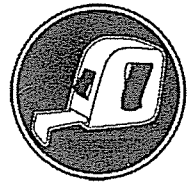


GE-55



Installation Manual

Our energy working for you.™



**Power
Generation**

Generator Set S3.8 Engine with PowerCommand® 1.1 or PowerStart® 0500 Controls

- × C44 D5
- C55 D5
- C66 D5
- C40 D6
- C50 D6
- C60 D6

Table of Contents

1. IMPORTANT SAFETY INSTRUCTIONS	1
1.1 Warning, Caution and Note Styles Used In This Manual	1
1.2 General Information	1
1.2.1 General Safety Precautions	1
1.3 Generator Set Safety Code	2
1.3.1 Moving Parts Can Cause Severe Personal Injury Or Death.....	3
1.3.2 Positioning of Generator Set.....	3
1.4 Electrical Shocks and Arc Flashes Can Cause Severe Personal Injury or Death.....	3
1.4.1 AC Supply and Isolation.....	4
1.5 Fuel And Fumes Are Flammable	4
1.5.1 Spillage	5
1.5.2 Fluid Containment.....	5
1.5.3 Do Not Operate in Flammable and Explosive Environments	5
1.6 Exhaust Gases Are Deadly.....	5
1.6.1 Exhaust Precautions	6
1.7 Earthing Rod Connection.....	6
1.8 Decommissioning and Disassembly	6
2. INTRODUCTION.....	7
2.1 About This Manual.....	7
2.1.1 Additional Installation Manual Information	7
2.2 Schedule of Abbreviations	8
2.3 Related Literature	9
2.4 After Sales Services.....	10
2.4.1 Maintenance.....	10
2.4.2 Warranty.....	10
3. SYSTEM OVERVIEW	11
3.1 Generator Set Identification	11
3.1.1 Nameplate.....	11
3.2 Generator Set Components.....	11
3.3 Generator Set Rating.....	12
3.4 Engine.....	12
3.5 Sensors.....	13
3.6 System Options.....	13
3.6.1 Annunciators	13
3.6.2 Battery Charger.....	14
3.6.3 Heavy Duty Air Cleaner	14
3.6.4 Fuel Filters	14
3.6.5 Skid Mounted Radiator Installation	14
3.6.6 Alternator Heaters.....	14
3.6.7 Coolant Heater.....	14

3.6.8 Battery Isolator	14
4. INSTALLATION OVERVIEW	15
4.1 Application and Installation	15
4.2 Safety Considerations	15
4.3 Standby Heating Devices	15
4.4 Product Modifications	16
4.5 InPower Service Tool	16
5. SPECIFICATIONS	17
5.1 Generator Set Specifications	17
5.2 Engine Fuel Consumption	18
6. INSTALLING THE GENERATOR SET	19
6.1 Location	19
6.2 Access to Set	20
6.3 Vibration Isolator Installation and Adjustment Procedure	20
6.4 Rigging Instructions	21
6.5 Moving the Generator Set	22
6.5.1 Positioning a Generator Set Using a Forklift Truck	23
6.6 Transportation	24
7. MECHANICAL CONNECTIONS	25
7.1 Fuel System	25
7.1.1 Fuel Return Restrictions (or Pressure) Limit	25
7.1.2 Fuel Lines Routing	25
7.1.3 Engine Fuel Connections	27
7.1.4 Supply Tank	27
7.1.5 Fuel Inlet Pressure/Restriction Limit	27
7.1.6 Day Tank	27
7.1.7 Fuel Transfer Pump Installation	28
7.1.8 Fuel Filters	28
7.2 Exhaust System	33
7.3 Ventilation and Cooling	35
7.4 Vents and Ducts	36
7.5 Dampers	37
7.6 Air Inlet and Outlet Openings	37
7.7 Heavy Duty Air Cleaner	38
7.7.1 Heavy Duty Air Cleaner Installation	39
8. DC CONTROL WIRING	43
8.1 TB1 Remote Monitor / Control Connections	43
8.2 PowerCommand 1.x TB1 Customer Connections	44
8.2.1 TB1 Customer Inputs	44
8.2.2 TB1 Customer Outputs	45
8.2.3 Switched B+	45
8.3 Run Relays (K10, K11)	45

9. AC ELECTRICAL CONNECTIONS	47
9.1 Transfer Switch	48
9.2 Generator Voltage Connections	49
9.3 Load Connections	49
9.4 Load Balancing	49
9.5 Current Transformers	50
9.5.1 CT Installation Requirements	50
9.6 Coolant Heater Installation	51
9.6.1 Coolant Heater Specifications	52
9.7 Alternator Heater Installation	53
9.7.1 Alternator Heater Specifications	53
9.8 Grounding	57
10. PRE-START PREPARATION	57
10.1 Electrical System	57
10.2 Battery Connections	57
10.3 Site-specific Configuration	57
10.4 Controller Configuration Relays	57
10.5 Starting	59
11. INSTALLATION CHECKLIST	61
11.1 Checklist	61
12. MANUFACTURING FACILITIES	63
12.1 How to Obtain Service	63
12.1.1 Locating Your Distributor	63
APPENDIX A. WIRING DIAGRAMS	65
S3.8 Wiring Diagram with PowerCommand 1.1 Control	67
APPENDIX B. CUSTOMER CONNECTIONS	69
S3.8 Customer Connections with PowerCommand 1.1 Control	71
APPENDIX C. ALTERNATOR RECONNECT DRAWING	73
Reconnect Drawing for Alternator	75
APPENDIX D. OUTLINE DRAWINGS	77
CoolPac Outline Drawing (S3.8 Intl. Spec.)	79
APPENDIX E. LIFTING DRAWINGS	81
S3.8 CoolPac Lifting Drawing	83


1 Important Safety Instructions


SAVE THESE INSTRUCTIONS - This manual contains important instructions that should be followed during installation and maintenance of the generator set and batteries.


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.


1.1 Warning, Caution and Note Styles Used In This Manual

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

 **DANGER:** Warns of a hazard that will result in severe personal injury or death.


 **WARNING:** Warns of a hazard that may result in severe personal injury or death.

 **CAUTION:** Warns of a hazard or an unsafe practice that can result in product or property damage.


 **NOTE:** A short piece of text giving information that augments the current text.


1.2 General Information


This manual should form part of the documentation package supplied by Cummins Power Generation with specific generator sets. In the event that this manual has been supplied in isolation please contact your authorized distributor.


 **NOTE:** It is in the Operator's interest to read and understand all Warnings and Cautions contained within the documentation relevant to the generator set, its operation and daily maintenance.















1.2.1 General Safety Precautions

 **WARNING:** Coolants under pressure can cause severe scalding. Do not open a radiator or heat exchanger pressure cap while the engine is running. Let the engine cool down before removing the coolant pressure cap. Turn the cap slowly and do not open it fully until the pressure has been relieved.

 **WARNING:** Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.


 **NOTE:** 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).


 **CAUTION:** Make sure that rags are not left on or near the engine.

-  **CAUTION:** Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.
-  **CAUTION:** Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
-  **CAUTION:** Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
-  **WARNING:** 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.
-  **WARNING:** Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breathe, ingest, or come into contact with exhaust gases.
-  **WARNING:** Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
-  **WARNING:** Wear hearing protection when going near an operating generator set.
-  **WARNING:** To prevent serious burns, avoid contact with hot metal parts such as the radiator, the turbo charger, and the exhaust system.
-  **WARNING:** Use personal protective equipment when maintaining or installing the generator set. Examples of personal protective equipment include but are not limited to: safety glasses, protective gloves, hard hats, steel-toed boots, and protective clothing.
-  **WARNING:** Do not use starting fluids that evaporate. They are highly explosive.
-  **CAUTION:** Do not step on the generator set when entering or leaving the generator room. Parts can bend or break leading to electrical shorts, or to fuel, coolant, or exhaust leaks.
-  **CAUTION:** To prevent accidental or remote starting while working on the generator set, disconnect the negative (-) battery cable at the battery.
-  **WARNING:** Ethylene glycol, used as engine coolant, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
-  **WARNING:** Moving parts can cause severe personal injury or death. Hot exhaust parts can cause severe burns. Make sure all protective guards are properly in place before starting the generator set.

1.3 Generator Set Safety Code

Before operating the generator set, read the 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.

-  **WARNING:** Improper operation and maintenance can lead to severe personal injury or loss of life and property by fire, electrocution, mechanical breakdown, or exhaust gas asphyxiation. Read and follow all Safety Precautions, Warnings and Cautions throughout this manual and the documentation supplied with your generator set.


-  **WARNING:** 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.

1.3.1 Moving Parts Can Cause Severe Personal Injury Or Death


- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect the battery charger from its AC source, then disconnect the starting batteries, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps; keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts.
- If any adjustments must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

1.3.2 Positioning of Generator Set

The area for positioning the set should be adequate and level and the area immediately around the set must be free of any flammable material.

-  **WARNING:** On an enclosed generator set, the canopy doors must be locked before re-positioning and they must remain locked during transportation and sitting.


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


-  **WARNING:** Any work with exposed energized circuits with potentials of 50 Volts AC or 75 Volts DC or higher poses a significant risk of electrical shock and electrical arc flash. These silent hazards can cause severe injuries 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.

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:


 **NOTE:** It is the policy of Cummins Inc. to perform all electrical work in a de-energized 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.


 **NOTE:** 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.

1.4.1 AC Supply and Isolation

It is the sole responsibility of the customer to provide AC power conductors for connection to load devices and the means to isolate the AC input to the terminal box; these must comply to local electrical codes and regulations. Refer to the wiring diagram supplied with the generator set.

 **NOTE:** Local electrical codes and regulations (for example BS EN 12601:2001) may require the installation of a disconnect means for the generator set, either on the generator set or where the generator set conductors enter a facility.

 **NOTE:** The AC supply must have the correct over current and earth fault protection according to local electrical codes and regulations. This equipment must be earthed (grounded).

The disconnecting device is not provided as part of the generator set, and Cummins Power Generation accepts no responsibility for providing the means of isolation.

1.5 Fuel And Fumes Are Flammable

Fire, explosion, and personal injury or death can result from improper practices.

- DO NOT fill fuel tanks while the engine is running, unless the tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Be sure all fuel supplies have a positive shutoff valve.
- Be sure the battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.


1.5.1 Spillage

Any spillage that occurs during fueling or during oil top-off or oil change must be cleaned up before starting the generator set.

1.5.2 Fluid Containment

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.


 **NOTE:** 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/sources.

1.5.3 Do Not Operate in Flammable and Explosive Environments


Flammable vapor can cause an engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. Do not operate a generator set where a flammable vapor environment can be created by fuel spill, leak, etc., unless the generator set is equipped with an automatic safety device to block the air intake and stop the engine. The owners and operators of the generator set are solely responsible for operating the generator set safely. Contact your authorized Cummins Power Generation distributor for more information.


1.6 Exhaust Gases Are Deadly

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.


 **WARNING:** Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.


1.6.1 Exhaust Precautions

 **WARNING:** Exhaust pipes and charge air pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard.

 **WARNING:** Hot exhaust gas can cause burns resulting in severe personal injury.

The exhaust outlet may be sited at the top or bottom of the generator set. Make sure that the exhaust outlet is not obstructed. Personnel using this equipment must be made aware of the exhaust position. Position the exhaust away from flammable materials - in the case of exhaust outlets at the bottom, make sure that vegetation is removed from the vicinity of the exhaust.

 **WARNING:** Inhalation of exhaust gases can result in serious personal injury or death. Be sure deadly exhaust gas is piped outside and away from windows, doors, or other inlets to buildings. Do not allow to accumulate in habitable areas.

 **WARNING:** *Contaminated insulation is a fire risk which can result in severe personal injury.*

The exhaust pipes may have some insulating covers fitted. If these covers become contaminated by fuel or oil, they must be replaced before the generator set is run.


To minimize the risk of fire, make sure the following steps are observed:

- Make sure that the engine is allowed to cool thoroughly before topping off the oil or draining the fuel filters.
- Clean the exhaust pipe thoroughly.


1.7 Earthing Rod Connection

Although this generator set may be supplied with an earthing rod, it may not be suitable for all local conditions.

The neutral of the generator set may be required to be bonded to earth ground at the generator location, or at a remote location depending on system design requirements. Consult the engineering drawings for the facility or a qualified electrical design engineer for proper installation.

 **NOTE:** The end user is responsible for ensuring that an earthing arrangement that is compliant with local conditions is established and tested before the equipment is used.

1.8 Decommissioning and Disassembly

 **NOTE:** Decommissioning and disassembly of the generator set at the end of its working life must comply with local guidelines and legislation for disposal/recycling of components and contaminated fluids. This procedure must only be carried out by suitably trained and experienced service personnel. For more information contact your authorized distributor.

2 Introduction

2.1 About This Manual

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 make sure that before commencing any work, they have the latest information available.

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

Should you require further assistance, contact your authorized distributor.

2.1.1 Additional Installation Manual Information

The purpose of this manual is to provide the Installation Engineer with sound, general information for the installation of the generator set. Refer to the Generator Set Operator Manual for additional information which must also be read before operating the set.

This manual provides installation instructions for the generator set models listed on the front cover. This includes the following information:

- **Mounting Recommendations** - for fastening the generator set to a base and space requirements for normal operation and service.
- **Mechanical and Electrical Connections** - covers most aspects of the generator set installation.
- **Prestart** - checklist of items or procedures needed to prepare the generator set for operation.
- **Installation Checklist** - reference checks upon completion of the installation.

This manual **DOES NOT** provide application information for selecting a generator set or designing the complete installation. If it is necessary to design the various integrated systems (fuel, exhaust, cooling, etc.), additional information is required. Review standard installation practices. For engineering data specific to the generator set, refer to the Specification and Data Sheets. For application information, refer to Application Manual T-030, "Liquid Cooled Generator Sets." To find this manual online:

1. Go to www.cumminspower.com
2. Click on "Application Engineering" under heading, Technical Information.
3. Click on "Liquid Cooled Genset Application Manual"

2.2 Schedule of Abbreviations

This list is not exhaustive. For example, it does not identify units of measure or acronyms that appear only in parameters, event/fault names, or part/accessory names.

AmpSentry and InPower are trademarks of Cummins Inc. PowerCommand is a registered trademark of Cummins Inc.

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
AC	Alternating Current	LED	Light-emitting Diode
AMP	AMP, Inc., part of Tyco Electronics	Mil Std	Military Standard
ASTM	American Society for Testing and Materials (ASTM International)	MMHG	Millimeters of Mercury
ATS	Automatic Transfer Switch	NC	Not Connected
AVR	Automatic Voltage Regulator	NC	Normally Closed
AWG	American Wire Gauge	NFPA	National Fire Protection Agency
CAN	Controlled Area Network	NO	Normally Open
CB	Circuit Breaker	NWF	Network Failure
CE	Conformité Européenne	OEM	Original Equipment Manufacturer
CFM	Cubic Feet per Minute	OOR	Out of Range
CGT	Cummins Generator Technologies	OORH / ORH	Out of Range High
CMM	Cubic Meters per Minute	OORL / ORL	Out of Range Low
CT	Current Transformer	PSI	Pounds per square inch
DC	Direct Current	PB	Push Button
ECM	Engine Control Module	PC	Personal Computer
ECS	Engine Control System	PCC	PowerCommand® Control
EMI	Electromagnetic interference	PGI	Power Generation Interface
EN	European Standard	PGN	Parameter Group Number
EPS	Engine Protection System	PI	Proportional/Integral
E-Stop	Emergency Stop	PID	Proportional/Integral/Derivative
FAE	Full Authority Electronic	PLC	Programmable Logic Controller
FMI	Failure Mode Identifier	PMG	Permanent Magnet Generator
FSO	Fuel Shutoff	PT	Potential Transformer
Genset	Generator Set	PTC	Power Transfer Control
GCP	Generator Control Panel	PWM	Pulse-width Modulation
GND	Ground	RFI	Radio Frequency Interference
HMI	Human-machine Interface	RH	Relative Humidity
IC	Integrated Circuit	RMS	Root Mean Square
INHG	Inches of Mercury	RTU	Remote Terminal Unit
ISO	International Organization for Standardization	SAE	Society of Automotive Engineers
kPA	kilo-Pascal	SPN	Suspect Parameter Number

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
LBNG	Lean-burn Natural Gas	SW_B+	Switched B+
LCD	Liquid Crystal Display	UL	Underwriters Laboratories
LCL	Low Coolant Level	UPS	Uninterruptible Power Supply
LCT	Low Coolant Temperature		

2.3 Related Literature

Before any attempt is made to operate the generator set, the operator should take time to read all of the manuals supplied with the generator set, and to familiarize themselves with the warnings and operating procedures.



CAUTION: A generator set must be operated and maintained properly if you are to expect safe and reliable operation. The Operator manual includes a maintenance schedule and a troubleshooting guide.

The Health and Safety manual must be read in conjunction with this manual for the safe operation of the generator set:

- Health and Safety Manual (0908-0110)

The relevant manuals appropriate to your generator set are also available, the documents below are in English:

- Operator Manual for S3.8 with PC1.1 (A040S819)
- Operator Manual for S3.8 with PS0500 (A035P107)
- Installation Manual for S3.8 PS0500 (A035N980)
- Controller Service Manual for S3.8 PC1.1 (A034L440)
- Controller Service Manual for S3.8 PS0500 (AXXXXXXX)
- Engine Service Manual for S3.8 PS0500 (A035P379)
- Alternator Service Manual for P0P1 (0900-9916)
- Parts Manual for S3.8 Genset (A035H834)
- Parts Manual for S3.8 Engine (A030B316)
- Recommended Spares List (RSL) for C44 D5 (A040S379)
- Recommended Spares List (RSL) for C55 D5 (A040S381)
- Recommended Spares List (RSL) for C66 D5 (A040S383)
- Recommended Spares List (RSL) for C40 D6 (A040S385)
- Recommended Spares List (RSL) for C50 D6 (A040S387)
- Recommended Spares List (RSL) for C60 D6 (A040S389)
- Standard Repair Times - FQ Family (A040T789)
- Standard Repair Times - EH Family (A028Z371)
- Standard Repair Times - EL Family (A030L534)
- Warranty Manual (F1117-0002)
- Global Commercial Warranty Statement (A028U870)

Contact your authorized distributor for more information regarding related literature for this product.

2.4 After Sales Services

We offer a full range of maintenance and warranty services.

2.4.1 Maintenance

⚠ WARNING: Incorrect service or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and/or mechanical service.

For customers who wish to have their generator sets expertly serviced at regular intervals your local distributor offers a complete maintenance contract package. This covers all items subject to routine maintenance and includes a detailed report on the condition of the generator set. In addition, this can be linked to a 24-hour call-out arrangement, providing year-round assistance if necessary. Specialist engineers are available to maintain optimum performance levels from customer's generator sets, and it is recommended that maintenance tasks are only undertaken by trained and experienced technicians provided by your authorized distributor.

2.4.2 Warranty

For details of the warranty coverage for your generator set, refer to the Global Commercial Warranty Statement (A028U870).

Extended warranty coverage is also available. In the event of a breakdown, prompt assistance can normally be given by factory trained service technicians with facilities to undertake all minor and many major repairs to equipment on site.

For further warranty details, contact your authorized distributor.

👉 NOTE: Damage caused by failure to follow the correct coolant recommendations will not be covered by the warranty. Please contact your authorized distributor.

2.4.2.1 Warranty Limitations

For details of the warranty limitations for your generator set, refer to the Warranty Statement applicable to the generator set application.

3 System Overview

This section provides an overview of the Generator Set.

3.1 Generator Set Identification

Each generator set is provided with a nameplate similar to that shown below. This provides information unique to each generator set.

