate the area, and evacuate the building. Contact suitably qualified personnel who are fully trained to handle emergencies

In normal use no special respiratory precautions are necessary, using suitable PPE (e.g. eye protection goggles, rubber gloves) is good practice. Avoid prolonged or repeated skin contact.

#### 4.8.3 Storage / Transport

Use with adequate ventilation. Keep away from sources of ignition. Store in flammable liquids storage area. Keep containers closed; ensure correct identification of containers. Avoid strong oxidizers and keep out of sewers and waterways.

#### 4.8.4 Emergency Action

- Fire extinguishing media: CO<sub>2</sub>, dry powder, foam, steam, or water fog. Water may be ineffective but can be used to cool containers. In the event of fire, attempt to shut off the supply and immediately inform the local fire authority. Vapors are heavier than air and may be sources of ignition and flashback. Firefighters must wear full protective clothing and use self contained breathing apparatus.
- · Ingestion: Do not induce vomiting. Obtain immediate medical attention.
- Inhalation (of vapor): Remove from further exposure. Inhalation can cause headaches, dizziness, nausea, or vomiting. High vapor concentrations can lead to general narcotic effect or unconsciousness. Administer oxygen and obtain medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Avoid contact with eyes. Wear eye protection.
- Skin: Avoid prolonged or repeated contact. Wear eye protection goggles, rubber gloves (e.g. PVC), if repeated contact is likely.
- Spillage: Remove or shut off all sources of ignition. Spray with water to disperse vapors wearing respirator. Prevent spread by creating barriers and absorbing on inert materials. Take special care to avoid discharge into drains, sewers, and waterways. Dispose of absorbed material in accordance with local authority environmental health regulations.

# 4.9 Grease – Chevron SRI No. 2

Formulated with ISOSYN<sup>®</sup> base stocks, a synthetic polyurea ashless organic thickener, and high performance rust and oxidation inhibitors. Its texture is smooth and buttery and its color is dark green. All the components of this material are in compliance with the EU Seventh Amendment Directive 92/32/EEC.

Boiling point: >371.1 °C (700 °F) and is insoluble in water but soluble in hydrocarbons. Flash point (Cleveland Open Cup): 260 °C (500 °F) (Min).

It is a high temperature ball and roller bearing grease and is used in generators, alternators, starters, air-conditioning units and unsealed electric motor bearings operating under moist conditions. Installers, operators, and maintainers are likely to encounter this product.

#### 4.9.1 Hazardous Reactions

This product is considered to be stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. It may react with strong oxidizing agents such as chlorates, nitrates, peroxides etc. There are no known results of decomposition and none are expected.

This material will burn although it is not easily ignited. Dependent on combustion conditions a complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved. Combustion may form oxides of nitrogen, zinc, and magnesium.

#### ▲ DANGER

Do not use pressure to empty drum or explosion may result causing severe personal injury or death.

Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have a potential of generating an accumulation of electrostatic charge.

#### 4.9.2 **Protective Measures**

Ensure good ventilation and avoid heat sources. Prevent small spills and leakages to avoid the hazard of slipping.

Adopt a high standard of personal hygiene. In the case of skin contact, apply a waterless hand cleaner, mineral oil, or petroleum jelly; then wash thoroughly with soap and water.

No special respiratory precautions are necessary in normal use and with adequate ventilation. If prolonged or repeated skin contact is likely, oil impervious gloves MUST be worn, and eye protection should be used.

High pressure injection under the skin may occur due to the rupture of pressurized lines.

#### 4.9.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Store away from heat, sparks, flame, or strong oxidants and combustible materials.

Contain leak/spill and prevent entry of substance into drainage/sewerage system, water-courses and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

#### 4.9.4 Emergency Action

- Fire: Extinguishing media CO<sub>2</sub>, foam, dry powder, and water fog. In enclosed areas firefighters MUST use self-contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterway, drains, and drinking water supplies.
- Unusual fire/explosion hazard: Do not use pressure to empty drum or explosion may result.
- Ingestion: If swallowed, give water or milk to drink. Do not induce vomiting. Seek medical attention.
- Inhalation (of vapor): Remove from further exposure. If respiratory discomfort or coughing occurs, seek medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Irrigate copiously with water or preferably eye-wash solution for at least fifteen minutes. If irritation persists, seek medical attention.