3.1.1 Nameplate

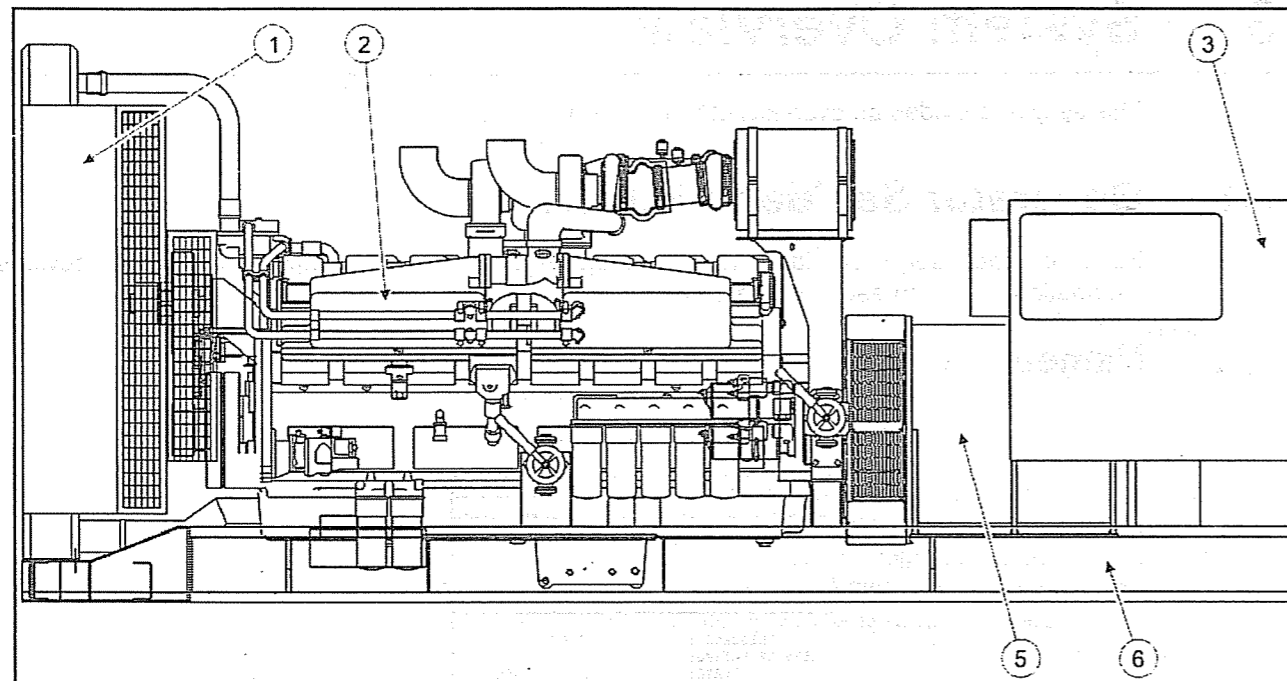
Model No.			
Serial No.		Spec.	
FREQUENCY: 60 HZ			
SERVICE RATING:		3PH	3PH
PHASE:			
RATED KW:		0.8	0.8
POWER FACTOR:			
RATED KVA:			
12 CAPABILITY:			
CONNECTIONS:			
BATTERY:	VOLTS	AMPS	AMPS
VDC:	220/380		
ROTATING SPEED: 1800RPM			
NOMINAL RATED			
FUEL:			
WIRING DIAGRAM:			

FIGURE 1. TYPICAL GENERATOR SET NAMEPLATE

3.2 Generator Set Components

The main components of a typical engine generator set are shown below, and referred to within this section.

There are various options listed although they may not be available for all models.



No	Description	No	Description
1	Radiator		(Not indicated)
2	Engine		Battery and Tray
3	Controller		Alarm Module
4	Battery		Battery Charger
5	Alternator		Engine Coolant Heater
6	Bed Frame		Alternator Heater

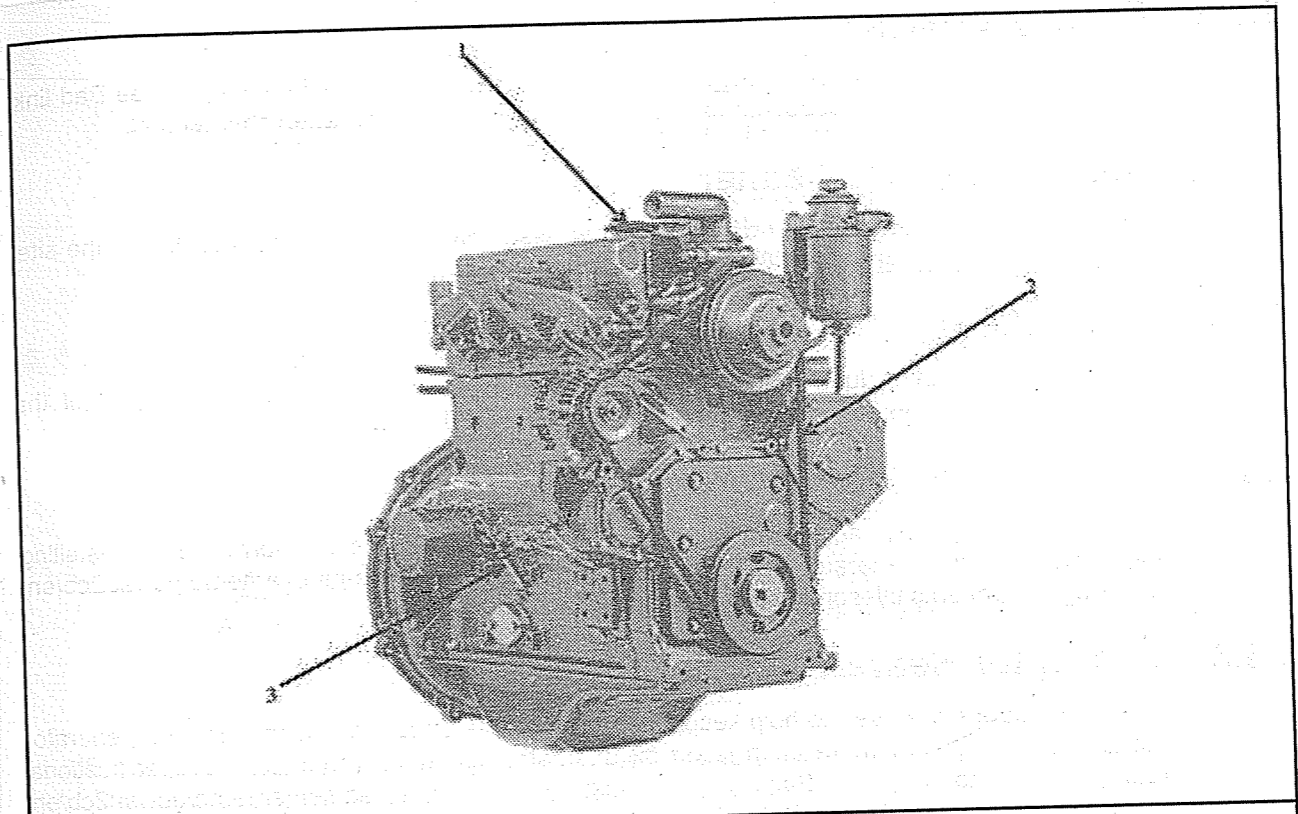
FIGURE 2. TYPICAL ENGINE GENERATOR SET

3.3 Generator Set Rating

For details of your generator set rating refer to the generator set nameplate. Refer to the Operator manual for operation at temperatures or altitudes above those stated on the nameplate.

3.4 Engine

For additional engine specific information, refer to the relevant engine manual for your generator set.



No.	Description
1	Oil filler cap
2	Fan belt
3	Dipstick

FIGURE 3. TYPICAL ENGINE COMPONENTS

3.5 Sensors

Various generator set parameters are measured by sensors, and the resulting signals are processed by the control board.

Engine-mounted sensors monitor a number of different systems, including:

- Lube Oil Pressure
- Cooling System Temperature

3.6 System Options

3.6.1 Annunciators

An annunciator provides lamps and a horn to annunciate the operating status and fault conditions of an emergency power system. For more information, see Bad link: c:/topleafserver/temp/guwsu2cb/en-us/.new_components/titlesonly/annunciators.xml.

3.6.2 Battery Charger

A battery charger can be wall mounted or bench mounted. For more information, see Bad link: c:/topleafserver/temp/guwsu2cb/en-us/.new_components/titlesonly/batterycharger.xml.

3.6.3 Heavy Duty Air Cleaner

If not already installed, a heavy duty air cleaner assembly will need to be installed at the site. Refer to **Section 7.7 on page 38**.

3.6.4 Fuel Filters

Generator sets that include a fuel filter kit need to have this kit installed as a part of the installation of the generator set. For more information, see **Section 7.1.8 on page 28**.

3.6.5 Skid Mounted Radiator Installation

When a radiator is shipped separately, it must be installed at the site. Information on installing the radiator on the generator set is included in Bad link: c:/topleafserver/temp/guwsu2cb/en-us/.new_components/titlesonly/radiatorassemblyinstructions.xml.

3.6.6 Alternator Heaters

Alternator heaters are used to help keep the alternator free of condensation when the generator set is not running. For more information on alternator heater components and specifications, refer to Bad link: c:/topleafserver/temp/guwsu2cb/en-us/.new_components/titlesonly/inbox/alternatorheaters.xml.

3.6.7 Coolant Heater

A coolant heater keeps the engine coolant warm when the engine is shut down. For more information on coolant heater components and specifications, see Bad link: c:/topleafserver/temp/guwsu2cb/en-us/.new_components/titlesonly/inbox/coolantheater.xml.

3.6.8 Battery Isolator

A battery isolator is provided which isolates the negative feed from the battery to the engine. This can be used to isolate the battery to prevent battery drain through prolonged periods of generator set inactivity or where static battery charging is not available.



WARNING: *The battery isolator switch must not be operated while the generator set is running, and will not stop the generator set. Attempting to use the isolator in this way may damage the battery and charging circuit.*

4 Installation Overview

These installation recommendations apply to typical installations with standard model generator sets. Whenever possible, these recommendations also cover factory designed options or modifications. However, because of the many variables in any installation, it is not possible to provide specific recommendations for every situation. If there are any questions not answered by this manual, contact your nearest authorized distributor for assistance.

4.1 Application and Installation

A power system must be carefully planned and correctly installed for proper operation. This involves two essential elements.

- **Application** (as it applies to generator set installations) refers to the design of the complete power system that usually includes power distribution equipment, transfer switches, ventilation equipment, mounting pads, cooling, exhaust, and fuel systems. Each component must be correctly designed so the complete system will function as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers or other trained specialists are responsible for the design of the complete power system and for selecting the materials and products required.
- **Installation** refers to the actual set-up and assembly of the power system. The installers set up and connect the various components of the system as specified in the system design plan. The complexity of the system normally requires the special skills of qualified electricians, plumbers, sheet-metal workers, etc. to complete the various segments of the installation. This is necessary so that all components are assembled using standard methods and practices.

4.2 Safety Considerations

The generator set has been carefully designed to provide safe and efficient service when properly installed, maintained, and operated. However, the overall safety and reliability of the complete system is dependent on many factors outside the control of the generator set manufacturer. To avoid possible safety hazards, make all mechanical and electrical connections to the generator set exactly as specified in this manual. All systems external to the generator (fuel, exhaust, electrical, etc.) must comply with all applicable codes. Make certain all required inspections and tests have been completed and all code requirements have been satisfied before certifying the installation is complete and ready for service.

4.3 Standby Heating Devices

Cummins Power Generation recommends installing standby generator sets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is below 40 °F (4 °C). Cummins Power Generation also requires that the engine be heated as necessary to maintain the water jacket temperature determined by the manufacturer for cold start and load acceptance for the type of system. Although most Cummins Power Generation generator sets will start in temperatures down to -25 °F (-32 °C) when equipped with engine jacket water coolant heaters, it might take more than 10 seconds to warm the engine before a load can be applied when ambient temperatures are below 40 °F (4 °C).

On generator sets equipped with a graphic display, the **Low Coolant Temperature** message, in conjunction with illumination of the Warning LED, is provided to meet the current requirements. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 70 °F (21 °C). In applications where the ambient temperature falls below 40 °F (4 °C), a cold engine may be indicated even though the coolant heaters are connected and operating correctly. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

4.4 Product Modifications

Agency certified products purchased from Cummins Power Generation comply only with those specific requirements and as noted on company product specification sheets. Subsequent modifications must meet commonly accepted engineering practices and/or local and national codes and standards. Product modifications must be submitted to the local authority having jurisdiction for approval.

4.5 InPower Service Tool


InPower™ is a PC-based service tool used to:

- Make adjustments to the controls trims and settings.
- Perform diagnostics and monitoring.
- Create a capture file of the controls trims and settings.
- Update control calibrations (InPower PRO version).

 **NOTE:** Refer to the InPower User Guide for specifics.

InPower Adjustment Feature

The adjustment feature allows you to make adjustments to generator set parameters, calibrations and settings. There are several groups of adjustment parameters.

 **NOTE:** Not all generator sets will have the same adjustments available.

InPower Capture File Description

InPower provides a method of extracting (capturing) a device's parameter values. Capturing saves device information in a file that is identified with a .CAP extension.

Capture files are used to store a copy of the generator set's parameter values. During generator set installation, it is suggested that a capture file be made before and after changes are made to the generator set operating parameters. This information can be very useful when troubleshooting the generator set (determine if parameters/settings have been modified after installation) and when replacement of the base board is necessary. The capture file can be used as a template to write the previous settings to the new base board software.

5 Specifications

5.1 Generator Set Specifications

TABLE 1. S3.8 SERIES SPECIFICATIONS

MODELS	C44 D5-C66 D5, C40 D6-C60 D6	
Engine Cummins Diesel Series	S3.8 G4, G6, G7, G8, G9, G10	
Generator kW Rating	See generator set nameplate for rating information.	
Engine Fuel Connection Inlet/Outlet Thread Size	Refer to generator set outline drawing supplied (A040U984)	
Maximum Weight	882 lb (400 kg)	
Fuel Max. Fuel Inlet Restriction Max. Fuel Return Restriction Fuel Pump Flow Rate	2 inHg (8 mmHg) 2 inHg (6.7 mmHg) 2.6 gal/hr (9.9 L/hr) for G4, 3.4 gal/hr (12.8 L/hr) for G6, 3.9 gal/hr (14.7 L/hr) for G7,	
Exhaust Outlet Size Max. Allowable Back Pressure Exhaust Flow at Rated Load Exhaust Temperature	1500 RPM 12 in. NB 2 in. (50 mm) Hg 15273 cfm (7208L/s at SBY) 818.9 °F (437.2 °C)	1800 RPM 12 in. NB 2 in. (50 mm) Hg 15273 cfm (7208L/s at SBY) 939 °F (504 °C)
Electrical System Starting Voltage Battery Group Number CCA (minimum)	24 Volts DC 31	
Cooling System Capacity with Standard Radiator	Non-CAC 55 °C @ 0.5" radiator; 3.3 US gal (12.5 L) CAC 55 °C @ 0.5" radiator; 3.9 US gal (15 L)	
Lubricating System Oil Capacity with Filters	2.4-1.85 US gal (7-9 L)	
Energy Requirement Min. Energy Content Requirement Natural Gas: Low Heat Value High Heat Value Liquid Propane: Low Heat Value High Heat Value	936 BTU/ft³ 1038 BTU/ft³ 2353 BTU/ft³ 2557 BTU/ft³	

5.2 Engine Fuel Consumption

TABLE 2. FUEL CONSUMPTION (L/HR) AT 1500 RPM (50 HZ)

Model	C44 D5	C55 D5	C66 D5
Engine	S3.8 G4	S3.8 G6	S3.8 G7
Engine Performance Data at 50Hz ¹	11.2	14.3	16.1

1. Standby/Full Load

Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

TABLE 3. FUEL CONSUMPTION (KG/HR) AT 1800 RPM (60 HZ)

Model	C40 D6	C50 D6	C60 D6
Engine	S3.8 G8	S3.8 G9	S3.8 G10
Engine Performance Data at 60Hz ¹	10.47	13.34	15.48

1. Standby/Full Load

Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

TABLE 4. FUEL CONSUMPTION (GAL/HR) AT 1500 RPM (50 HZ)

Model	C44 D5	C55 D5	C66 D5
Engine	S3.8 G4	S3.8 G6	S3.8 G7
Engine Performance Data at 50Hz ¹	3	3.8	4.3

1. Standby/Full Load

Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.

TABLE 5. FUEL CONSUMPTION (GAL/HR) AT 1500 RPM (50 HZ)

Model	C40 D6	C50 D6	C60 D6
Engine	S3.8 G8	S3.8 G9	S3.8 G10
Engine Performance Data at 50Hz ¹	2.76	3.52	4.09

1. Standby/Full Load


Refer to Data Sheets for other applications. In line with the CPG policy of continuous improvement, these figures are subject to change.


6 Installing the Generator Set

Generator set installations must be engineered so that the generator set will function properly under the expected load conditions. Use these instructions as a general guide only. Follow the instructions of the consulting engineer when locating or installing any components. The complete installation must comply with all local and state building codes, fire regulations, and other applicable regulations.

Requirements to be considered prior to installation are:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of generator set air
- Non-combustible mounting surface
- Discharge of exhaust gases
- Electrical connections
- Accessibility for operation and servicing
- Noise levels
- Vibration isolation


 **CAUTION:** Depending on your location and intended use, ensure that international, national or local laws and regulations regarding Air Quality Emissions have been observed and complied with. Be sure to consult local pollution control or air quality authorities before completing your construction plans.


 **CAUTION:** Operating the generator set with the shipping brackets installed has an effect on engine performance because vibration increases. Shipping brackets, which are mared in red, are for transportation of the generator set only. Remove all shipping brackets before starting the generator set.

6.1 Location

Generator set location is decided mainly by related systems such as ventilation, wiring, fuel, and exhaust. The set should be located as near as possible to the main power service entrance. Exhaust gases must not be able to enter or accumulate around inhabited areas.

Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions.

 **WARNING:** Incorrect installation, service or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical component installation.

 **NOTE:** Depending on your location and intended use, additional laws and regulations may require for you to obtain an air quality emissions permit before beginning installation of your generator set. Be sure to consult local pollution control or air quality authorities before completing your construction plans.

6.2 Access to Set

Generally, at least 1 meter (3.3 feet) of clearance should be provided on all sides of the generator set for maintenance and service access. (Increase clearance by width of door if optional housing is used.) A raised foundation or slab of 152 mm (6 inches) or more above floor level will make servicing easier. Lighting should be adequate for operation, maintenance and service operations and should be connected on the load side of the transfer switch so that it is available at all times.

6.3 Vibration Isolator Installation and Adjustment Procedure

1. Place the vibration isolators (see **Figure 4 on page 21**) on the generator set support structure. The isolators should be shimmed or grouted to make sure that all of the isolator bases are within 0.25 inch (6 mm) elevation of each other. The surface that the isolator bases rest on must also be flat and level.
2. Loosen the side snubber lock nuts so that the top plate of the isolator is free to move vertically and horizontally. Be sure that the top plate is correctly aligned with the base and springs.
3. Place the generator set onto the isolators while aligning the skid's mounting with the threaded isolator hole. The top plates will move down and approach the base of the isolator as load is applied.
4. Once the generator set is in position, the isolators may require adjusting so that the set is level. The isolators are adjusted by inserting the leveling bolt through the skid and into the isolator (the leveling bolt's locking nut should be threaded up towards the bolt head).

The leveling bolt will adjust the clearance between the top plate and the isolator base. A nominal clearance of 0.25 inch (6 mm) or greater is desired. This will provide sufficient clearance for the rocking that occurs during startup and shutdown. If the 0.25 inch (6 mm) clearance is not present, turn the leveling bolt until the desired clearance is achieved.

5. If the radiator and engine are mounted on separate skids, make sure the radiator skid and engine/alternator skid are level with each other after adjusting the isolators. If not level, proper fan belt alignment cannot be achieved.
6. The generator set may not be level yet; therefore, adjust the leveling bolts until the set is level and sufficient clearance still remains. (Clearance on all isolators should be roughly equal). Once all isolators have been set, lock the leveling bolt in place with the lock nut.
7. The snubber nuts must remain loose and therefore provide better isolation between the generator set and the support structure.

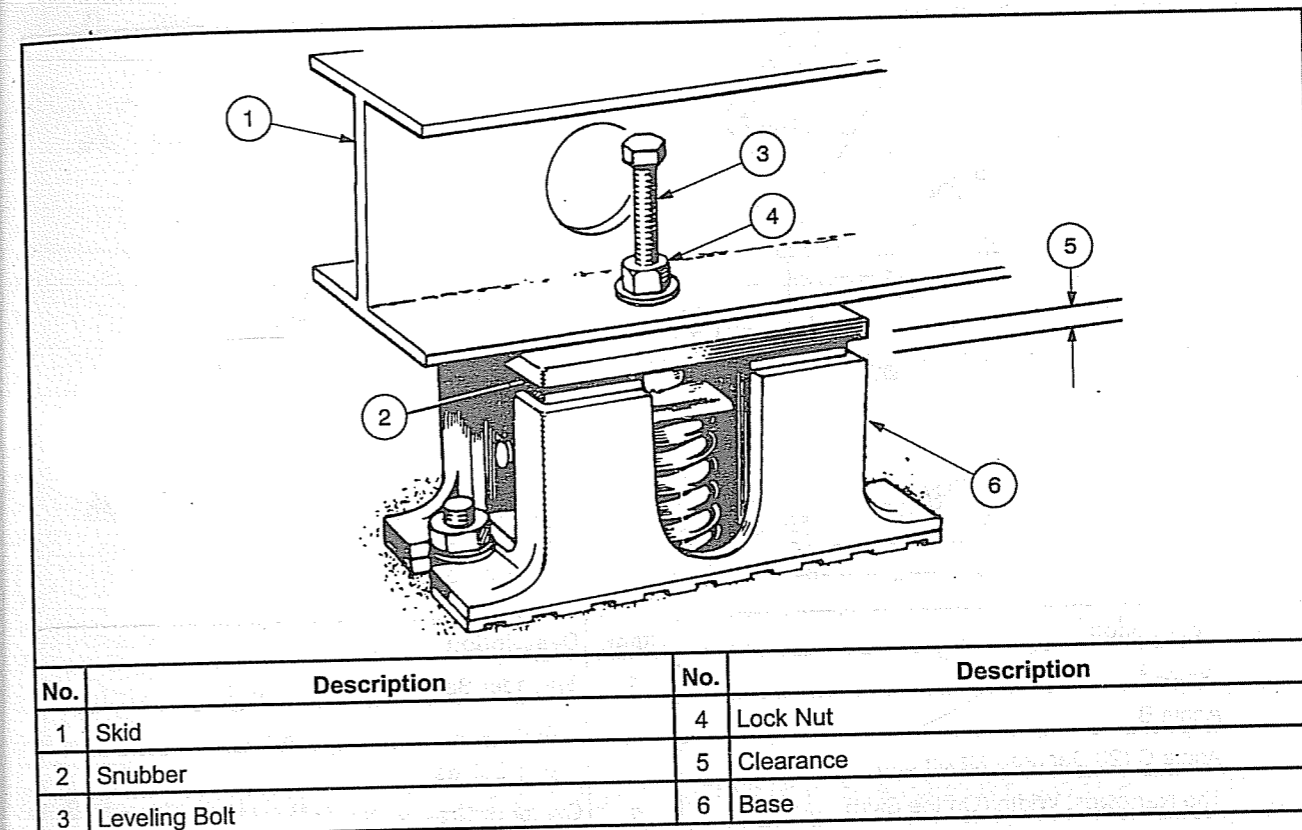


FIGURE 4. VIBRATION ISOLATOR INSTALLATION

6.4 Rigging Instructions

WARNING: *Incorrect generator set installation can result in severe personal injury, death, and/or equipment damage. Personnel must be trained and experienced in rigging and hoisting.*

WARNING: *Improper lifting can result in severe personal injury or death. Do not stand under or near the generator set when lifting. Failing to follow these instructions can result in load rotating without warning.*

1. Consult the generator set outline drawing for weight and center-of-gravity information.
2. Attach cables from the lifting lugs to a spreader bar. Never make the spreader bar cable attachment points wider than the attachment points on the skid or the bars. Make sure cables do not touch any other part of the generator set other than the skid.




NOTE: *Spreader bar cable attach points width "Y" must never be wider than skid cable attach points "X." Distance "X" is the narrowest width.*

NOTE: *Angle B must be slightly greater than angle A. Angle B should be as close to 90 degrees as possible to provide a stable lift.*

3. With pedestal box (not shown), the spreader bars (front and back) should be used to clear the pedestal box and the attachment cables must be as vertical as possible.

NOTE: *The lifting angle (angle C) must not exceed 20 degrees from vertical.*

6.6 Transportation

-  **WARNING:** *Transportation and handling of generator sets must only be undertaken by suitably trained and experienced personnel who are familiar with the transport of these items.*
-  **WARNING:** *Do not lift the generator set by attaching to the engine or alternator lifting points. Improper handling of the generator set may cause serious damage to the generator set and its components and can result in severe personal injury or death.*
-  **WARNING:** *On an enclosed generator set, the canopy doors must be locked before re-positioning and must remain locked during transportation and siting.*
 - Ensure the generator set is prepared for transport. If necessary drain fluids and ensure that acid or fumes do not leak from the battery (where applicable).
 - If the generator set is transported over long distances, protect it against environmental influences by sealing it in a plastic cover or similar.
 - For lifting procedures, see **Section 6.5 on page 22.**
 - Ensure the generator set is secured to the vehicle with suitable securing straps. Wooden chocks and pallets alongside the securing straps can prevent movement during transportation.
 - If required, attached impact indicators to the generator set. Upon delivery, check these impact indicators and contact the transport company immediately if an impact has been detected. Impacts can cause serious damage to the generator set and its components.
 - Ensure that the generator set cannot turn over during transportation.
 - Do not overload the transport vehicle. Under no circumstances should the generator set be started while inside a truck.
 - Lifting eyes where fitted are to be checked at regular intervals to ensure they are damage free and tight.


7 Mechanical Connections

The generator set mechanical system installation includes connecting the fuel, exhaust, ventilation, and cooling systems. Before starting any type of fuel installation, all pertinent state and local codes must be complied with and the installation must be inspected before the unit is put in service.


7.1 Fuel System

Cummins engines normally use a diesel fuel specified to ASTM No. 2 or BS EN 590:2000, Automotive fuels.

In all fuel system installations, cleanliness is of the utmost importance. Make every effort to prevent entrance of moisture, dirt, or contaminants of any kind into the fuel system. Clean all fuel system components before installing.


 **NOTE:** *A fuel filter/strainer/water separator of 100-120 mesh or equivalent (approximately 150 microns nominal) must be fitted between either the main tank and day tank or between the main tank and the engine.*

Use only compatible metal fuel lines to avoid electrolysis when fuel lines must be buried. Buried fuel lines must be protected from corrosion.

 **CAUTION:** *Never use galvanized or copper fuel lines, fittings, or fuel tanks. Condensation in the tank and lines combines with the sulfur in diesel fuel to produce sulfuric acid. The molecular structure of the copper or galvanized lines or tanks reacts with the acid and contaminates the fuel.*

An electric solenoid valve in the supply line is recommended for all installations and required for indoor automatic or remote starting installations. Connect the solenoid wires to the generator set "Switched B+" circuit to open the valve during generator set operation.

Separate fuel return lines to the day tank or supply tank must be provided for each generator set in a multiple-set installation to prevent the return lines of idle sets from being pressurized. Fuel return lines must not contain a shutoff device. Engine damage will occur if the engine is run with the return fuel lines blocked or restricted.

 **CAUTION:** *Never install a shutoff device in fuel return line(s). If fuel return line(s) is blocked or exceeds fuel restriction limit, engine damage will occur.*

7.1.1 Fuel Return Restrictions (or Pressure) Limit

Fuel return drain restriction (consisting of friction head and static head) between the engine injector return line connection and the fuel tank must not exceed the limit stated in the model-specific generator set *Specification Sheet*.

7.1.2 Fuel Lines Routing

A flexible fuel hose(s) or section of flexible fuel hose(s) must be used between the engine's fuel system and fuel supply and return line(s) to protect the fuel system from damage caused by vibration, expansion, and contraction. Flexible lines for connecting between the engine and the stationary fuel lines are supplied as standard equipment.

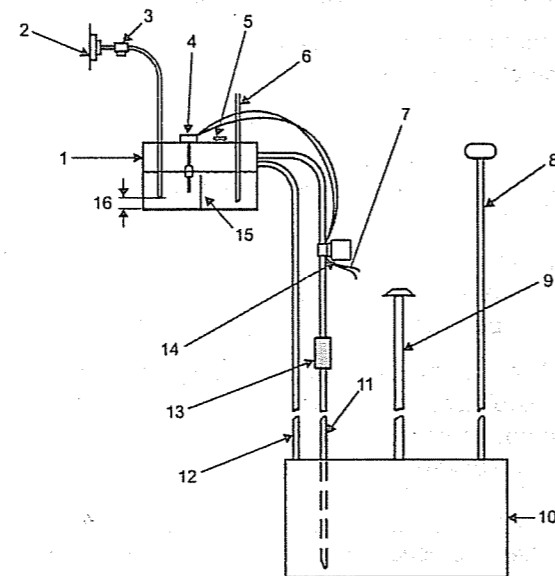
WARNING: Fuel leaks create fire and explosion hazards which can result in severe personal injury or death. Always use flexible tubing between the engine and fuel supply to avoid line failure and leaks due to vibration. The fuel system must meet all application codes.

Installation of the fuel hose must be done according to all application codes and standards, and installation recommendations provided by the manufacturer. The supplied flexible hose is approved by the hose manufacturer for use with the generator set fuel type and product application.

Support fuel lines to restrain movement and prevent chafing on contact with sharp edges, electrical wiring, and hot exhaust parts.

WARNING: Sparks and hot surfaces can ignite fuel, leading to severe personal injury or death. Do not route fuel lines near electrical wiring or hot exhaust parts.

Fuel lines must be routed and secured to maintain a 12.7 mm (½ inch) minimum clearance from electrical wiring and a 51 mm (2 inch) minimum clearance from hot exhaust parts.



No.	Description	No.	Description
1	Day Tank	9	Fill Pipe
2	Engine Fuel Pump	10	Main Fuel Tank
3	Shut Off Valve	11	Supply Line
4	Float Switch	12	Larger Overflow Line 120 Mesh Fuel Strainer
5	Vented Fill Cap	13	120 Mesh Fuel Strainer
6	Injector Fuel Return Line	14	Fuel Transfer Pump Electric Motor Driven
7	Connect to AC Output	15	Baffle
8	Vent Pipe	16	25.4 mm (1 inch) Clearance

FIGURE 6. TYPICAL FUEL SUPPLY INSTALLATION

7.1.3 Engine Fuel Connections

Identification tags are attached to the fuel supply line and fuel return line connections. All models require a fuel return line from the injectors to the tank.

7.1.4 Supply Tank

Locate the fuel tank as close as possible to the generator set and within the restriction limitations of the fuel pump.

Install a fuel tank that has sufficient capacity to supply the generator set operating continuously at full rated load for the planned period of operation or power outage. Refer to **Chapter 5 on page 17** for fuel consumption data.

If the fuel inlet restriction exceeds the defined limit due to the distance/customer-supplied plumbing between the generator set and the main fuel tank, a transfer tank (sometimes referred to as a day tank) and auxiliary pump will also be required. If an overhead main fuel tank is installed, a transfer tank and float valve will be required to prevent fuel head pressures from being placed on the fuel system components.

NOTE: For critical start applications, where generator sets are paralleled or must satisfy emergency start-time requirements, it is recommended that a fuel tank or reservoir be located such that the lowest possible fuel level is not less than 6 inches (150 mm) above the fuel pump inlet. This will prevent air from accumulating in the fuel line while the generator set is in standby, eliminating the period during startup when it has to be purged.

7.1.5 Fuel Inlet Pressure/Restriction Limit

Engine performance and fuel system durability will be compromised if the fuel inlet pressure or restriction limits are not adhered to. Fuel inlet pressure or restriction must not exceed the limits stated in the model-specific generator set *Specification Sheet*.

7.1.6 Day Tank

Some generator set installations may include a fuel day tank. They are used when fuel inlet restriction limits cannot be met, or the supply tank is overhead and presents problems of high fuel head pressure for the fuel inlet and return lines.

7.1.6.1 Supply Tank Lower Than Engine

With this installation, the day tank is installed near the generator set, below the fuel injection system and within the fuel inlet restriction limit. Install a fuel transfer pump, to pump fuel from the supply tank to the day tank. A float switch in the day tank controls operation of the auxiliary fuel pump.

NOTE: The supply tank top must be below the day tank top to prevent siphoning from the fuel supply to the day tank.

Provide a return line from the engine injection system return connection to the day tank. Plumb the return line to the bottom of day tank as shown in **Figure 6 on page 26**. Provide a day tank overflow line to the supply tank in case the float switch fails to shut off the fuel transfer pump.

WARNING: Spilled fuel presents the hazard of fire or explosion which can result in severe personal injury or death. Provide an overflow line to the supply tank from the day tank.

7.1.6.2 Supply Tank Higher Than Engine

With this installation, the day tank is installed near the generator set, below the fuel injection system and within the fuel inlet restriction limit. Include an automatic fuel shutoff valve in the fuel line between the fuel supply tank and the day tank to stop fuel flow when the generator set is off.

Provide a return line from the engine injection system return connection to the day tank. Plumb the return line to the bottom of day tank as shown in **Figure 6 on page 26**.

WARNING: Spilled fuel can create environmental hazards. Check local requirements for containment and prevention of draining to sewer and ground water.

7.1.7 Fuel Transfer Pump Installation

A fuel transfer pump and control are available as an option when a sub-base or an in-skid day tank is provided. The automatic control operates the fuel pump to maintain a reservoir of fuel in the day tank.

WARNING: Diesel fuel is highly combustible. Improper installation of this kit can lead to spillage of large quantities of fuel and loss of life and property if the fuel is accidentally ignited. Installation and service must be performed by trained and experienced persons in accordance with the applicable codes.

WARNING: Do not smoke near fuel and keep flames, sparks, pilot lights, arcing switches and equipment, and other sources of ignition well away.

7.1.8 Fuel Filters

Some generator sets require the installation of a fuel filter kit as part of the installation of the generator set.

7.1.8.1 Fuel Filter Installation

The fuel filter and pump assembly is shipped with the engine. It includes thread sealant, isolator rings, isolators, and the hardware (flange nuts, flat washers, and head head screws) necessary to install the kit.

The fuel filter mounting kit is shipped secured to the skid. It includes the fuel filter mounting bracket, a fuel line, and a stock box that contains elbows and a reducer.

The three types of fuel filter kits that are available are shown below.

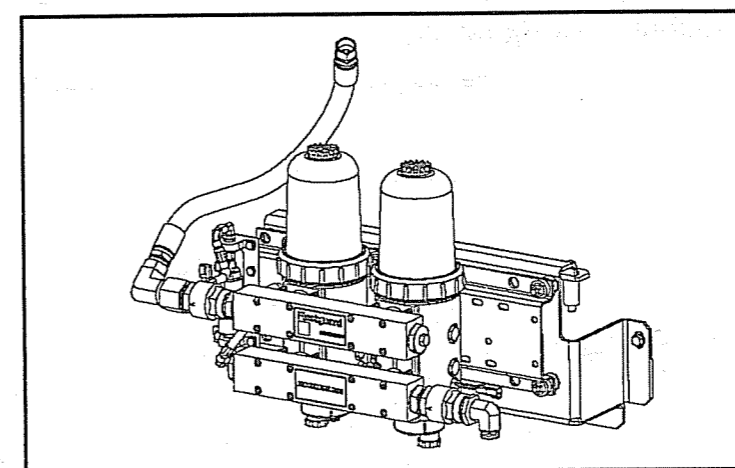


FIGURE 7. DUAL FUEL FILTER

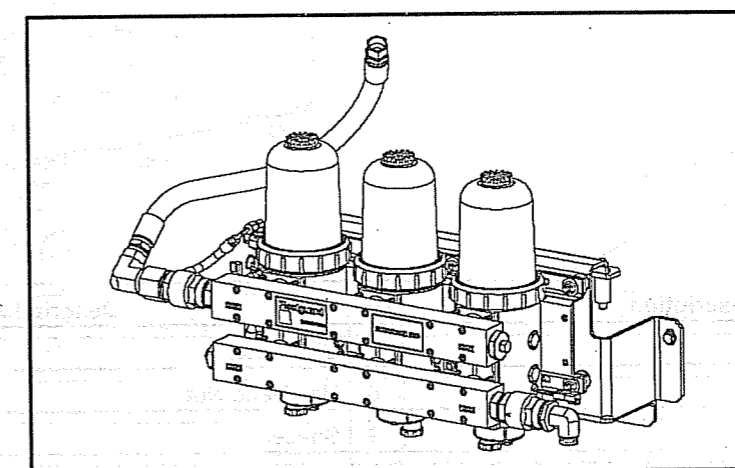


FIGURE 8. TRIPLE FUEL FILTER

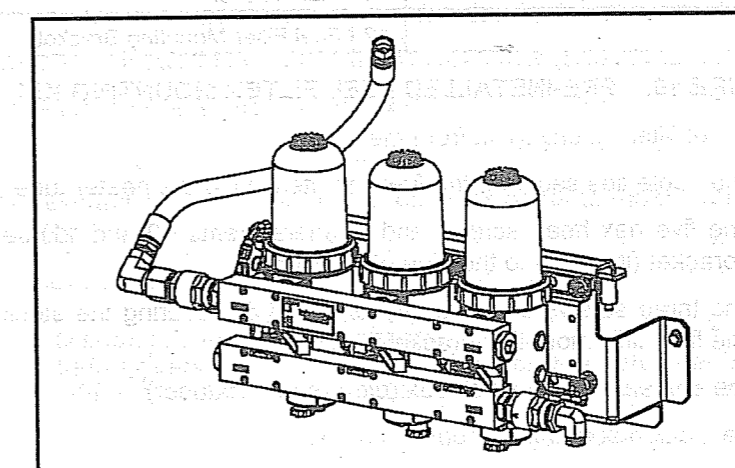
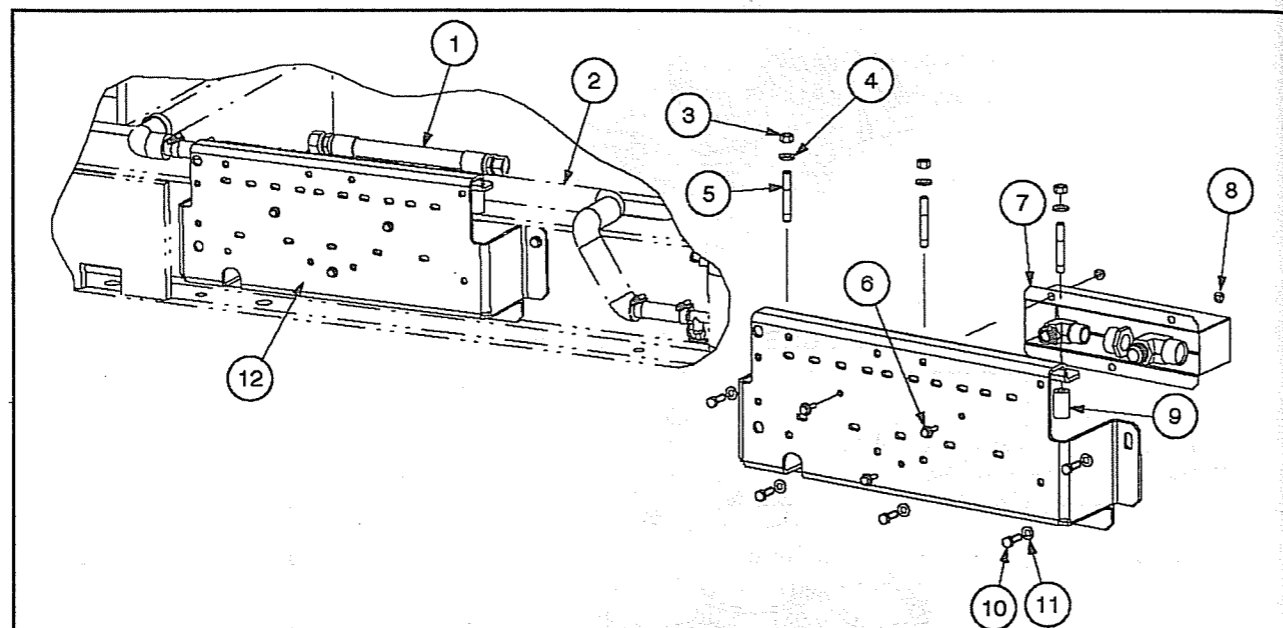


FIGURE 9. TRIPLEX FUEL FILTER

7.1.8.1.1 Fuel Filter Mounting Kit Removal

When shipped from the factory, the fuel filter mounting kit is secured to the skid (see **Figure 10**).