 Skin: To remove the material from skin, apply a waterless hand cleaner, mineral oil or petroleum jelly then wash thoroughly with soap and water. Remove and clean oil soaked clothing daily and wash affected area.

In an accident involving high-pressure equipment, this product may be injected under the skin. Such an accident may result in a small, sometimes bloodless, puncture wound. However, because of its driving force, material injected into a fingertip can be deposited into the palm of the hand. Within 24 hours there is usually a great deal of swelling, discoloration, and intense throbbing pain. Immediate treatment at a surgical emergency center is recommended.

 Spillage: Eliminate all sources of ignition in vicinity of spilled material. Contain spilled liquid with sand or other suitable absorbent. Dispose of used material as directed under Storage/Transport.

# 4.10 Grease – Exxon Polyrex EM

This polyurea grease is formulated with base oil and additives including Amines, C12-14-ALKYL, 1-5 ISOOCTYL Phosphates. It is blue colored grease with a mild odor.

Boiling point: 330 °C (626 °F). Flash point: 204 °C (400 °F) (Estimated for oil, ASTM D-92 [COC]). It is insoluble in water.

It is high temperature ball and roller bearing grease and is used for long-life and corrosion resistance, even in salt water. Installers, operators, and maintainers are likely to encounter this product.

#### 4.10.1 Hazardous Reactions

Under normal conditions of use, this product is not considered hazardous. This product is considered to be stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Keep containers closed when not in use. Store away from heat, strong oxidizing agents, and combustible material. This product does not decompose at ambient temperatures; however carbon monoxide, sulphur oxides, aldehydes and other decomposition products may be found in the case of incomplete combustion.

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Empty containers retain residue and may explode causing injury or death. Do not pressurixe, or expose to any source of ignition.

## 4.10.2 Protective Measures

Ensure good ventilation and avoid heat sources. Prevent small spills and leakages to avoid the hazard of slipping.

Adopt a high standard of personal hygiene. In the case of skin contact, wash thoroughly with soap and water.

No special respiratory precautions are necessary in normal use and with adequate ventilation. If prolonged or repeated skin contact is likely, oil impervious gloves MUST be worn, and eye protection should be used.

High pressure injection under the skin may occur due to the rupture of pressurized lines.

#### 4.10.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Store away from heat, sparks, flame or strong oxidants and combustible materials.

Contain leak/spill and prevent entry of substance into drainage/sewerage system, waterways and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

Do not attempt to refill or clean container. Empty drums should be completely drained, properly closed/sealed and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with all applicable regulations.

#### 4.10.4 Emergency Action

- Fire: Extinguishing media CO<sub>2</sub>, foam, dry powder, and water fog. Water or foam may cause frothing. In enclosed areas firefighters MUST use self-contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterway, drains and drinking water supplies.
- Unusual fire/explosion hazard: Do not use pressure to empty drum or an explosion may result.
- Ingestion: Do not induce vomiting. Seek medical attention.
- Inhalation (of vapor): Remove from further exposure. If respiratory discomfort or coughing occurs, seek medical attention.
- · Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Irrigate copiously with water. If irritation persists seek medical attention.
- Skin: To remove the material from skin, wash thoroughly with soap and water. Remove
  and clean oil soaked clothing daily and wash affected area. In an accident involving high
  pressure equipment, this product may be injected under the skin. Regardless of the
  appearance of the wound or its size, the individual should be evaluated immediately by a
  physician as a surgical emergency. Even though initial symptoms from high pressure
  injection may be minimal or absent, early surgical treatment within the first few hours
  may
  significantly reduce the ultimate extent of the injury.
- Spillage: Eliminate all sources of ignition in vicinity of spilled material. Contain spilled liquid with sand or other suitable absorbent. Dispose of used material as directed under Storage/Transport.