No.	Description	No.	Description
1	Fuel Line	7	Stock Box
2	Heater Tube	8	Hex Head Nut
3	Nut	9	Spacer
4	Flat Washer	10	Hex Head Screw
5	Stud	11	Flat Washer
6	Hex Head Screw	12	Fuel Filter Mounting Bracket

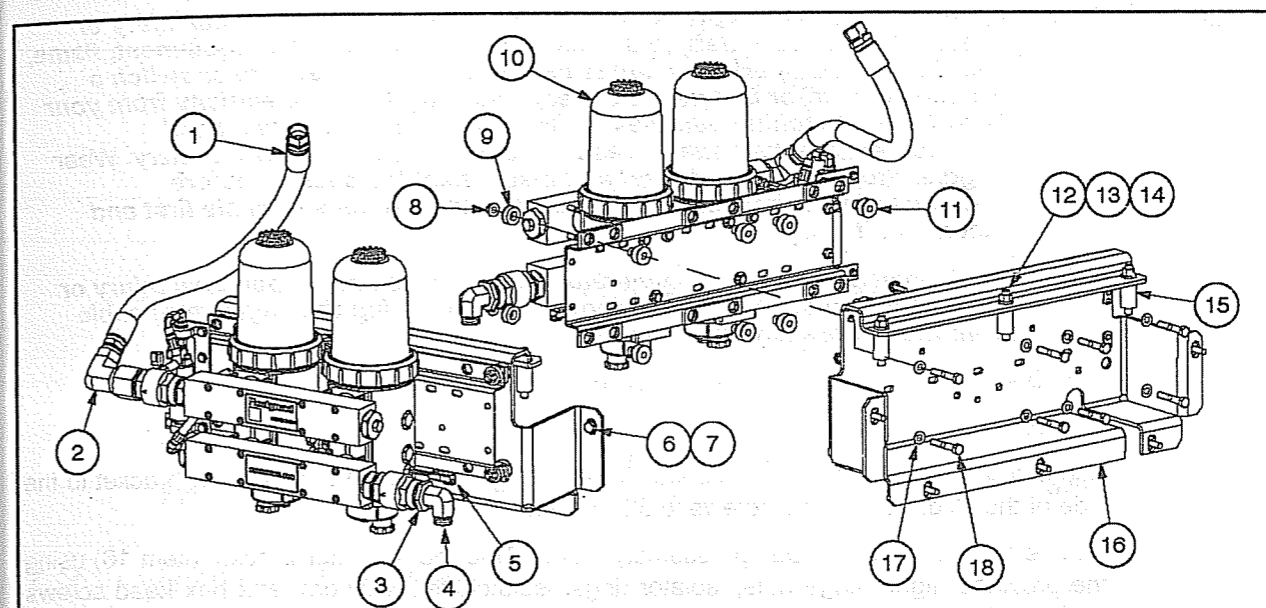
FIGURE 10. PRE-INSTALLED FUEL FILTER MOUNTING KIT

To remove the fuel filter mounting kit from the skid,

1. Remove the cable ties securing the fuel line (item 1) to the heater tube (item 2).
2. Remove the five hex head screws and washers (items 10 and 11) securing the fuel filter mounting bracket (item 12) to the side of the skid.
3. Remove the three screws and nuts (items 6 and 8) securing the stock box (item 7) to the inside of the fuel filter mounting bracket.
4. Remove the contents of the stock box (elbows and reducer).
5. Discard the stock box and its mounting hardware.

7.1.8.1.2 Fuel Filter Kit Assembly

Figure 11 shows the installation of the fuel filter kit.



No.	Description	No.	Description
1	Fuel Line	10	Fuel Filter and Pump Assembly
2	Tube Elbow (1 5/16-12 x 1 1/4 NPT)	11	Isolator
3	Reducer (1 1/4 x 1 NPT)	12	Hex Head Nut (M12)
4	Tube Elbow (1 NPT x 1 3/16 ORFS)	13	Flat Washer (M12)
5	Fuel Filter Harness Connector	14	Stud
6	Hex Head Screw (M10 x 30mm)	15	Spacer
7	Flat Washer (M10)	16	Fuel Filter Bracket
8	Flange Nut (M10 x 1.5)	17	Flat Washer (3/8 inch)
9	Isolator Ring	18	Hex Head Screw (3/8-16 x 1 inch)

FIGURE 11. FUEL FILTER KIT INSTALLATION (DUAL FILTER SHOWN)

To install the fuel filter assembly on the skid,

1. Make sure the generator set is disabled.
 - a. Press the STOP button on the operator panel to make sure the control is in the OFF mode.
 - b. Activate the E-Stop button.
- WARNING:** Disconnect the battery charger from its AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes which can cause damage to the DC control circuits of the generator set.
- c. If equipped, disconnect the batter charger. Remove any other electrical supply sources.

WARNING: Ignition of explosive battery gasses can cause severe personal injury or death. ARching at battery terminals, a light switch or other equipment, flame, pilot lights, and sparks can ignite battery gas. Do not smoke or switch a trouble light ON or OFF near a battery. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface. Ventilate the battery area before working on or near a battery. Wear goggles. Stop the generator set and disconnect the charger before disconnecting battery cables. Disconnect the negative (-) cable first and reconnect it last.

WARNING: Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

- d. Disconnect the generator set negative (-) battery cable.
2. Remove the cap from the fuel inlet port of the engine.
3. Use five M10 screws and flat washers (items 6 and 7) to secure the fuel filter bracket to the side of the skid. Torque the screws to 52 ± 5 N·m.
4. Secure the fuel filter and pump assembly (item 10) to the fuel filter bracket (item 16) using the provided eight flange nuts, isolator rings, isolator, flat washers, and hex head screws (items 8, 9, 11, 17, and 18). Torque the M10 flange nuts to 52 ± 5 N·m.
5. Apply thread sealant and install the 1-5/16 inch elbow (item 2) on the upper part of the fuel filter pump.
6. Install the fuel line to the elbow installed above.
7. Apply thread sealant and install the 1-1/4 to 1-inch reducer (item 3) on the lower part of the fuel filter pump.
8. Apply thread sealant and install the 1-inch elbow (item 4) on the reducer.
9. Connect the fuel line (item 1) to the fuel inlet connector, as shown in **Figure 12**.
10. Connect the engine harness to the fuel filter harness connector (item 5).
11. Reconnect the negative (-) cable to the starting battery.
12. Reconnect the battery charger (if equipped).
13. Open the fuel shutoff valve (if equipped).
14. Prime the fuel system. Start the generator set and check for fuel leaks. If any fuel leaks are discovered, make sure they are fixed before placing the generator set in service.

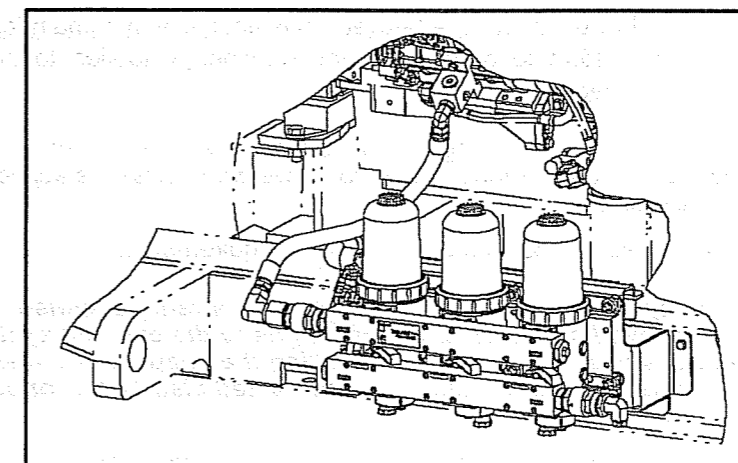


FIGURE 12. INSTALLED FUEL FILTER ASSEMBLY (TRIPEX FILTER SHOWN)

7.2 Exhaust System

Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlets away from any air inlets to avoid gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation, and light loads. Regularly inspect the exhaust system both visually and audibly to see that the entire system remains fume tight and safe for operation.

WARNING: Inhalation of exhaust gasses can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Terminate exhaust pipes away from enclosed or sheltered areas, windows, doors, and vents.

For indoor installation, the exhaust system should use sealed joint type fittings where possible to provide a tight exhaust system. Use of slip type fittings (secured with a clamp) may allow leakage of exhaust gases into the building if not fitted correctly. Check to make sure there are no exhaust leaks.

Use an approved thimble (see **Figure 13 on page 35**) where exhaust pipes pass through wall or partitions. Insulated wall/roof thimbles are used where exhaust pipes pass through a combustible roof or wall. This includes structures, such as wood framing or insulated steel decking, etc. Uninsulated wall/roof thimbles are used where exhaust pipes pass through a non-combustible wall or roof, such as concrete. Where applicable, refer to NFPA 37, Section 6-3, *Stationary Combustion Engines and Gas Turbines*, for accepted design practices. Build according to the code requirements in effect at the installation site.

WARNING: Hot exhaust pipes can start a fire and cause severe injury or death if improperly routed through walls. Use an approved thimble where exhaust pipes pass through wall or partitions.

WARNING: Inhalation of exhaust gases can result in severe personal injury or death. Do not use exhaust heat to warm a room, compartment, or storage area.

Rain caps are available for the discharge end of vertical exhaust pipes. The rain cap clamps onto the end of the pipe and opens due to exhaust discharge force from the generator set. When the generator set is stopped, the rain cap automatically closes, protecting the exhaust system from rain, snow, etc.

Use a section of flexible exhaust pipe between the engine and remainder of exhaust system. Support the exhaust system to prevent weight from being applied to engine exhaust outlet elbow/turbocharger connection.

CAUTION: *Weight applied to the engine manifold can result in turbocharger damage. Support the silencer and exhaust piping so no weight or stress is applied to the engine exhaust elbow.*

The exhaust system design should meet local code requirements.

NOTE: *Liability for injury, death, damage, and warranty expense due to use of unapproved silencers or modifications to the exhaust system becomes the responsibility of the person installing the unapproved silencer or performing the modification. Contact your authorized distributor for approved exhaust system parts.*

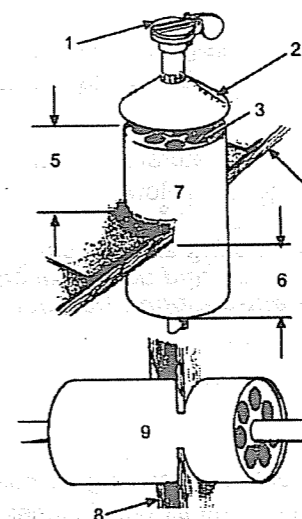
Avoid sharp bends by using sweeping, long radius elbows and provide adequate support for the silencer and tailpipe. Pitch a horizontal run of exhaust pipe downward (away from engine) to allow any moisture condensation to drain away from the engine. If an exhaust pipe must be turned upward, install a condensation trap at the point where the rise begins see **Figure 14 on page 35**.

CAUTION: *Gaseous fuels are susceptible to high condensation levels in the exhaust and therefore it is important to have properly routed/sized exhaust systems to prevent harm to turbochargers and Oxygen sensors (HEGO).*

Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 305 mm (12 inches) of clearance if the pipes pass close to a combustible wall or partition. Before installing insulation on exhaust system components, check the exhaust system for leaks while operating the generator set under full load and correct all leaks.

WARNING: *Exhaust pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard. Shield or insulate exhaust pipes if there is danger of personal contact or when routed through walls or near other combustible materials.*

Refer to Application Manual T-030, "Liquid Cooled Generator Sets" for more detailed information about sizes of exhaust system pipes and fittings.



NO	Description	NO	Description
1	Rain Cap	6	230 mm (9 inches)
2	Drip Cap	7	Vertical Alignment
3	Holes in End of Inner Sleeve	8	Wall or Partition
4	Roof	9	Horizontal Alignment
5	230 mm (9 inches)		

FIGURE 13. MOUNTING EXHAUST THIMBLE

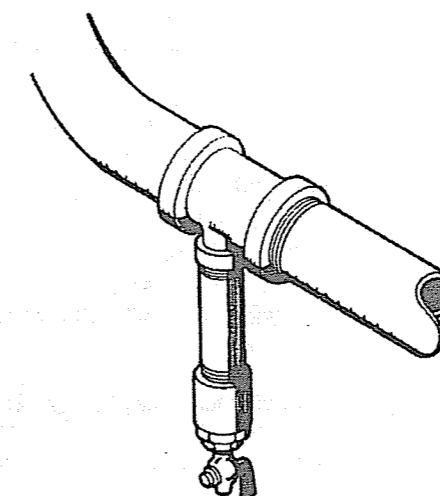


FIGURE 14. CONDENSATION TRAP

7.3 Ventilation and Cooling

Generator sets create considerable heat that must be removed by proper ventilation.

Generator sets in factory-mounted housings for outdoor installation are designed for proper cooling and ventilation.

Indoor installations require careful design with respect to cooling and ventilation. In an indoor installation, all radiator cooling air must be discharged to the out-of-doors. Duct adapter kits are available.

Outdoor installations normally rely on natural air circulation but indoor installations need properly sized and positioned vents for required airflow.

WARNING: *Engine or radiator cooling air may carry deadly carbon monoxide gas which can cause asphyxiation and death. All engine or radiator cooling air must be discharged to the out-of-doors. Do not use it for heating a room or compartment.*

7.4 Vents and Ducts

For indoor installations, locate vents so incoming air passes through the immediate area of the installation before exhausting. Install the air outlet higher than the air inlet to allow for convection air movement.

Size the vents and ducts so they are large enough to allow the required flow rate of air.

NOTE: *The 'free area' of ducts must be as large as the exposed area of the radiator. Refer to the generator set Specification Sheet for the airflow requirements and allowed airflow restriction.*

Wind will restrict free airflow if it blows directly into the air outlet vent. Locate the outlet vent so the effects of wind are eliminated, or if outlet vent cannot be located as mentioned, install a wind barrier, see [Figure 15](#).

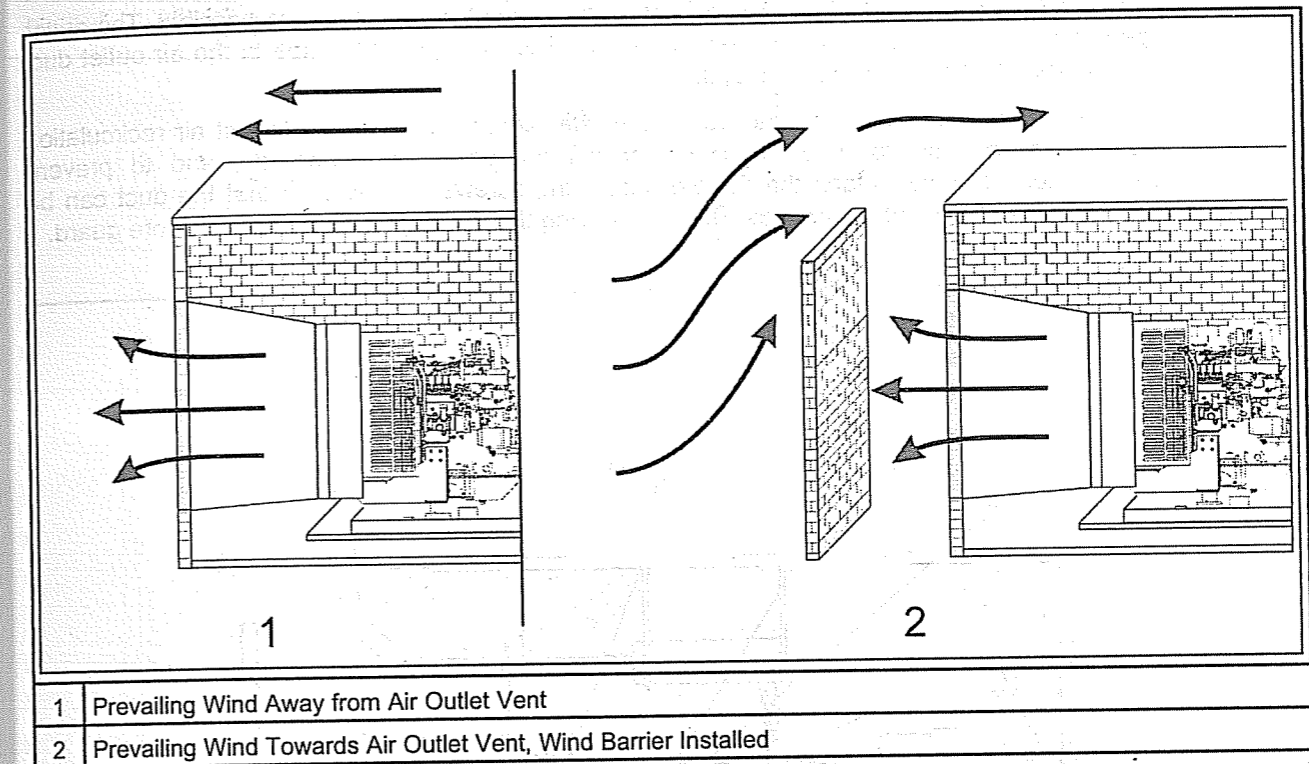


FIGURE 15. WIND BARRIER

7.5 Dampers

Dampers or louvers protect the generator set and equipment room from the outside environment. Their operation of opening and closing should be controlled by operation of the generator set.

In cold climates, the radiator exhaust air can be recirculated to modulate the ambient air temperature in the generator set room. This will help the generator set warm up faster, and help to keep fuel temperatures higher than the cloud point of the fuel. If recirculation dampers are used, they should be designed to 'fail closed', with the main exhaust dampers open, so that the generator set can continue to operate when required. Designers should be aware that the generator set room operating temperature will be very close to the outdoor temperature, and either not route water piping through the generator set room, or protect it from freezing.

7.6 Air Inlet and Outlet Openings

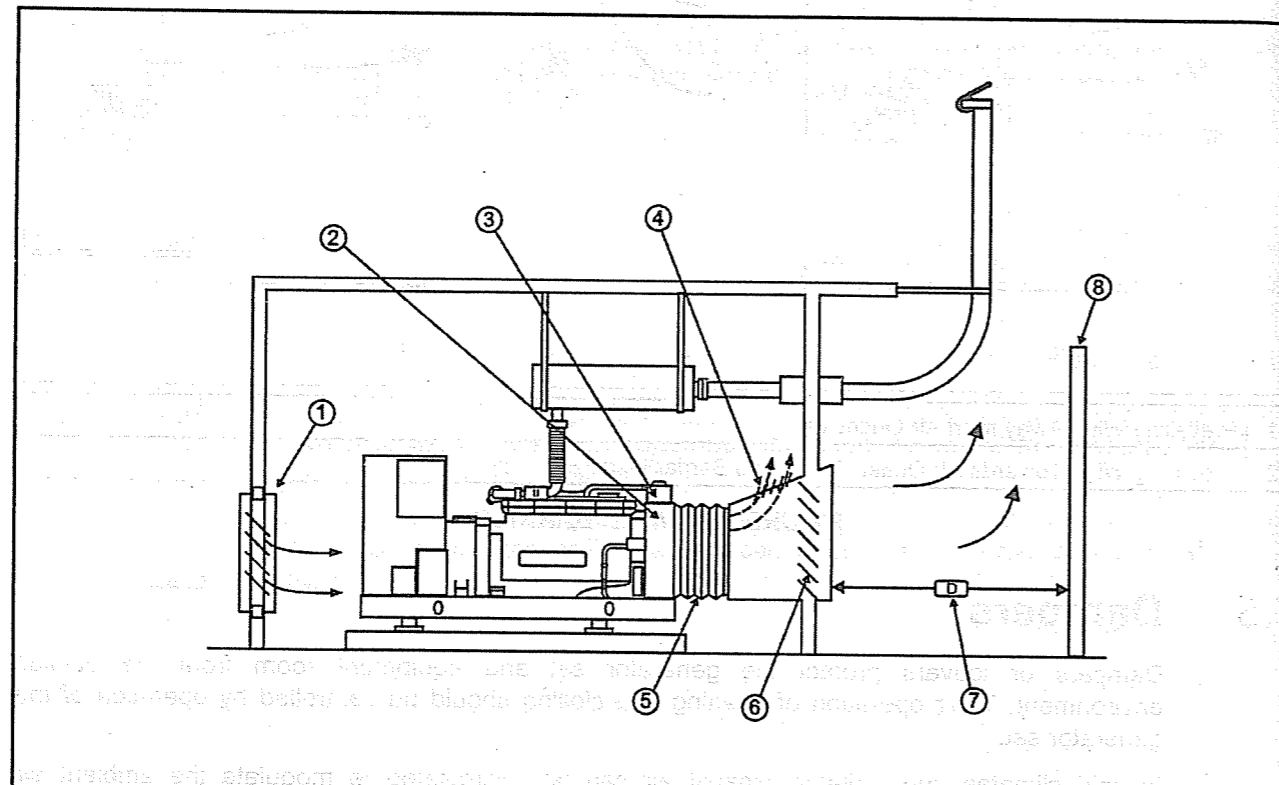
Louvers and screens over air inlet and outlet openings restrict air flow and vary widely in performance.

A louver assembly with narrow vanes, for example, tends to be more restrictive than one with wide vanes. The effective open area specified by the louver or screen manufacturer should be used.

Radiator set cooling air is drawn past the control end of the set by a pusher fan that blows air through the radiator. Locate the air inlet to the rear of the set. Make the inlet vent opening 1.5 times larger than the radiator area.

Locate the cooling air outlet directly in front of the radiator and as close as possible. The outlet opening must be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to airflow.

A flexible duct connector must be provided at the radiator to prevent exhaust air recirculation around the radiator, to take up generator set movement and vibration, and to prevent transmission of noise. Attach the flexible duct using screws and nuts so that the duct can be removed for maintenance purposes. Before installing the duct, remove the radiator core guard.



1	Cool Air Inlet Damper	5	Flexible Duct Connector
2	Engine Driven Fan	6	Hot Air Outlet Damper
3	Radiator	7	Distance Should Not be Less Than Height of Radiator
4	Thermostat Controlled Re-circulating Damper	8	Wind / Noise Barrier

FIGURE 16. TYPICAL RADIATOR SET INSTALLATION

7.7 Heavy Duty Air Cleaner

If not already installed, the heavy duty air cleaner assembly must be installed at the site.

7.7.1 Heavy Duty Air Cleaner Installation

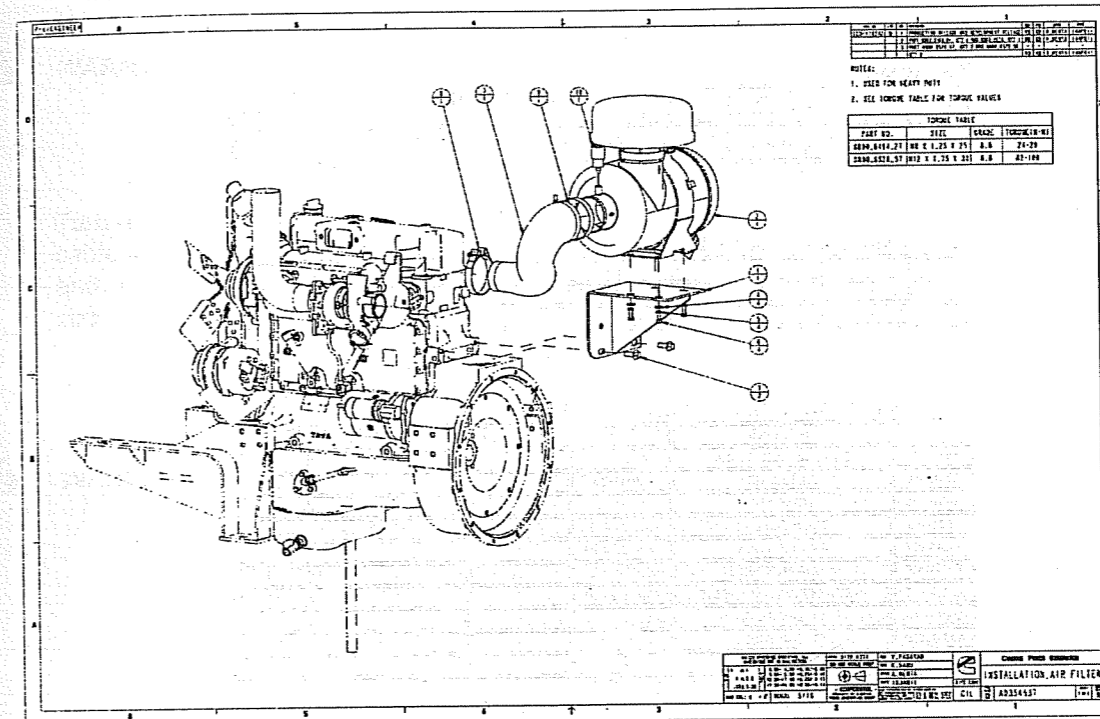


FIGURE 17.

Part A035A537 B

Description	Legacy Name	External Regulations	Application Status	Release Phase Code	Security Classification	Alternates
INSTALLATION,AIR FILTER	A035A537	None	Production Only	Production	Public	

Part Specifications :A035A537 B

Name	Description	Legacy Name
A030B356	SPECIFICATIONMATERIAL	CES10903
A035A538	DRAWING,ENGINEERING	A035A538

Engineering BOM: A035A537 B Level 1

Name	Description	Legacy Name	Find Number	Reference Designator	Quantity
A034P564	BRACKET,AIR FILTER	A034P564	1		1.0
A034P650	FILTER,AIR	A034P650	2		1.0
A034P555	HOSE,AIR	A034P555	3		1.0
A024J966	WASHER,FLAT	0526-2400-25	4		4.0
A024M698	WASHER,LOCK	0850-2114-09	5		4.0
A024M577	SCREW,HEX HEAD	0800-6494-27	6		4.0
A024M617	SCREW,HEX FLANGE HEAD	0800-6520-57	7		2.0
A024M104	CLAMP,HOSE	0503-3163-01	8		1.0
A024M020	CLAMP,TUBE	0502-1721	9		1.0
A019V593	INDICATOR,SERVICE	0140-4287	10		1.0

↓
ZERO

Drawing Name: A035A538 Revision: B
Part Name: A035A537 Revision: B
Sheet 2 of 2

FIGURE 18.

WARNING: Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical component installations.

WARNING: AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Incorrect installation, service, or parts replacement can result in severe personal injury, death, and/or equipment damage. Only trained and experienced personnel are to perform the following procedures.

Turn off or remove AC power from the battery charger and then remove the negative (-) battery cable from the set starting battery. This is to make sure the set will not start while working on it and to avoid circuit board damage, caused by voltage spikes when removing and replacing circuit board connectors.

CAUTION: If present, always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the generator set.

WARNING: Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).

Make certain the battery area has been well-ventilated before servicing the battery. Wear goggles. Stop the generator set and disconnect the charger before disconnecting battery cables. Arcing can ignite explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur when a cable is removed or re-attached, or when the negative (-) battery cable is connected and a tool used to connect or disconnect the positive (+) battery cable touches the frame or other grounded metal part of the generator set. Always remove the negative (-) cable first, and reconnect it last. Make certain hydrogen from the battery, engine fuel, and other explosive fumes are fully dissipated. This is especially important if the battery has been connected to a battery charger.

WARNING: Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near a battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Ventilate the battery area before working on or near the battery. Wear goggles. Stop the generator set and disconnect the battery charger before disconnecting battery cables-Disconnect the negative (-) cable first and reconnect it last.

[Faint, illegible text from the reverse side of the page is visible through the paper.]

This page is intentionally blank.

8 DC Control Wiring

⚠ WARNING: AC voltages and currents present an electrical shock hazard that can result in severe personal injury or death. Avoid contact with the voltage sense and bus sense leads; voltages of up to 600 VAC may still be present. These voltages could be live even when the generator set is switched off.

The generator set control box contains connection points for remote control and monitor options.

⚠ CAUTION: Stranded copper wire must be used for all customer connections to the control panel. Solid copper wire may break due to the generator set vibration.

Use flexible conduit for all wiring connections to the generator set.

⚠ WARNING: Hazardous voltage! Touching uninsulated high voltage parts inside the control box can result in severe personal injury or death. Make sure all power is off before performing control wire installation.

⚠ WARNING: To prevent accidental electrocution, stand on a clean dry wooden platform or clean rubber insulating mat, make sure your clothing and shoes are dry, remove all jewelry, and use tools with insulated handles.

⚠ CAUTION: Always run control circuit wiring in a separate metal conduit from the AC power cables to avoid inducing currents that could cause problems within the control.

Use cable ties to keep control wiring away from sharp edges and AC power cables within the control housing.

8.1 TB1 Remote Monitor / Control Connections

Customer monitor/control connections are attached to terminal block TB1. Optional equipment, such as sensing devices used to monitor generator set operation, remote start/stop switches, etc. are also attached to TB1.

Available options will vary between controller models.

8.2 PowerCommand 1.x TB1 Customer Connections

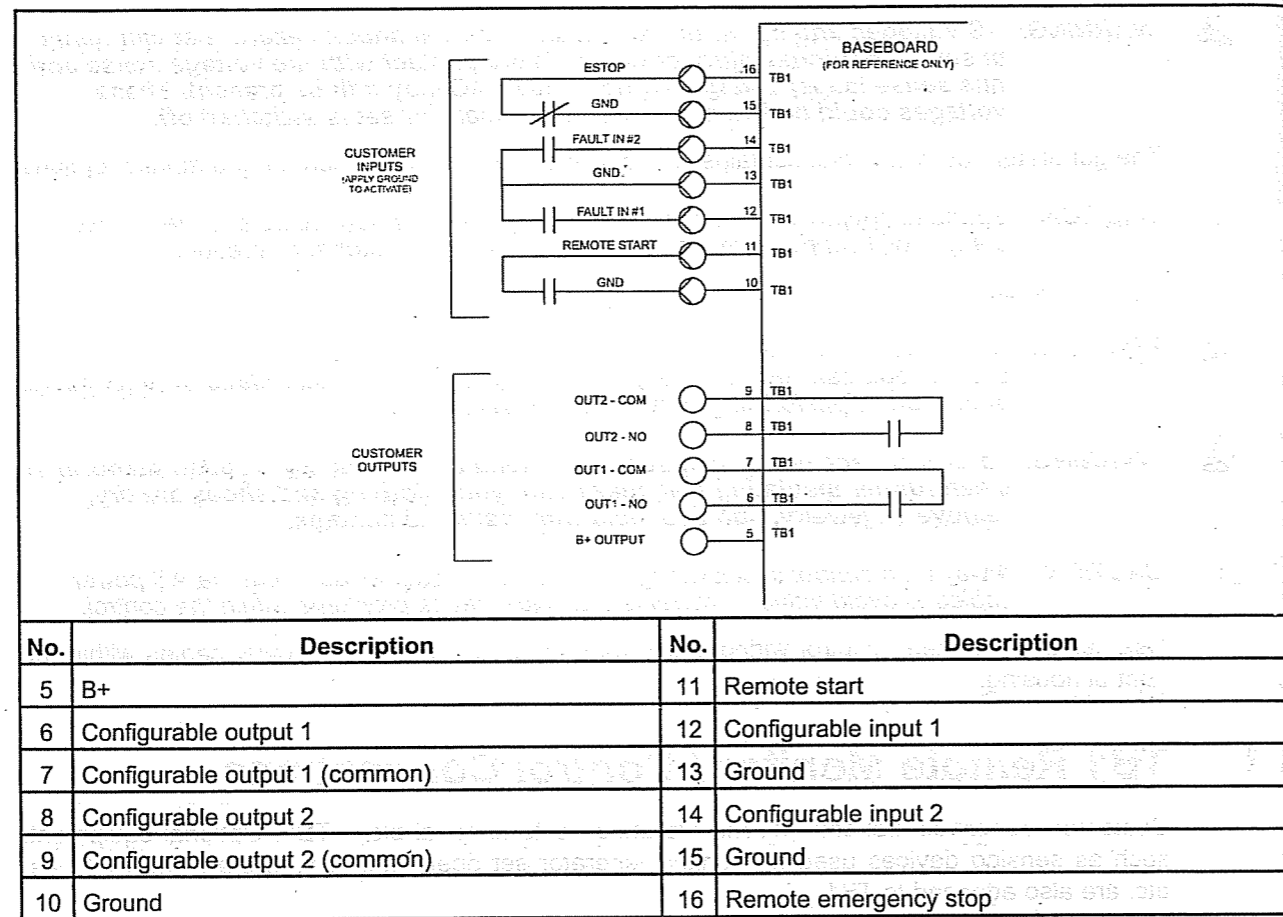


FIGURE 19. TYPICAL POWERCOMMAND 1.X TB1 CUSTOMER CONNECTIONS

8.2.1 TB1 Customer Inputs

Remote Start: When the control is in Auto/Remote mode, grounding this input initiates the engine cranking and start sequence. This circuit must be opened to permit resetting a shutdown condition with the Reset input. (The remote stop is actually the removal of the remote start signal to the control.)

Remote Emergency Stop (ESTOP): Opening this input causes an immediate shutdown. Emergency stop must be reset at the front panel.

Customer Fault Inputs 1 and 2: Grounding any one of these inputs activates the corresponding warning or shutdown sequence.

External sensing equipment must be connected to the designated digital input.

The nature of the fault is an optional customer selection. Example inputs: Low Coolant Level, Low Fuel Level, Ground Fault, etc.

Each of the two fault functions can be programmed as follows:

Status, Warning or Shutdown. Default = Warning.

NOTE: *The InPower service tool or access to the Setup submenus is required to modify the customer fault inputs. Contact your authorized distributor for assistance.*

8.2.2 TB1 Customer Outputs

Customer Outputs 1 and 2: One set of normally open (NO) contacts, rated for X amps at 30 VDC for each of the two output signals. The relays can be used to control small devices and indicator lamps.

The nature of the customer output signal (contacts closed) is an optional customer selection. Example outputs: Generator set running (event), common warning, common shutdown, etc. (Refer to Generator Set Operator manual for the Warning and Shutdown code listing and the Service (Controller) manual for event code listing).

Each relay can be independently programmed to energize by entering a code number (0 through 255, default = 0) for the desired event.

NOTE: *Using the InPower service tool or accessing the Setup submenus is required to modify the customer outputs. Contact an authorized distributor for assistance.*

No.	Description	No.	Description
1	x	6	x
2	x	7	x
3	x	8	x
4	x	9	x
5	x	10	x

FIGURE 20. SUGGESTED CUSTOMER WIRE ROUTING

8.2.3 Switched B+

Switched B+ is fused at 15 amps. The wiring is the same as the wiring for switched B+ in TB1.

The switched B+ quick connect terminal is located on the TB2-12 DIN rail.

8.3 Run Relays (K10, K11)

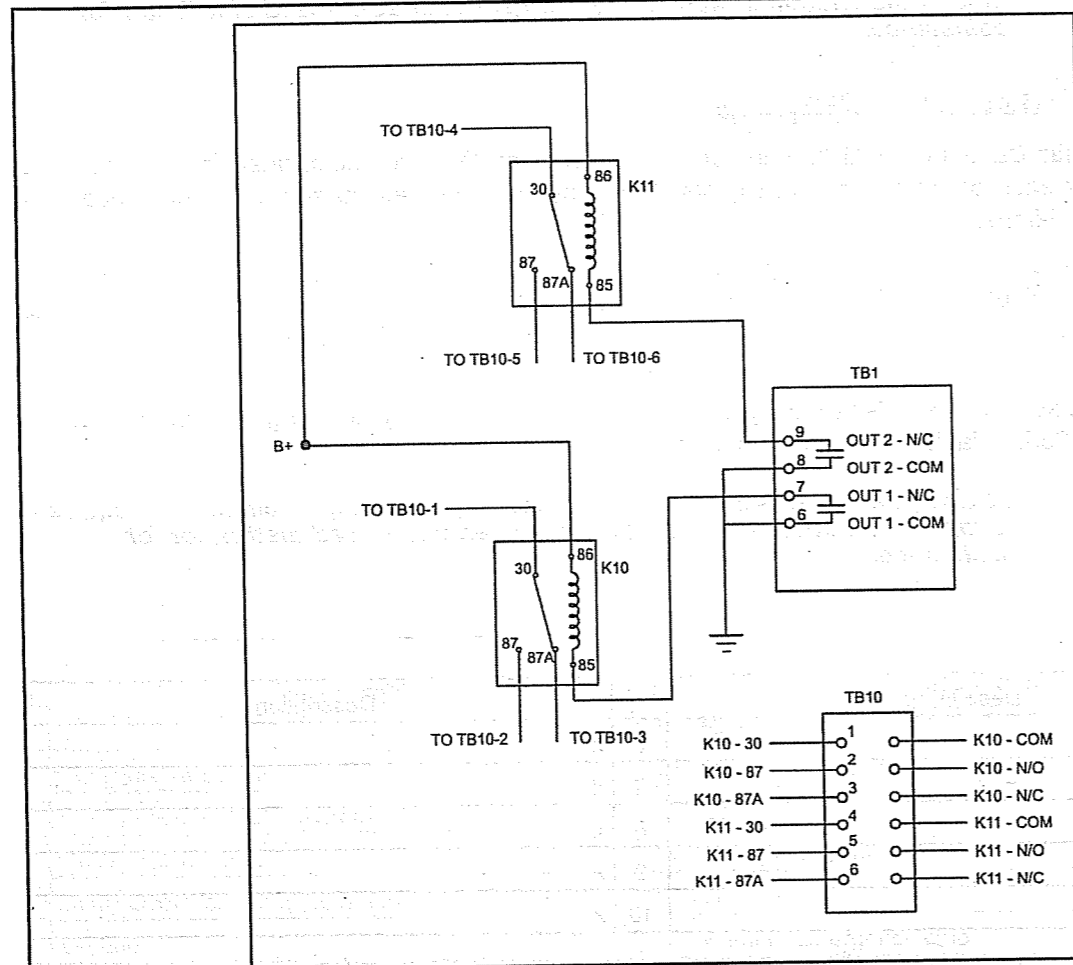
Optional run relays (see **Table 6**) are mounted inside the control box. The single-pole, double-throw run relays are used for customer connections to control auxiliary equipment such as fans, pumps, and motorized air dampers.

The run relays are energized when the generator set control receives a start signal.

The contacts are rated:

- 20 Amps resistive at 30 VDC
- 15 Amps inductive at 30 VDC

TABLE 6. OPTIONAL RUN RELAYS (K10, K11)

**Legend:**

COM = Common
 N/O = Normally Open
 N/C = Normally Closed
 TB = Terminal Block

9 AC Electrical Connections

This section provides the procedure that is used to connect the AC electrical system of the generator set.

WARNING: AC voltages and currents present an electrical shock hazard that can result in severe personal injury or death. Avoid contact with the voltage sense and bus sense leads; voltages of up to 600 VAC may still be present. These voltages could be live even when the generator set is switched off.

Before making any AC electrical connections, make certain the generator set cannot be accidentally started. Make sure the Operator Panel is in OFF mode. Turn off or remove AC power from the battery charger and then remove the negative (-) battery cable from the set starting battery.

If the generator set is being installed in an application where it may parallel with other generators or utility sources, the generator set control system may be energized from an external source. Lock out tag out any external source that can provide AC power to the generator set.

WARNING: Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch a trouble light ON or OFF near a battery. Discharge static electricity from body before touching the batteries by first touching a grounded metal surface.

WARNING: Ventilate the battery area before working on or near battery. Wear goggles. Stop the generator set and disconnect the battery charger before disconnecting battery cables. Disconnect negative (-) cable first and reconnect last.

CAUTION: Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the set.

WARNING: Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

WARNING: Each of the operations described in this section should be done only by persons trained and experienced in electrical maintenance. Improper procedures may result in property damage, bodily injury or death.

WARNING: Electric current can cause severe personal injury or death. The AC sensing harness and other cabling will become energized when the generator set is in operation.

Connecting the generator set AC electrical system involves:

- Installation of transfer switch
- Installation or verification of paralleling switchboard
- Generator output voltage selection
- Load cable connection
- Standard and optional AC equipment connections (e.g., control box heater, coolant heater, etc.).

Local regulations often require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire sizes, materials used, etc. must conform to the requirements of electrical codes in effect at the installation site.

⚠ WARNING: Improper wiring can cause a fire or electrical hazard, resulting in severe personal injury or death and/or property and equipment damage.

Before starting the generator set, check to make sure that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the generator set are properly connected.

⚠ WARNING: Backfeed to a utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after the building main switch is opened.

9.1 Transfer Switch

If the installation is for standby service, a transfer switch must be used for switching the load from the normal power source to the generator set (see **Figure 21 on page 48**). Follow the installation instructions provided with the transfer switch when connecting the load and control wiring.

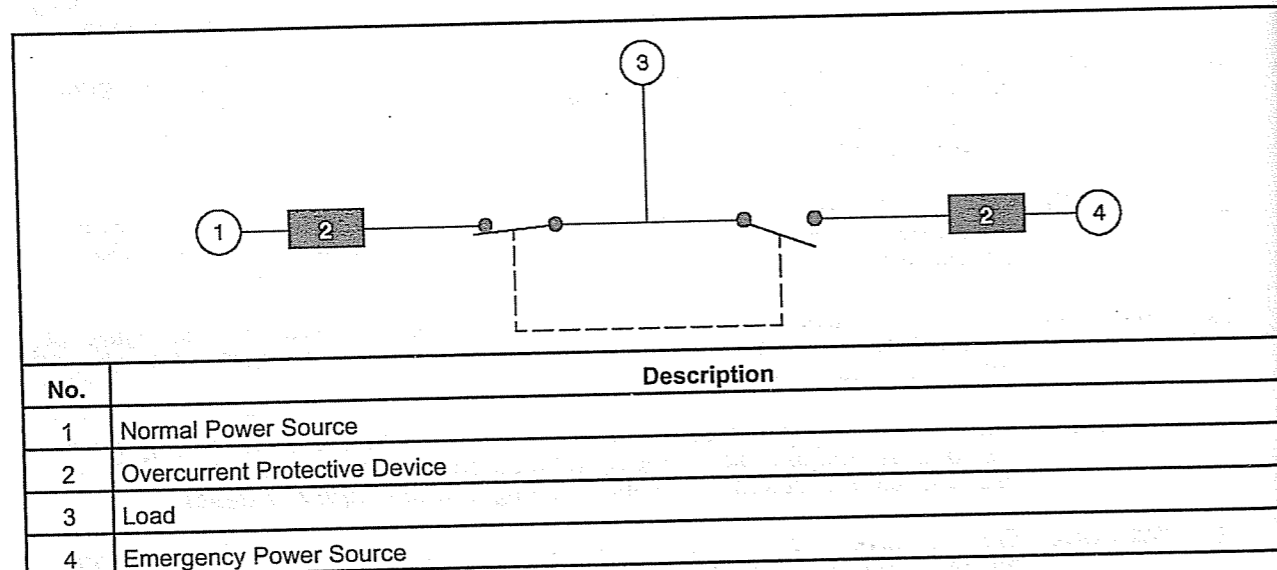


FIGURE 21. TYPICAL LOAD TRANSFER FUNCTION

9.2 Generator Voltage Connections

These generators can be configured to the nameplate voltages as shown on the Reconnection Diagram decal, attached to the backside of the control box cover. Many of the voltages listed will require reconfiguration of the generator output leads on the connection terminal block. This reconfiguration must only be done by service personnel that are trained and experienced to perform electrical installation. The generator set was adjusted to produce a specified voltage during production verification testing prior to shipment. The installer must always check the stator lead terminal block connections and perform any necessary reconnect to obtain the voltage required.