## 4.11 Grease – Klüber Asonic GHY72

This is Ester oil based grease with polyurea thickener. It is a beige colored paste having a characteristic odor.

Flash point: >200 °C (392 °F) using DIN ISO 2176 (BASE OIL) flash method.

It is used to lubricate bearings where good resistance to water washout and corrosion are required. Installers, operators, and maintainers are likely to encounter this product.

#### 4.11.1 Hazardous Reactions

This product is considered to be stable. However it is incompatible with strong oxidizing agents. In case of fire, carbon monoxide and hydrocarbons can be released.

Prolonged skin contact may cause skin irritation and/or dermatitis.

#### **4.11.2 Protective Measures**

Ensure good ventilation and avoid heat sources. Prevent small spills and leakages to avoid the hazard of slipping.

Adopt a high standard of personal hygiene. In the case of skin contact, clean skin thoroughly with soap and water, and apply skin cream.

No special respiratory precautions are necessary in normal use and with adequate ventilation. If prolonged or repeated skin contact is likely, oil impervious gloves MUST be worn and eye protection should be used.

High pressure injection under the skin may occur due to the rupture of pressurized lines.

#### 4.11.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Store away from heat, sparks, flame or strong oxidants and combustible materials.

Contain leak/spill and prevent entry of substance into drainage/sewerage system, water-courses and land.

The code of waste has to correspond to the Council Directive 75/442/EEC and be specific as far as the related sector and process are concerned. It can be incinerated when in compliance with local, state and federal regulations.

Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

Offer rinsed packaging material to local recycling facilities.

## 4.11.4 Emergency Action

- Fire: Extinguishing media CO<sub>2</sub>, foam, dry powder, and water fog. High volume water jet is unsuitable as an extinguishing medium. In enclosed areas firefighters MUST use selfcontained breathing apparatus. In case of fire carbon monoxide and hydrocarbons can be released. Keep fire exposed containers cool. Prevent run-off from entering waterway, drains and drinking water supplies.
- Ingestion: Do not induce vomiting. Seek medical attention.
- Inhalation (of vapor): Remove from further exposure. If respiratory discomfort or coughing occurs, seek medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Irrigate copiously with water or preferably eye-wash solution for at least fifteen minutes. If irritation persists seek medical attention.
- Skin: To remove the material from skin wash thoroughly with soap and water, apply skin cream. Remove and clean oil soaked clothing daily and wash affected area.
- Spillage: Eliminate all sources of ignition in vicinity of spilled material. Contain spilled liquid with sand or other suitable absorbent. Dispose of used material as directed under Storage/Transport.

# 4.12 Grease – Mobilgrease XTC

This grease is also known as NLGI No. 1 lithium soap-based product. It is highly viscous, dark brown in color, and with a mild odor. It contains bitumen or vacuum residue, zinc alkyl and longchain alkyl dithiophosphates. Based on available information, this product is not expected to produce adverse effects on health when used for the intended application and the recommendations provided in the MSDS are followed.

Boiling point: >316 °C (600 °F) and has negligible solubility in water. Flash point: >204°C (399 °F). Vapor pressure: <0.1mm Hg at 20 °C (68 °F).

It is for industrial use only and is used in high speed flexible gearing and couplings in industrial situations for high speed and high temperature coupling applications. The use of hand-operated grease guns at low ambient temperatures, without auxiliary heat, is discouraged. Installers, operators, and maintainers are likely to encounter this substance.

#### 4.12.1 Hazardous Reactions

Under normal conditions of use, this product is not considered hazardous according to regulatory guidelines, although excessive exposure may result in eye, skin or respiratory irritation.

#### 4.12.2 Protective Measures

Ensure good ventilation and avoid heat sources. Prevent small spills and leakages to avoid the hazard of slipping.

Adopt a high standard of personal hygiene. In the case of skin contact, wash with soap and water.

No special respiratory precautions are necessary in normal use and with adequate ventilation. If prolonged or repeated skin contact is likely, oil impervious gloves MUST be worn, and eye protection should be used.

High pressure injection under the skin may occur due to the rupture of pressurized lines.

#### 4.12.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers closed when not in use. Store away from heat, sparks, flame, or strong oxidants and combustible materials.

Contain leak/spill and prevent entry of substance into drainage/sewerage system, waterways and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

#### 4.12.4 Emergency Action

- Fire: Extinguishing media CO<sub>2</sub>, foam, dry powder, and water fog. In enclosed areas firefighters MUST use self-contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains, and drinking water supplies.
- Ingestion: Do not induce vomiting. Seek medical attention if discomfort occurs.
- Inhalation (of vapor): Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.

- Eyes: Irrigate copiously with water or preferably eye-wash solution for at least five minutes. If irritation persists, seek medical attention.
- Skin: Wash thoroughly with soap and water. Remove and clean oil soaked clothing daily and wash affected area.
- Spillage: Contain spilled liquid with sand or other suitable absorbent. Dispose of used material as directed under Storage/Transport.

# 4.13 Grease – Val-Lith EP 2

This is a lithium based grease having a liquid (paste) consistency, is light brown in color, and has a slight characteristic sulphurous odor. The preparation is not classified as dangerous according to Directive 1999/45/EC and its amendments. This product is not classified according to the EU regulations.

Boiling point: 371 °C (699 °F) and is insoluble in water. Flash point (Closed Cup): > 221 °C (429 °F).

It is used in automotive and industrial equipment for the lubrication of bearings and shaft joints to reduce ingress of moisture over a wide temperature range. Installers, operators, and maintainers are likely to encounter this product.

#### 4.13.1 Hazardous Reactions

The product is considered to be stable. However do not expose containers to heat or sources of ignition. It is reactive with oxidizing agents. Results of decomposition are carbon oxides (CO,  $CO_2$ ), water, and some metallic oxides.

Repeated or prolonged exposure is not known to aggravate medical conditions.

#### 4.13.2 Protective Measures

Ensure good ventilation and avoid heat sources. Prevent small spills and leakages to avoid the hazard of slipping.

Adopt a high standard of personal hygiene. In the case of skin contact, wash with soap and water.

No special respiratory precautions are necessary in normal use and with adequate ventilation. Wear a lab coat and wash hands after handling.

## 4.13.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers tightly sealed when not in use. Store in a well ventilated area, away from heat and combustible materials.

Wear boots and gloves and use a tool to scoop up solid or absorbed material. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

## 4.13.4 Emergency Action

• Fire: Extinguishing media for small fires CO<sub>2</sub>, dry chemical powder. Larger fires: water spray, fog or foam. For safety reasons, do not use a full water jet. Firefighters should wear self-contained breathing apparatus, and full turnout gear. Keep fire exposed containers cool.

- Ingestion: Do not induce vomiting. Seek medical attention if discomfort occurs.
- Inhalation (of vapor): Remove from further exposure. Seek medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Irrigate copiously with water or preferably eye-wash solution for at least fifteen minutes. If irritation persists, seek medical attention.
- Skin: Wash thoroughly with soap and water. Remove oil soaked clothing daily and wash before reuse. Clean shoes thoroughly before reuse. Obtain medical attention.
- Spillage: Use a tool to scoop up solid or absorbed material and dispose of used material as directed under Storage/Transport.

# 4.14 Lubrication Oil – Premium Blue E 15W40

Also known as oil, lube oil, or sump oil. New oil is a dark, viscous liquid with a slight, characteristic odor. The base oil contains; distillates (petroleum), solvent-dewaxed heavy paraffinic. It is not classified as dangerous according to Directive 1999/45/EC and its amendments, and is not classified according to the EU regulations.

Boiling point: > 150 °C (302 °F). Flash point (Cleveland Open Cup): 220 °C (428 °F), and is insoluble in cold water.