Some generator sets are capable of producing a wide range of voltages and connection configurations; others have specific limited capabilities. Refer to wiring diagram and generator voltages (from the nameplate) when reviewing the voltage connection information and use the wiring diagram supplied with your generator set when actually performing load connections.

⚠ CAUTION: Reconfiguring generator sets to higher voltages can exceed the voltage capability of the specific generator windings and damage the generator and also decrease line current, rendering line circuit breakers too large. Consult with your authorized distributor before performing reconnection for a different voltage.

⚠ CAUTION: Reconfiguring generator sets to lower voltages can reduce generator set ratings, and also increase line current, rendering line circuit breakers too small. Consult with your authorized distributor before performing reconnection for a different voltage.

9.3 Load Connections

⚠ WARNING: Flexible conduit and stranded conductors must be used for connections to take up movement of the generator set.

All loads are connected to the generator by bolting stranded load wires to the appropriate terminals on the generator reconnection terminal block or circuit breaker lugs. The terminals are marked U, V, W, and N to indicate the line and neutral connections. (Reference: U, V, and W correspond with L1, L2 and L3; and N with L0 respectively). See **Appendix D** for details about the following:

- Load connections
- Conduit
- Cable Size

9.4 Load Balancing

When connecting loads to the generator set, balance the loads so that the current flow from each line terminal (L1, L2, and L3) is about the same. This is especially important if both single phase and three phase loads are connected. Any combination of single phase and three phase loading can be used as long as each line current is about the same, within 10 percent of median value and no line current exceeds the name plate rating of the generator. Check the current flow from each line after connections by observing the Operator Panel ammeter.

9.5 Current Transformers

Current transformers (CTs) are used to display generator set load in kVA and alternator amperage. The CTs must be installed as noted in the following *CT Installation Requirements*.

Refer to the Reconnection Diagram to identify the generator output leads/phase that must be routed through each CT, and also appropriate transformer post selection for control sensing leads. The transformers are labeled CT1, CT2, and CT3 on the re-connection wiring diagram.

9.5.1 CT Installation Requirements

The CT has a dot on one side. This dot must be facing toward the generator reconnection terminal block (conventional current flowing into the dot). A dot is also used to indicate pin 1 of the CT.

Route the load lead through the appropriate CT (refer to Reconnection Diagram).

The CTs have dual secondary's (3 pins). The CT secondary wire marked 1 is connected to pin 1 of the CT. CT secondary wire marked 2/3 is connected to pin 3 for low voltage generator sets.

9.6 Coolant Heater Installation

A coolant heater keeps the engine coolant warm when the engine is shut down. It heats and circulates the coolant within the engine. This reduces start-up time and lessens engine wear caused by cold starts. It is electrically operated and thermostatically controlled.

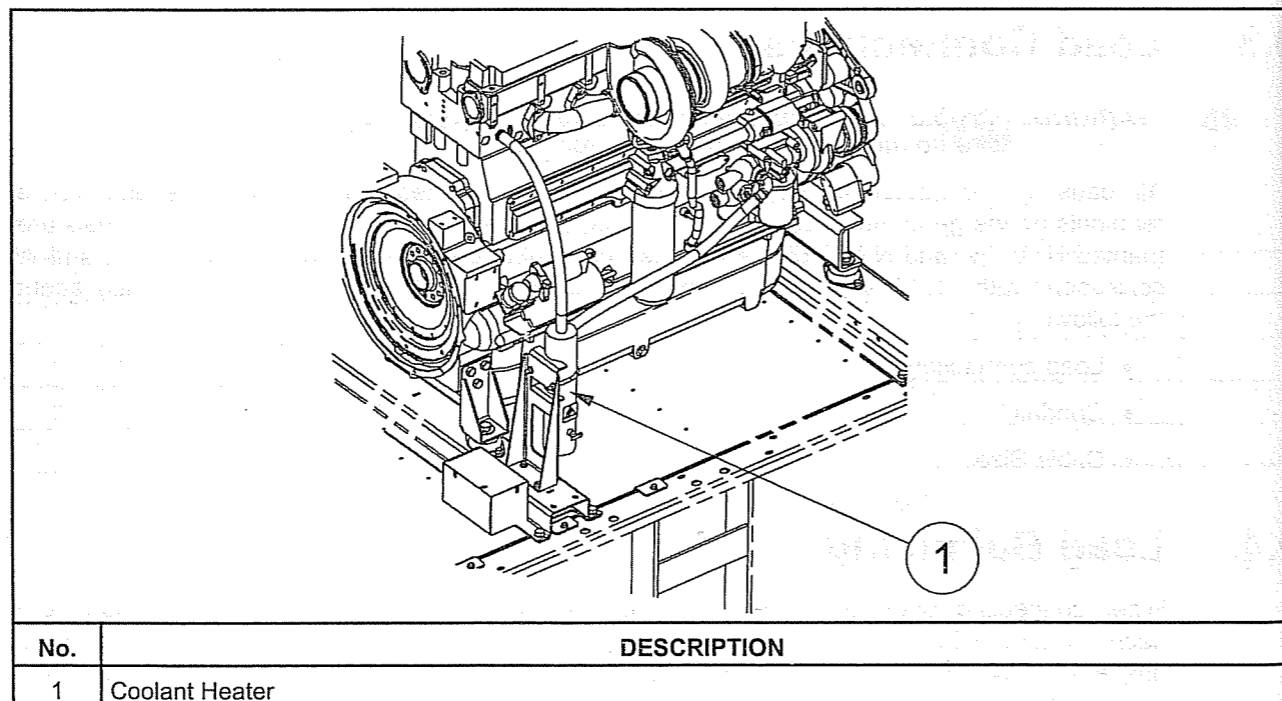


FIGURE 22. TYPICAL COOLANT HEATER MOUNTED ON THE GENERATOR SET

CAUTION: The coolant heater must not be operated while the cooling system is empty or damage to the heater will occur.

Figure 23 shows the heater line connection. Connect the heater to a source of power that will be on during the time the engine is not running. Ensure the supply voltage and circuit current is correct for the heater element rating.

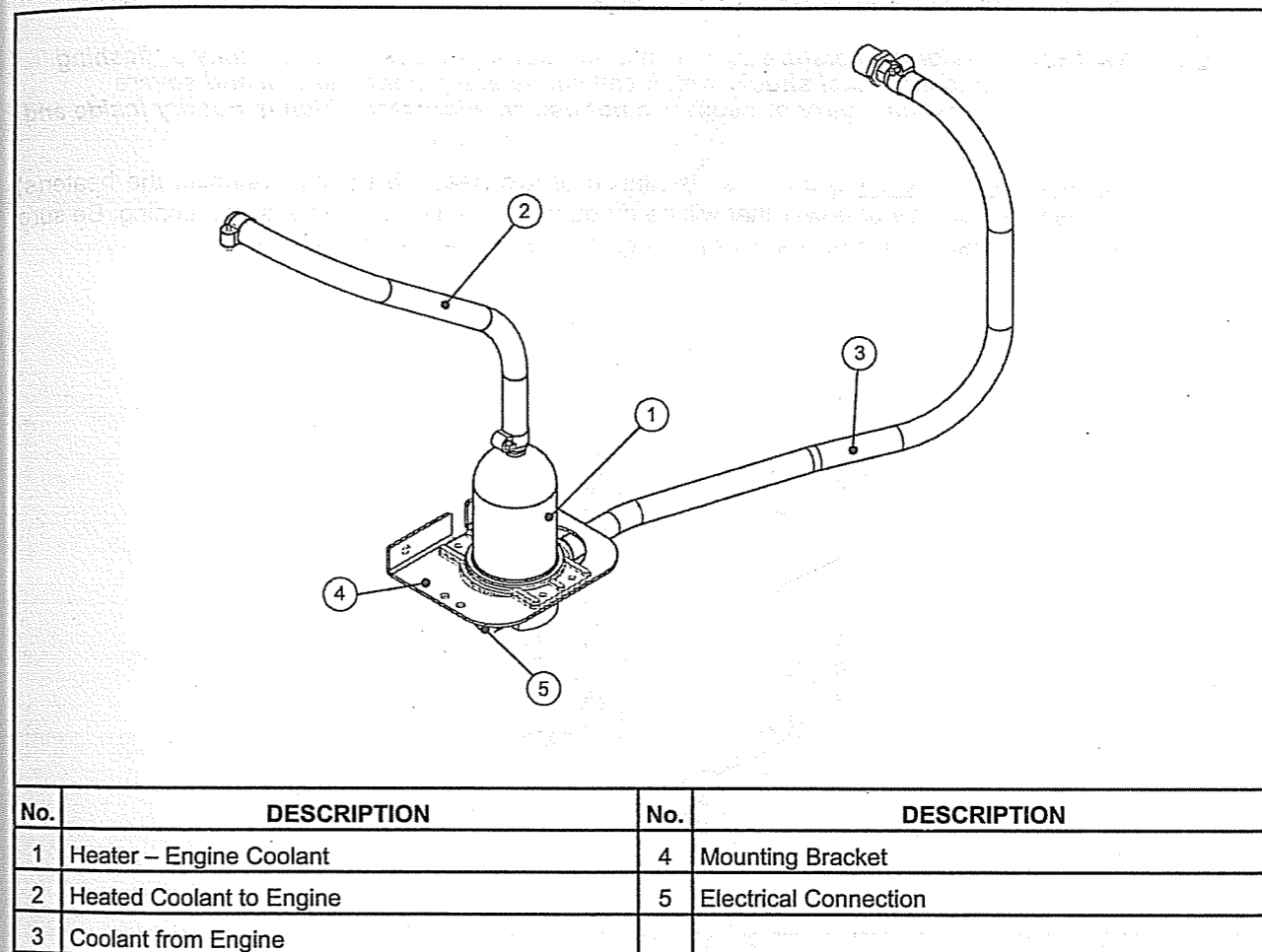


FIGURE 23. COOLANT HEATER

9.6.1 Coolant Heater Specifications

The coolant heaters are designed to allow the generator set to start and pick up load within 10 seconds in a 40 °F (4.4 °C) environment. In colder ambient temperature environments the starting time may be longer.

An installation may include one of two types of coolant heaters.

- 4990 watt at nominal voltage - This coolant heater is used in an environment where the minimum temperature is 40 °F (4 °C).
- 6420 watt at nominal voltage - This coolant heater is used in an environment where the temperature is less than 40 °F (4 °C).

A coolant heater can be set up for 480 V or 240-208 V configurations.

9.7 Alternator Heater Installation

An alternator heater(s) is used to help keep the alternator free of condensation when the generator set is not running. During cool and humid conditions, condensation can form within an alternator, creating flashing and shock hazards.

⚠ WARNING: *Water or moisture inside an alternator increases the possibility of flashing and electrical shock, which can cause equipment damage and severe personal injury or death. Do not use an alternator which is not dry inside and out.*

Figure 24 on page 53 shows the installation of two heater elements. Connect the heater(s) terminals to a source of power that will be on during the time the engine is not running. Be sure the supply voltage and circuit amperage is correct for the heater element rating.

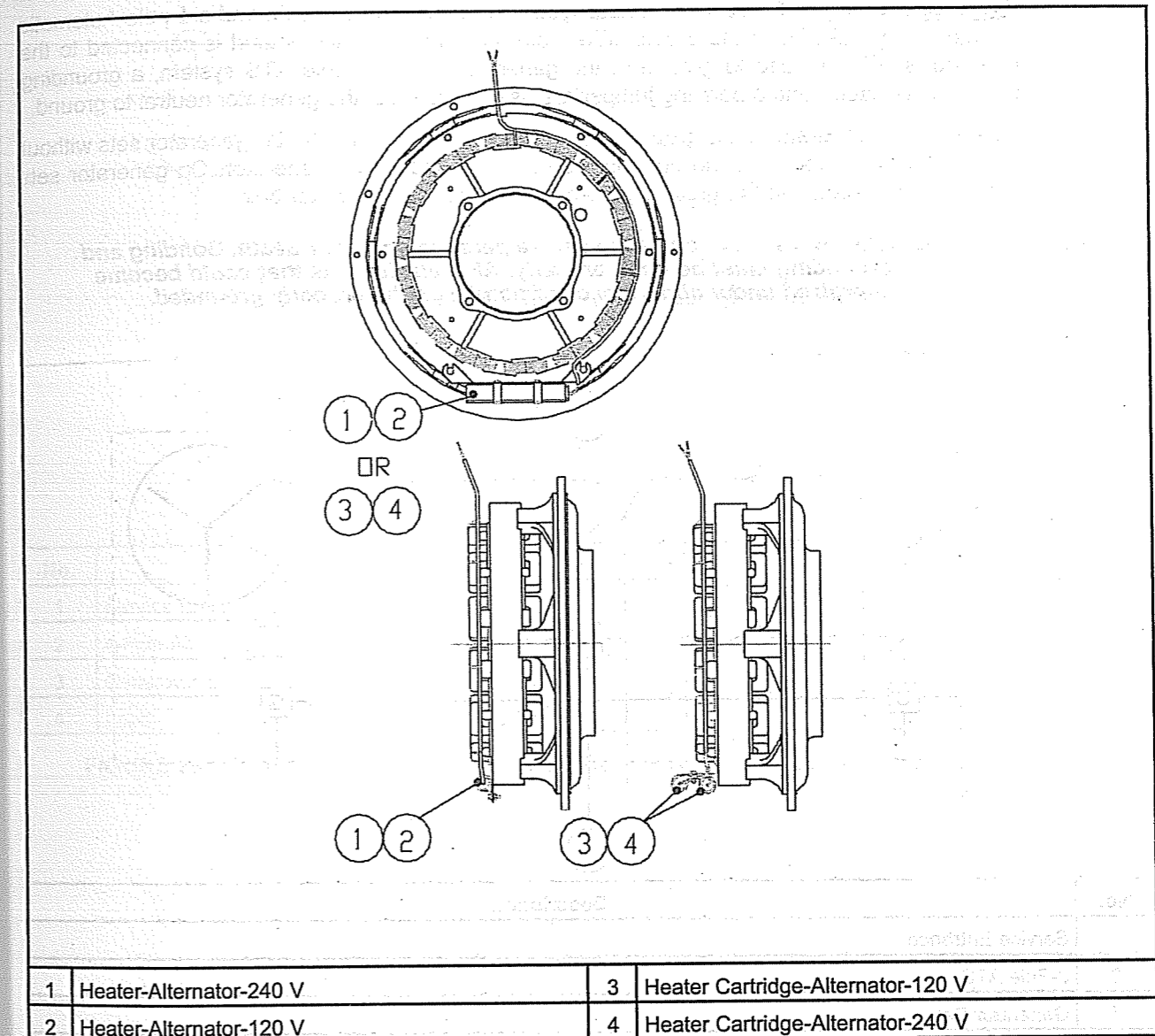


FIGURE 24. TYPICAL ALTERNATOR HEATERS

9.7.1 Alternator Heater Specifications

The 120V alternator heater is used with UCD22 alternators.

The 240V alternator heater is used with UCD27 alternators.

9.8 Grounding

The following is a brief description of system and equipment grounding of permanently installed AC generators within a facility wiring system.

NOTE: *It is important to follow the requirements of the local electrical code.*

Figure 25 and **Figure 26** illustrate typical system grounding for a 3-pole and a 4-pole Automatic Transfer Switch (ATS). In the 3-pole ATS, note that the generator neutral is connected to the ATS and is NOT bonded to ground at the generator. In the 4-pole ATS system, a grounding electrode conductor and a bonding jumper are used to connect the generator neutral to ground.

Make sure the generator set is grounded to earth in one location only. On generator sets without a circuit breaker, ground to the point indicated on the top of the generator. On generator sets with circuit breakers, use the ground lug provided in the circuit breaker box.

⚠ WARNING: Electric current can cause severe personal injury or death. Bonding and grounding must be done properly. All metallic parts that could become energized under abnormal conditions must be properly grounded.