It is used in engine lubrication oil systems, sump pan and filters, make-up tanks and piping systems as a lubrication oil for use in wide range of diesel engines operating under severe conditions. Installers, operators, and maintainers are likely to encounter this product.

#### 4.14.1 Hazardous Reactions

This product is stable although slightly re-active with oxidizing agents. Results of decomposition are carbon oxides (CO,  $CO_2$ ) and water.

Although harmful if swallowed or aspirated (breathed in), repeated or prolonged exposure is not known to aggravate medical conditions.

Used oil may contain harmful combustion by-products and unburnt fuel that will cause skin reactions as detailed for fuel. Particular care must be taken if oil from a severely overheated engine is handled; use impervious gloves, lab coat, and safety glasses.

Do not breathe vapor/spray.

#### 4.14.2 Protective Measures

Ensure good ventilation and avoid heat sources.

Adopt a high standard of personal hygiene. In case of skin contact, wash thoroughly with soap and water.

Use safety glasses, impervious gloves and lab coat. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

No special respiratory precautions are necessary in normal use. Do not breathe vapor/spray when handling hot materials.

#### 4.14.3 Storage / Transport

Store and transport only in correctly marked containers. Keep containers tightly sealed when not in use. Keep in a cool, well ventilated area, out of sunlight and away from open flames. Store well away from food-stuffs and drinking water.

Wear splash goggles, full suit, boots, and gloves. Absorb leak/spill with an inert material and dispose of unwanted or absorbed substance through an authorized contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

#### 4.14.4 Emergency Action

- Fire: Extinguishing media for large fires use water spray, fog or foam. Do not use water jet. Small fire Use dry chemical powder or CO<sub>2</sub>. Firefighters must use self contained breathing apparatus and full turnout gear. Keep fire exposed containers cool.
- · Ingestion: Do not induce vomiting. Obtain medical attention immediately.
- Inhalation (of vapor): Remove from further exposure. Obtain medical attention.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Flush copiously with water or preferably eye-wash solution for at least fifteen minutes. Obtain medical attention.
- Skin: Wash thoroughly with soap and water. Obtain medical attention if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage: Absorb with an inert material and dispose of this as directed under Storage/Transport.

# 4.15 Natural Gas

Also known as Methane, this gas is not visible. A strong smell may be detectable if the gas has been treated with a smell additive for leakage detection. Natural Gas is piped to the generator set and would be found in the gas pipeline, gas train, or generator set carburetor system. It is soluble in water, alcohol, ether, and most organic solvents. Installers, operators, and maintainers are likely to encounter this product.

#### 4.15.1 Hazardous Reactions

Extremely flammable/explosive at **low** levels in air atmosphere (4% to 15% gas in air). Relatively low levels of gas leakage in confined areas can cause explosions and fires if a spark occurs to ignite it. Inhalation of large volumes of natural gas can cause asphyxiation and death.

Effects of over exposure include headaches, dizziness, drowsiness, nausea, or vomiting. Gas under pressure can penetrate skin; high concentrations can damage eyesight or cause blindness.

#### 4.15.2 Protective Measures

Ensure good ventilation and avoid heat sources. Ensure all pipelines, gas train, and fittings are gas tight and free from leaks. If leakage occurs isolate the gas supply, do not operate any electrical equipment which may cause a spark or become a source of ignition. Fully ventilate the area, and evacuate the building. Contact suitably qualified personnel who are fully trained to handle natural gas emergencies

No special respiratory precautions are necessary in normal use.

In the event of a gas leakage, eye protection goggles, rubber gloves (e.g. PVC), and breathing apparatus may be required.

#### 4.15.3 Storage / Transport

Gas pipeline – not applicable.