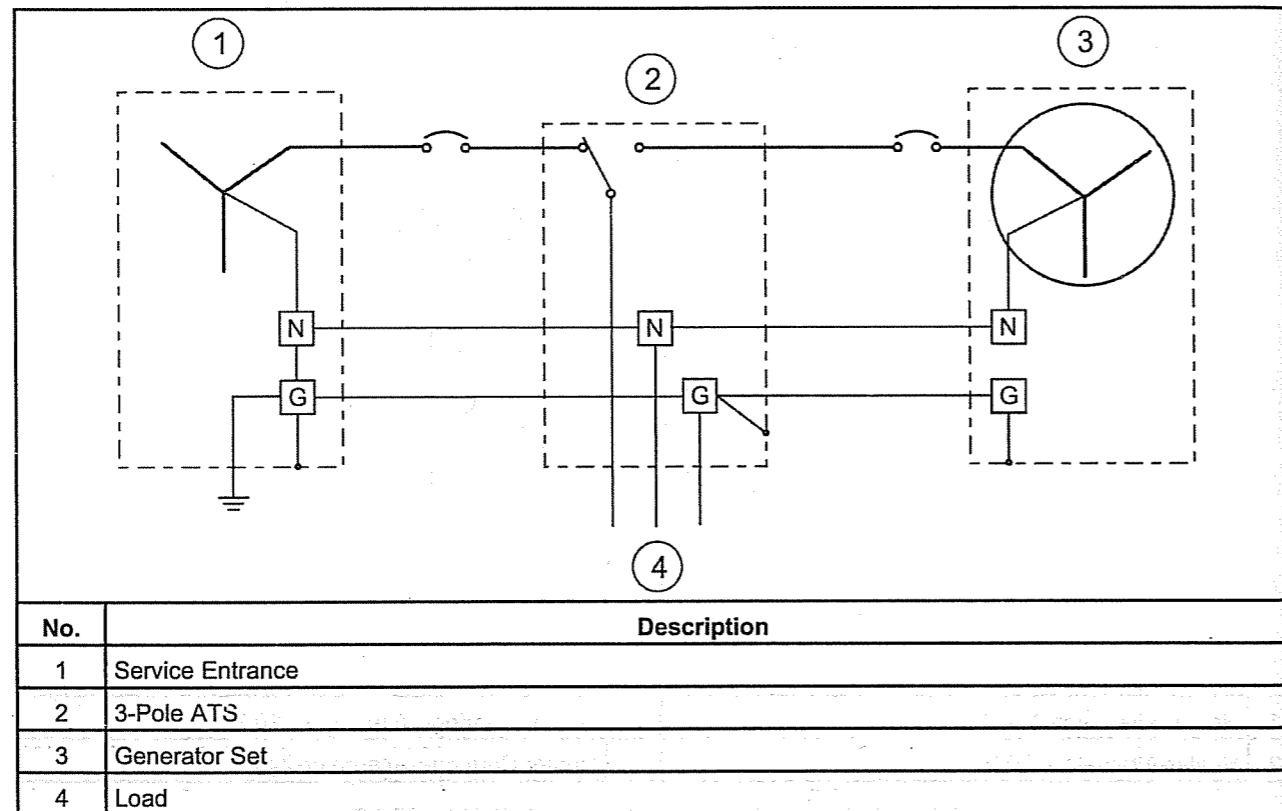


FIGURE 25. TYPICAL SYSTEM - THREE-PHASE, FOUR WIRE UTILITY, THREE-POLE ATS

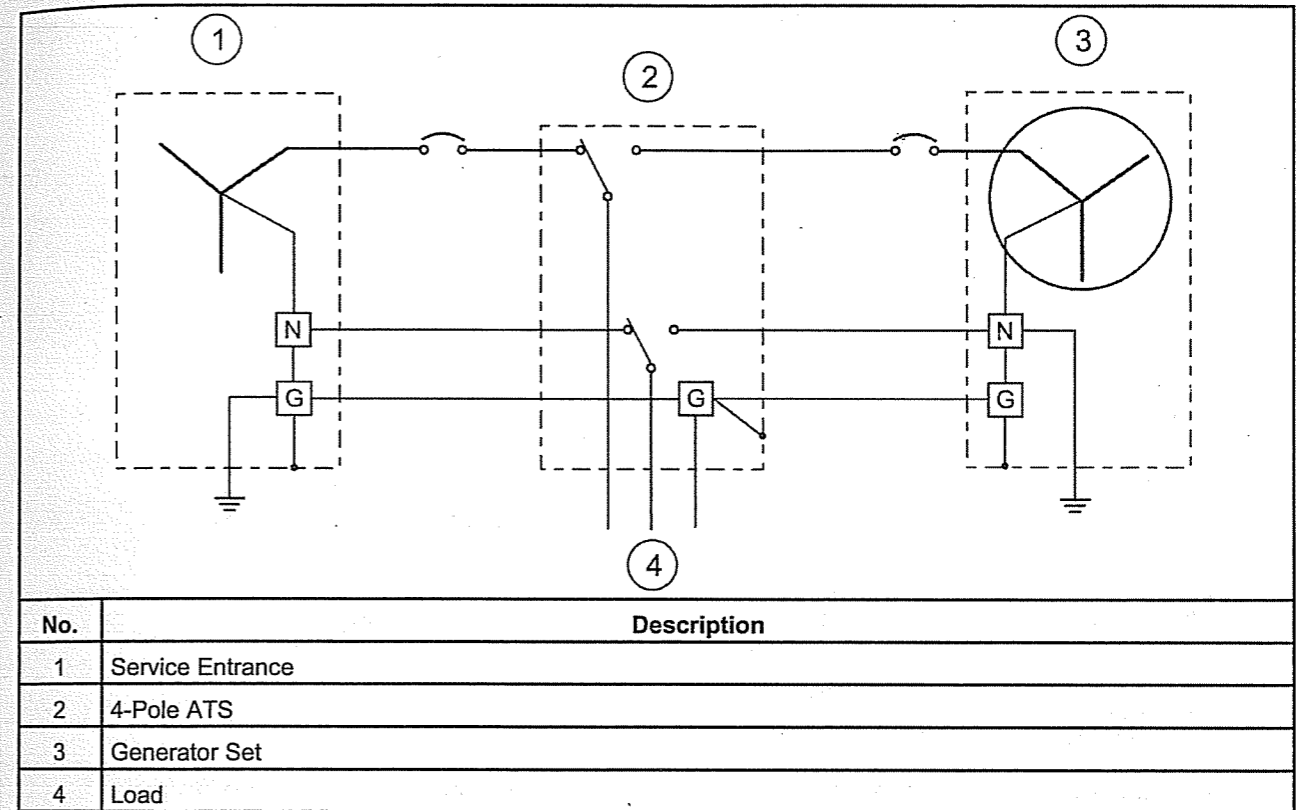
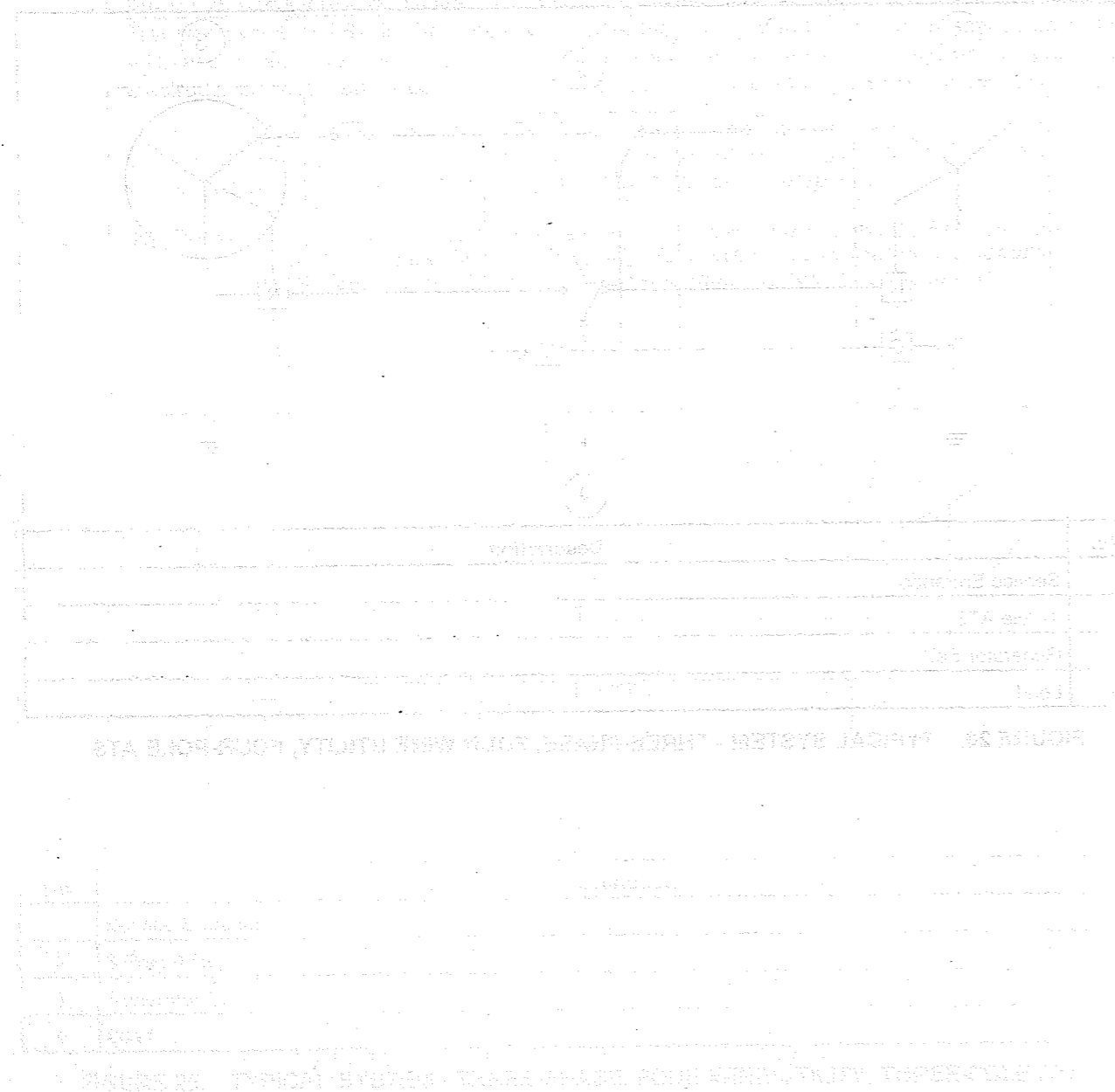


FIGURE 26. TYPICAL SYSTEM - THREE-PHASE, FOUR WIRE UTILITY, FOUR-POLE ATS



10 Pre-Start Preparation

Before attempting an initial start of the generator set, be sure to complete the Installation Checklist, see [Chapter 11 on page 61](#).

⚠ WARNING: *Make sure that all items listed in the Installation Checklist are carried out before starting the generator set. The failure to do a complete installation can result in equipment damage and severe personal injury or death.*

10.1 Electrical System

Verify all electrical connections are secure and all wiring is complete and inspected. Replace and secure any access panels that may have been removed during installation.

10.2 Battery Connections

⚠ WARNING: *Accidental starting of the generator set can cause severe personal injury or death. Make sure that the PowerCommand[®] Control is in the OFF mode before connecting the battery cables.*

⚠ WARNING: *Ignition of explosive battery gases can cause severe personal injury or death. Always connect the negative (-) battery cable last to prevent arcing.*

⚠ WARNING: *Arcing at battery terminals, light switch or other equipment, flame, pilot lights, and sparks can ignite battery gases and cause severe personal injury or death. Ventilate the battery area before working on or near a battery. Do not smoke, or switch trouble light ON or OFF near a battery. Discharge static electricity from body before touching the batteries by first touching a grounded metal surface.*

Starting the unit requires one or more batteries. For more information on batteries, refer to [Chapter 5 on page 17](#). Connect the positive battery cable before connecting the negative battery cable to prevent arcing.

If an automatic transfer switch is installed without a built-in charge circuit, connect a separate battery charger. Proper selection and maintenance of batteries and battery chargers is essential for system reliability.

10.3 Site-specific Configuration

👉 NOTE: *Site-specific configuration is to be undertaken by suitably trained and qualified service personnel only.*

Some configuration is done by the factory. Any site-specific configuration should be done by qualified service personnel before starting the generator set.

10.4 Controller Configuration Relays

The figure below shows a block representation of the Controller Configuration menus.

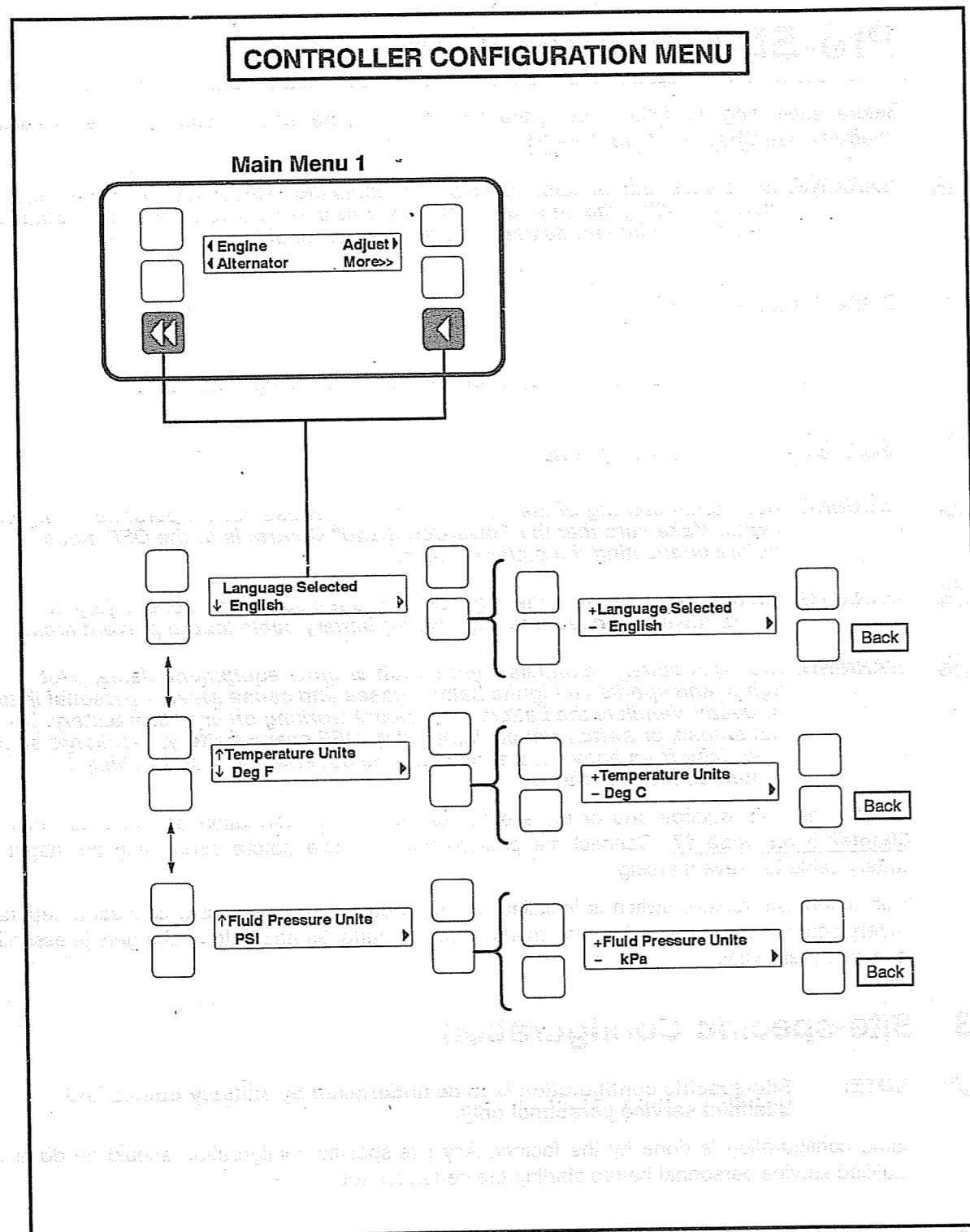


FIGURE 27. CONTROLLER CONFIGURATION MENU

To view the first Controller Configuration menu, make sure Main Menu 1 is displayed and simultaneously press the Home Menu and Previous Main Menu buttons.

As shown in the diagram, the Controller Configuration menu has three submenus.

Press the buttons next to the up and down symbols in the digital display to navigate between the menus.

Press the button next to the \blacktriangleright symbol in the display until the + and - symbols are displayed.

Press the button next to the + or - symbol to select the desired option.

After selecting option, pressing the \blacktriangleright symbol results in the changes being saved. If the Home button or Previous Main Menu button is pressed before pressing the \blacktriangleright symbol, the changes are not saved.

After selecting option, pressing the \blacktriangleright symbol results in the changes being saved. If the Home button or Previous Main Menu button is pressed before pressing the \blacktriangleright symbol, the changes are not saved.

Language Selected submenu: Used to select desired language (default = English).

Temperature Units submenu: Used to select Fahrenheit or Centigrade for temperature readings.

Fluid Pressure Units submenu: Used to select PSI or kPA for pressure readings.

10.5 Starting

Refer to the generator set Operator manual for important safety precautions and recommended procedures for starting the generator set and verifying proper operation. Start the generator set and verify all engine and generator menus are displaying the correct values.

11 Installation Checklist

11.1 Checklist

Tick	General Items
	Generator set wattage capacity is sufficient to handle maximum anticipated load.
	At least 3 feet (914.4 mm) of clearance (or greater for housing door) is provided around the entire generator set for service and ventilation.
	The generator set is located in an area not subject to flooding.
	All operating personnel have read and are familiar with the generator set Operator manual, all health and safety procedures, warnings, cautions, precautions, and the other documentation supplied with the generator set.
	All operators have been thoroughly briefed on preventative maintenance procedures.
	All operators have read and understand all important safety instructions.
	Generator Set Support
	The floor, roof, or earth on which the generator set rests is strong enough and will not allow shifting or movement. Observe local codes on soil bearing capacity due to freezing and thawing.
	The generator set is properly supported and retained to an approved base
	The supporting base is large enough and is of non-combustible material, extending 6 inches (152.4 mm) all around the generator set.
	Cooling Air Flow
	Generator set air inlet is faced into direction of strongest, prevailing winds.
	Air inlet openings are unrestricted and are at least 1 to 1½ times larger than air outlet area.
	Cooling air outlet is on downwind side of building (if not, wind barrier is constructed).
	Proper ducting material (sheet metal, canvas) is used between radiator and air outlet.
	Diesel Fuel System (if applicable)
	Fuel tanks meet or exceed all Local, State, or National codes (if applicable).
	Fuel lines are properly installed, supported, and protected against damage.
	The fuel filters have been installed.
	Approved flexible fuel line is installed between the main fuel supply and the generator set's fuel system near the generator set, to protect it against damage caused by vibration, expansion, and contraction.
	Strainer or fuel screen (100 to 200 mesh) is installed in the fuel supply line to protect the fuel lift pump, day tank transfer pump, or float valve seat from fuel tank debris (if applicable).
	The fuel filter assembly shipped with the generator set is installed and operational (if applicable).
	Fuel supply shutoff valves are installed to prevent fuel flow in case of leaks.
	No shutoff valves are installed on engine fuel return line (if applicable).
	External fuel pumps are connected and operational at all times - generator set started or shut down (if applicable).
	Fuel tanks are filled with the correct grade / type of fuel (if applicable).
	Fuel system is properly primed.
	No fuel leaks are found in supply line or engine fuel system.

Gaseous Fuel System (if applicable)	
	Check fuel line and use equations to verify it has proper volume capability.
	Check if fuel pressure is between 7-13 inches water column.
	Check for any gas leaks.
	If necessary, perform initial demand regulator adjustment procedure.
	Make sure fuel pressure does not drop below 7 inches water column under full load.
Exhaust System	
	The breather tube routing is set up to blow the fumes away from the generator set (if applicable)
	Operators are thoroughly briefed on the dangers of carbon monoxide gas.
	If the installation includes a heavy duty air cleaner, it has been installed.
	Areas around generator set are well ventilated. No possibility of exhaust fumes entering building doors, windows, or intake fans.
	Exhaust gases are piped safely outside and away from building.
	The correct length of approved rigid pipe is connected to the generator set flexible pipe using approved securing methods with no weight resting on engine exhaust components. There are no bends in flex section.
	Condensation drain is provided in lowest section of exhaust piping.
	Exhaust piping is insulated to guard against burns to personnel.
	Exhaust piping passing through walls or ceilings have approved fire-proof materials and are in compliance with all codes.
	Exhaust piping is large enough in diameter to prevent excessive back pressure on engine.
	Verify that the pyrometer meters are functioning.
AC and DC Wiring	
	For bottom entry circuit breaker installations, the cable chute has been installed (if applicable).
	Wire sizes, insulation, conduits and connection methods all meet applicable codes.
	AC and DC wires are separated in their own conduit to prevent electrical induction.
	All load, line and generator connections are well made and correct.
	Flexible conduit is used between the generator and the building or surrounding structure.
	Check phase rotation.
Generator Set Pre-Start	
	Generator set engine is properly serviced with oil and coolant.
	Battery charger is installed using the appropriate cable size and is operational.
	Battery charger is configured for the proper DC battery voltage, battery type, and float voltage.
	Batteries are properly installed, serviced and charged.
	Battery temperature sensor is connected and operational (if applicable).
	Engine coolant heater is connected and operational.
	All generator set covers and safety shields are installed correctly.
	All fuel and coolant shutoff valves are operational.
	Radiator fan and other external moving parts including drive belts are unrestricted.

12 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
Phone +1 763 574 5000 Toll Free +1 800 888 6626 Fax +1 763 574 5298	Phone +44 1843 255000 Fax +44 1843 255902	Phone +65 6417 2388 Fax +65 6417 2399
BRAZIL	CHINA	INDIA
Rua Jati, 310, Cumbica Guarulhos, SP 07180-900 Brazil	Cummins Power Generation 2 Rongchang East Street, Beijing Economic – Technological Development Area Beijing 100176, P.R.China	35A/1/2, Erandawana Pune 411 038 India
Phone +55 11 2186 4195 Fax +55 11 2186 4729	Phone +86 10 5902 3000 Fax +86 10 5902 3199	Phone +91 020 6602 7525 Fax +91 020 6602 8090
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	

12.1 How to Obtain Service

When a product requires servicing, contact your nearest Cummins Power Generation distributor. To locate your local Cummins Power Generation distributor, refer to www.cumminspower.com and select Distributor Locator. When contacting your distributor, always supply the complete Model, Specification, and Serial Number as shown on the nameplate.

12.1.1 Locating Your 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. By selecting Option 1 (press 1), you will be automatically connected to the distributor nearest you.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS – ELECTRIC or

ENGINES – GASOLINE OR DIESEL

If you have difficulty arranging service or resolving an issue, please contact the Service Manager at the nearest Cummins Power Generation distributor for assistance.

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

Outside North America

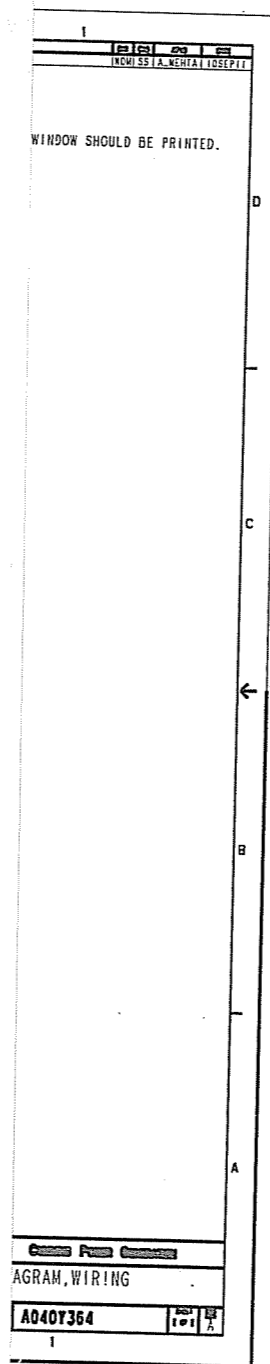
If you are outside North America, telephone Cummins Power Generation at +1-763-574-5000 from 7:30 am to 4:00 pm, Central Standard Time, Monday through Friday, or fax +1-763-528-7229.