#### 4.15.4 Emergency Action

- Fire extinguishing media: CO<sub>2</sub>, dry powder, or Halon, Sand, Waterspray Fog, Mist or Water Based Foam. In the event of fire, attempt to shut off the gas supply and immediately inform the local fire authority and gas supplier. Natural gas is extremely flammable and may reignite after fire is extinguished. Carbon Dioxide (CO<sub>2</sub>) and Carbon Monoxide (CO) gas is released when burning.
- Ingestion: Not expected to be a health risk via this route.
- Inhalation (of vapor): Remove from further exposure. Inhalation can cause headaches, dizziness, nausea, or vomiting. High vapor concentrations can lead to general narcotic effect or unconsciousness. High volumes of gas or vapor displaces oxygen content available for breathing and can cause asphyxiation and death.
- Aspiration (inhalation of liquid): Not applicable.
- Eyes: Gas under pressure can penetrate skin; high concentrations can damage eyesight or cause blindness.
- Skin: In the event of a gas leakage, eye protection goggles, rubber gloves (e.g. PVC), and breathing apparatus may be required.
- Spillage: In the event of gas leakage, isolate the gas supply, ventilate the area and inform the local supplier. Do **not** operate electrical switches, mobile phones, torches etc, or any other equipment that may cause a spark to ignite gas – these should be removed or rendered inoperable. In circumstances of excessive leakage, evacuate the building, and call the emergency services and the local gas supplier.

# 4.16 **Propane (LPG or LP gas)**

Propane is normally a gas, but compressible to a transportable liquid. A mixture of propane and butane, is commonly known as liquefied petroleum gas (LPG or LP gas), this gas is not visible. A strong smell may be detectable if the gas has been treated with a smell additive for leakage detection. Propane is piped to the generator set and would be found in the gas pipeline, gas train or generator set carburetor system. It is soluble in water, alcohol, ether, and most organic solvents. Installers, operators, and maintainers are likely to encounter this product.

## 4.16.1 Hazardous Reactions

Extremely flammable/explosive at **low** levels in air atmosphere. Relatively low levels of gas leakage in confined areas can cause explosions and fires if a spark occurs to ignite it. Inhalation of large volumes of natural gas can cause asphyxiation and death. Vapor is heavier than air and may travel to remote sources of ignition (e.g. drainage systems, basements).

Effects of over exposure include headaches, dizziness, drowsiness, nausea or vomiting. Gas under pressure can penetrate skin; high concentrations can damage eyesight or cause blindness.

Cold burns will result from skin/eye contact with liquid.

#### 4.16.2 **Protective Measures**

Ensure good ventilation and avoid heat sources. Ensure all pipelines, gas train, and fittings are gas tight and free from leaks. If leakage occurs isolate the gas supply, do not operate any electrical equipment which may cause a spark or become a source of ignition. Fully ventilate the area, and evacuate the building. Contact suitably qualified personnel who are fully trained to handle natural gas emergencies

No special respiratory precautions are necessary in normal use.

In the event of a gas leakage, eye protection goggles, rubber gloves (e.g. PVC), and breathing apparatus may be required.

## 4.16.3 Storage / Transport

Store and transport only in correctly marked containers, when not in use, close cylinder valve to prevent contamination of the cylinder. Make sure equipment is adequately earthed. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier for further information. Keep cool, out of sunlight and away from ignition sources (including static discharges). Store container below 50 °C (122 °F) in a well ventilated place. Refer to supplier's container handling instructions.

#### 4.16.4 Emergency Action

- Fire extinguishing media for large fires: none. In the event of large fire, attempt to shut off the supply and cool containers with water spray. Water spray may aid approach of the fire. Small fires: dry powder. Do not use water or foam. Immediately inform the local fire authority and gas supplier. Propane is extremely flammable and may re-ignite after fire is extinguished. Carbon Dioxide (CO<sub>2</sub>) and Carbon Monoxide (CO) gas is released when burning. Firefighers must wear full protective clothing and use self contained breathing apparatus.
- · Ingestion: Not expected to be a health risk via this route.
- Inhalation (of vapor): Remove from further exposure. Inhalation can cause headaches, dizziness, nausea or vomiting. High vapor concentrations can lead to general narcotic effect or unconsciousness. High volumes of gas or vapor displaces oxygen content available for breathing and can cause asphyxiation and death.
- Aspiration (inhalation of liquid): Remove from further exposure. Immediately obtain medical attention.
- Eyes: Gas under pressure can penetrate skin; high concentrations can damage eyesight or cause blindness.

- Skin: In case of cold burns (frostbite) spray with water for at least 15 minutes. Obtain medical attention. In the event of a gas leakage, eye protection goggles, rubber gloves (e.g. PVC), and breathing apparatus may be required.
- Spillage: In the event of leakage, isolate the supply, ventilate the area and inform the local supplier. Do **not** operate electrical switches, mobile phones, torches etc, or any other equipment that may cause a spark to ignite gas – these should be removed or rendered inoperable. In circumstances of excessive leakage, evacuate the building and call the emergency services and the local gas supplier.

# 4.17 Sulfuric Acid - Battery Quality 1140–1400 SG (15-50%)

Also known as battery acid, battery electrolyte, electrolyte. It is a colorless to dark brown liquid, with a characteristic acrid, acidic odor. It is readily soluble in water forming a dilute, corrosive solution. Sulfuric acid battery quality 1140–1400sg (15-50%) contains aqueous solutions of sulfuric acid including all grades between 1140 (10%)–1400 (50%). Sulfuric acid is a potentially hazardous product.

Boiling point between 104–124 °C (219–255 °F). Vapor pressure of 6.2mm Hg at 20 °C (68 °F).

In solution it is used as an electrolyte for lead acid batteries. These batteries are used in the starting and control systems on generating sets. Installers, operators, and maintainers are likely to encounter this product.

#### 4.17.1 Hazardous Reactions

The product is considered to be stable. However, it may give rise to hazardous fumes in a fire. Violent reaction with water generates heat and may cause an explosion. It attacks many metals liberating hydrogen gas. Combustion will generate oxides of sulfur.

Avoid contact with body tissue. It causes destruction of body tissue, severe burns.

Inhalation of the spray mist may produce severe irritation of the respiratory tract. It may be fatal if swallowed, causing burns to mouth, throat, and stomach. Corrosive to eyes. Repeated or prolonged exposure to spray mist may produce chronic eye irritation, severe skin irritation, and respiratory irritation leading to frequent attacks of bronchial infection.

#### 4.17.2 Protective Measures

Ensure good ventilation and avoid heat sources. Fumes must be positively removed from confined spaces by fume extraction.

Adopt a high standard of personal hygiene. Use total eye protection goggles, acid-resistant gloves (e.g. PVC), overalls, acid resistant apron and rubber boots. Note that handling contaminated clothing may result in acid burns.

No special respiratory precautions are necessary in normal use; however, respiratory protection should be used if there is a risk of uncontrolled exposure to vapor. Avoid contact with acid mist if large quantities of batteries are being charged or if working close to charging batteries.

#### 4.17.3 Storage / Transport

Store and transport only in correctly marked containers and keep tightly sealed when not in use. Stock tanks should be bunded separately, away from organic substances such as wood, paper, straw, and other reactive chemicals. Prevent water or steam from entering container at all times. Suitable storage materials are PTFE, and glass. Store in rubber-lined tanks for acid concentrations less than 70%. Do not store in metal drums, nylon, or plasticized PVC.

Keep cool, out of sunlight, and away from open flames. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers, and waterways.

In case of spillage, contain using earth, sand or other inert material and transfer to suitable containers. Arrange disposal in accordance with local regulations. Advise the Emergency Services if the substance has entered a waterway or sewer, or has contaminated soil or vegetation.

#### 4.17.4 Emergency Action

- Fire: Keep containers and surroundings cool with water spray. Water must not enter tanks or containers. Select extinguishing media appropriate to other materials involved. It may give rise to hazardous fumes in a fire. Violent reaction with water generates heat and may cause an explosion. Prevent run-off from entering waterways, drains, and drinking water supplies. Firefighters must wear full protective clothing and use self contained breathing apparatus.
- Ingestion: Do not induce vomiting. Wash out mouth with water. Give sips of cold water or milk to soothe the affected parts. Ingested acid must be diluted by approximately x 100, to render harmless to tissues. Obtain medical attention immediately.
- Inhalation (of vapor): Remove from further exposure. If breathing stops or shows signs of failing, give artificial respiration. Do not use mouth to mouth ventilation. If there is difficulty in breathing, give oxygen. Keep warm and at rest. Obtain medical attention urgently.
- Aspiration (inhalation of liquid): Obtain immediate medical attention.
- Eyes: Irrigate copiously with water or preferably eye-wash solution for at least fifteen minutes. Seek medical attention.
- Skin contact: Flush area with copious quantities of water, preferably under a shower. Remove contaminated clothing, which should be washed or dry-cleaned before re-use. Obtain medical attention if blistering or redness persists.
- Spillage: Wear appropriate protective clothing. Ventilate the area to dispel possible toxic, decomposition fumes. Contain and absorb using earth, sand or other inert material. Transfer to suitable container for disposal in accordance with local regulations as directed under Storage/Transport.

#### 4.17.5 Special Note: Identification of Usage

#### ▲ DANGER

Care must be taken to identify that the sulfuric acid 'battery electrolyte' or 'electrolyte' is the correct substance for use in a battery. A violent chemical reaction will occur if sulfuric acid is accidentally mixed with alkaline battery electrolyte that may result in severe personal injury or death.

## 4.17.6 Special Note: Concentrated Sulfuric Acid

#### ▲ DANGER

Do not add water to acid - a violent reaction will occur. This reaction may casue severe personal injury or death.

In some cases, sulfuric acid may be purchased in concentrated form. This is a clear viscous liquid. Do not attempt to add this type of acid to batteries. Dilution should only be attempted by experienced personnel. If spillage of concentrated acid occurs contact emergency services immediately and quote hazard code 1830.

#### 4.17.7 Special Note: Lead Acid Batteries

Lead acid batteries contain significant quantities of metallic lead, which is harmful. Provided that the battery is not dismantled in any way, there is no risk of heavy metal poisoning from batteries. Use gloves when connecting and adopt a high standard of personal hygiene. Batteries can be recycled, and used batteries should be disposed of in accordance with local authority environmental health regulations.

# 5 Manufacturing Facilities

NORTH AMERICA	EMEA, CIS	ASIA PACIFIC
Cummins Power Generation Limited 1400 73rd Ave. NE Minneapolis, MN 55432 USA	Cummins Power Generation Limited Columbus Avenue Manston Park Manston, Ramsgate Kent CT12 5BF United Kingdom	Cummins Power Generation Limited 10 Toh Guan Road #07-01 TT International Tradepark Singapore 608838
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LATIN AMERICA	MEXICO	
3350 Southwest 148th Ave. Suite 205 Miramar, FL 33027 USA	Eje 122 No. 200 Zona Industrial San Luis Potosi, S.L.P. 78395 Mexico	
Phone +1 954 431 551 Fax +1 954 433 5797	Phone +52 444 870 6700 Fax +52 444 824 0082	

# 5.1 How to Obtain Service

When a product requires servicing, contact the nearest Cummins Power Generation distributor. To locate the distributor, refer to <u>power.cummins.com</u> and select Distributor Locator. When contacting the distributor, always supply the complete model, specification, and serial number as shown on the nameplate.

# 5.1.1 Locating a Distributor

#### In North America

Telephone +1 800 888 6626 (this is an automated service for touch-tone phones only) to contact the nearest Cummins Power Generation distributor in the United States or Canada. Select Option 1 (press 1), to automatically connect to the nearest distributor.

#### **GENERATORS – ELECTRIC or**

ENGINES – GASOLINE OR DIESEL

If unable to arrange a service or resolve an issue, contact the Service Manager at the nearest Cummins Power Generation distributor for assistance.

When contacting the distributor, always supply the complete Model, Specification, and Serial Number as shown on the product nameplate.

#### Outside North America

Refer to **power.cummins.com** and select Distributor Locator, or send an email to ask.powergen@cummins.com.

#### www.cumminspower.com

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