Appendix A. Wiring Diagrams

Table of Contents

S3.8 WIRING DIAGRAM WITH POWERCOMMAND 1.1 CONTROL	67
Figure 28. Sheet 1	67

S3.8 Wiring Di



... 71
... 71

S3.8 Wiring Diagram with PowerCommand 1.1 Control

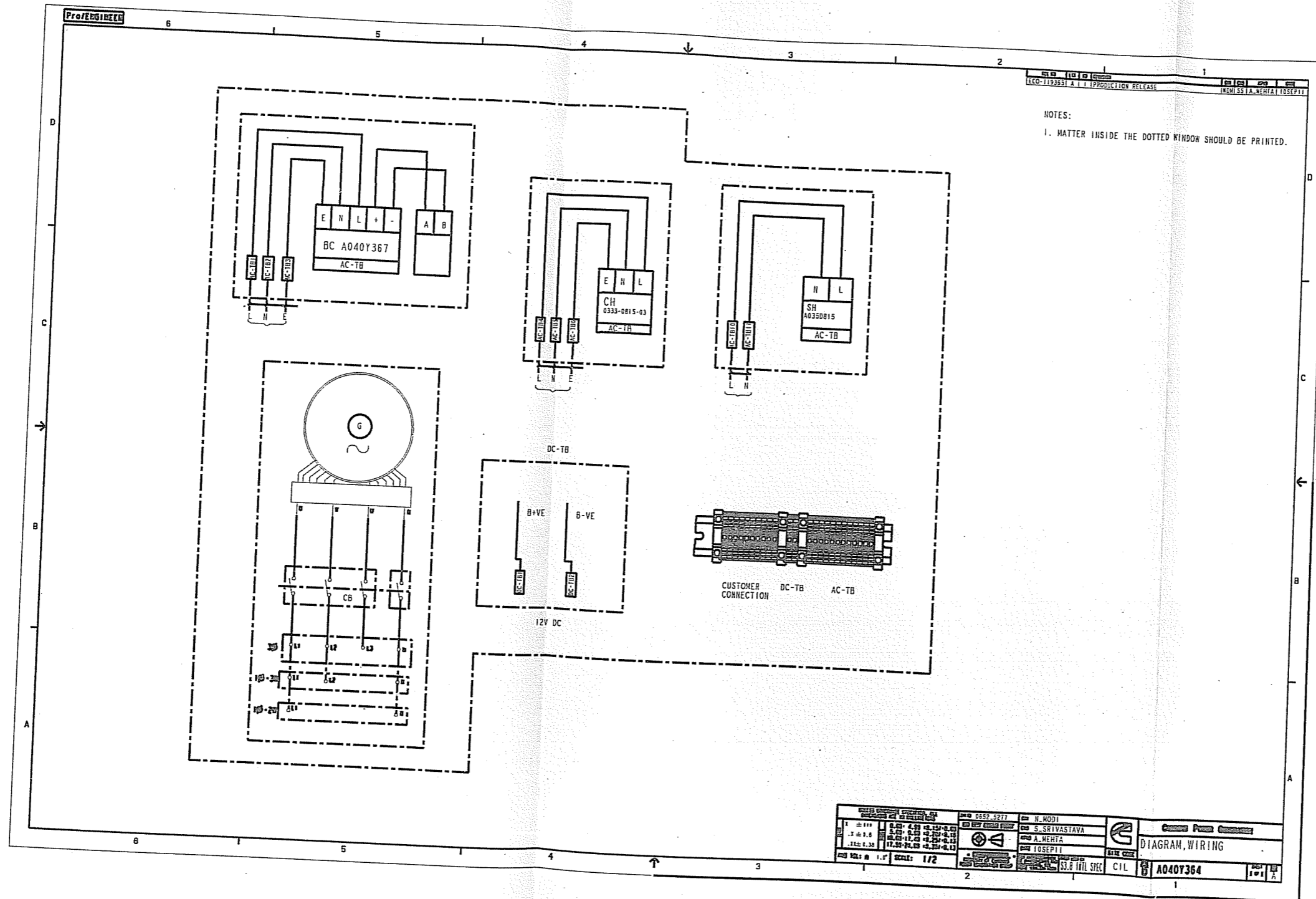


FIGURE 28. SHEET 1

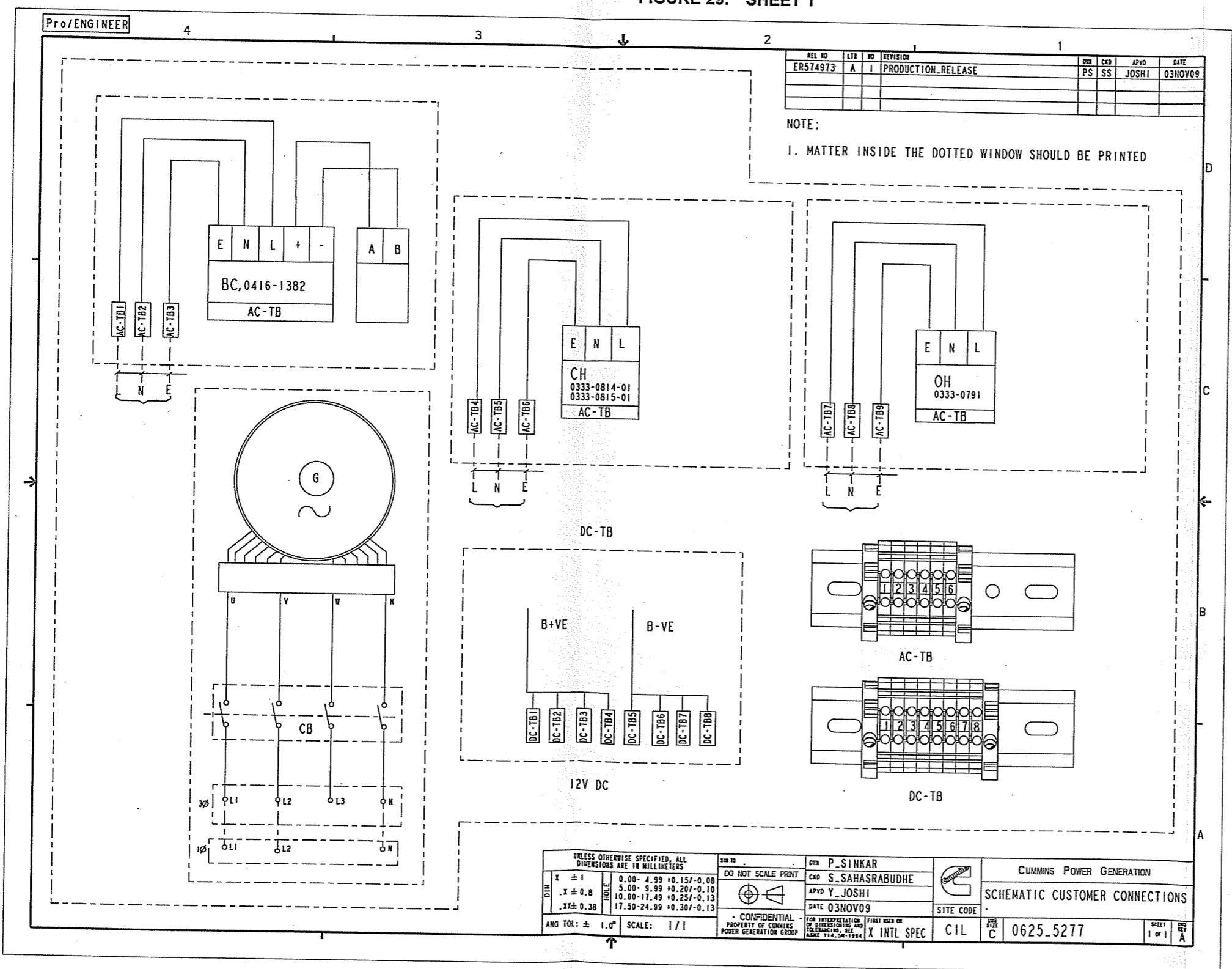
Appendix B. Customer Connections

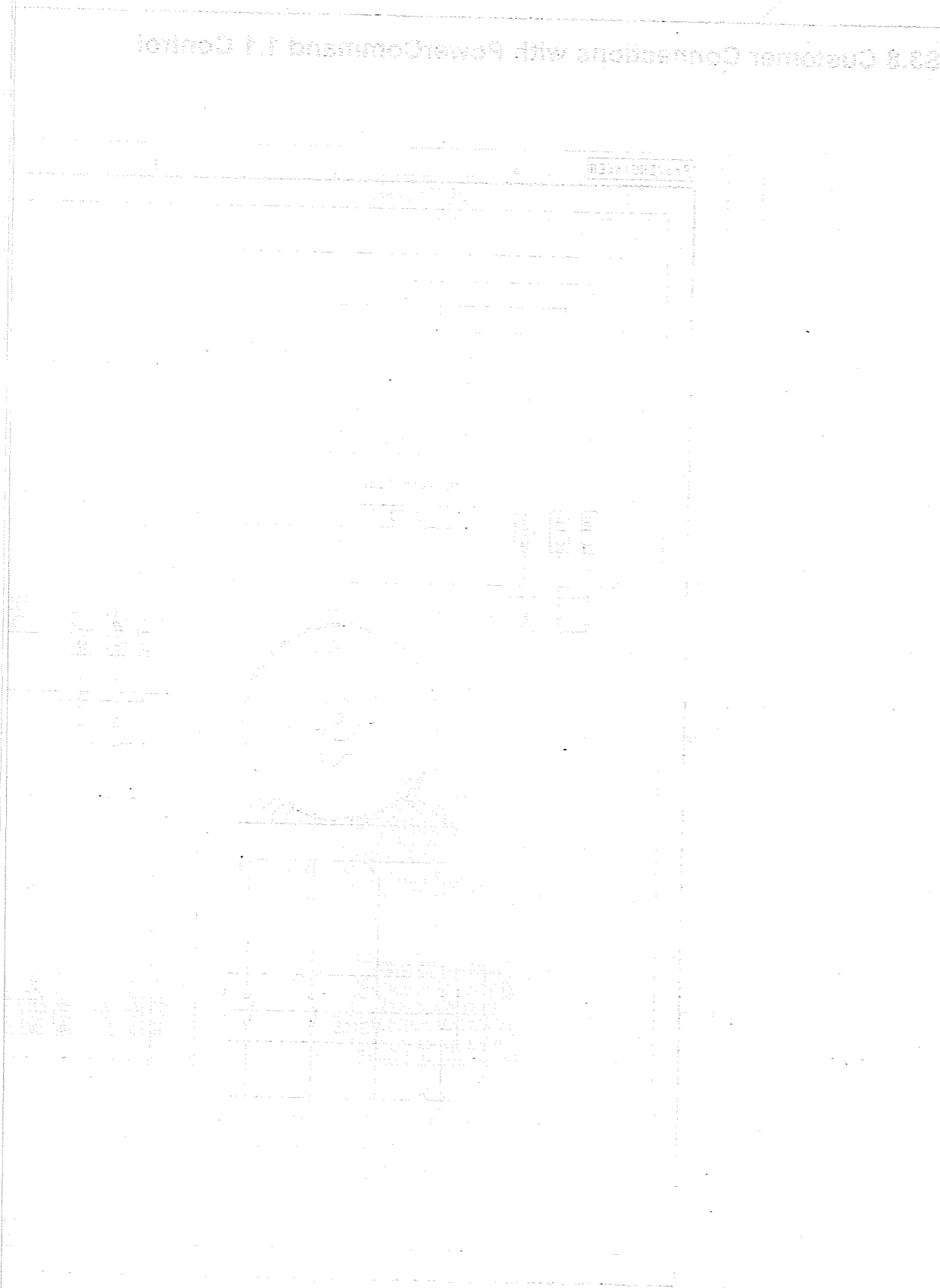
Table of Contents

S3.8 CUSTOMER CONNECTIONS WITH POWERCOMMAND 1.1 CONTROL	71
Figure 29. Sheet 1	71

S3.8 Customer Connections with PowerCommand 1.1 Control

FIGURE 29. SHEET 1





11-2011

23.8 Customer Connectors with PowerCommand 1.1 Control

Appendix C. Alternator Reconnect Drawing

Table of Contents

RECONNECT DRAWING FOR ALTERNATOR	75
Figure 30. Sheet 1	75

Reconnect Drawing for Alternator

Pro/ENGINEER

4

3

2

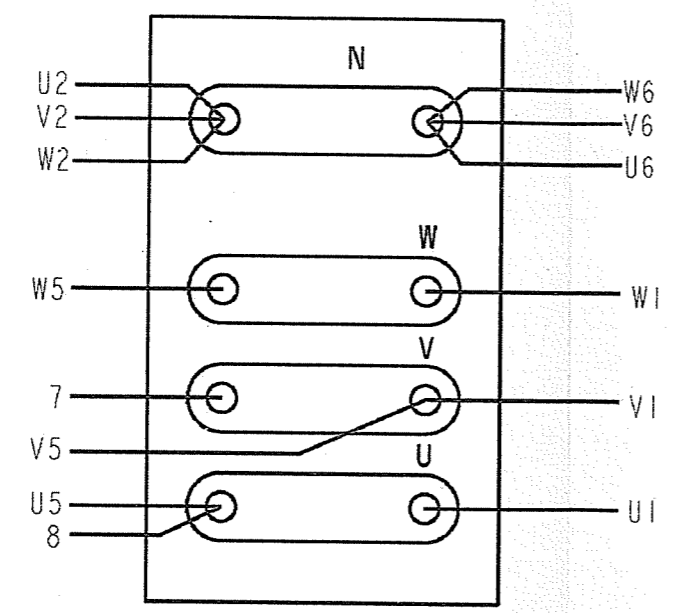
1

REL NO	LTR	ED	REVISION	DES	CHKD	APVD	DATE
ECO-115933	A	1	PRODUCTION RELEASE	NB	SS	I_MAHADSHWAR	28APR11

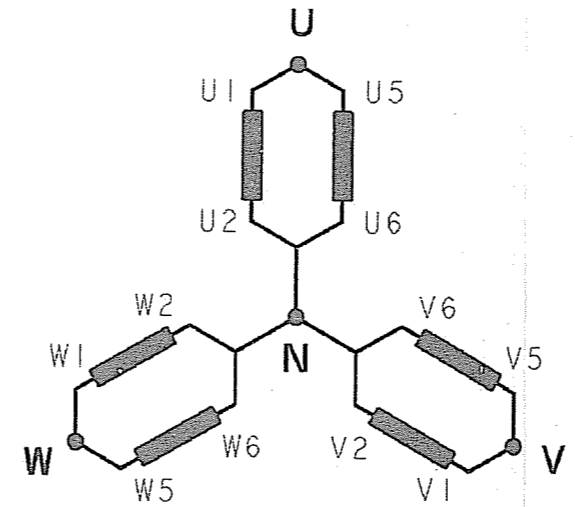
NOTES:

1. TIGHTENING TORQUE FOR FASTNERS IN UG 224 TERMINAL BOX IS 20-30 Nm.
2. POWER CABLE CONNECTIONS :-
 - a) CONNECT L1 AT U
 - b) CONNECT L2 AT V
 - c) CONNECT L3 AT W
 - d) CONNECT N AT N.

PARALLEL STAR 3PH, 4W
OUTPUT TERMINALS (U,V,W,N)



12 ENDS STANDARD TERMINAL ARRANGEMENT
(AS PER CGT PART NO.450-1530613)



SCHEMATIC ARRANGEMENT

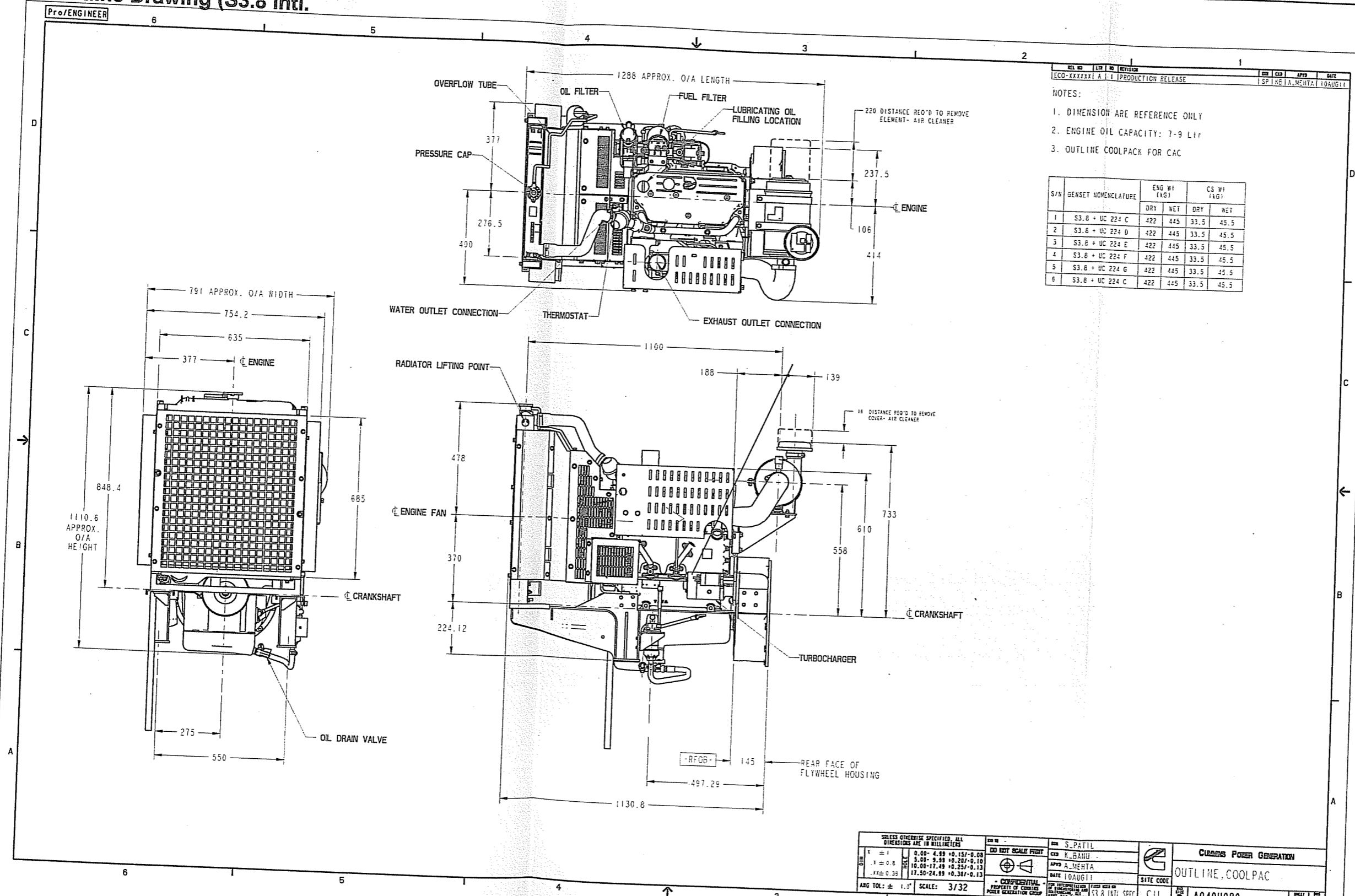
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS		SIZE 10	DATE N_BABAR	CUMMINS POWER GENERATION
DO NOT SCALE PRINT		DATE 28APR11	CHKD S_SRIVASTAVA	
DIR	X ± 1	0.00- 4.99 +0.15/-0.08	APVD I_MAHADSHWAR	DIAGRAM, WIRING
	.X ± 0.8	5.00- 9.99 +0.20/-0.10	DATE 28APR11	
	.XX ± 0.38	10.00-17.49 +0.25/-0.13		
ANG TOL: ± 1.0°		SCALE: 1/2	SITE CODE CIL	NO. 1 OF 1
CONFIDENTIAL PROPERTY OF CUMMINS POWER GENERATION GROUP		FIRST USED ON S3.8 INTL SPEC	REV A	

Appendix D. Outline Drawings

Table of Contents

COOLPAC OUTLINE DRAWING (S3.8 INTL. SPEC.)	79
Figure 31. Sheet X	79

CoolPac Outline Drawing (S3.8 Intl.



REV	NO	DATE	BY	CHKD	APPD	DATE
ECO-KXXXXX	A	1				
PRODUCTION RELEASE						
S.P. K.B. A. MEHTA 10AUG11						

- NOTES:
1. DIMENSION ARE REFERENCE ONLY
 2. ENGINE OIL CAPACITY: 7-9 Lit
 3. OUTLINE COOLPACK FOR CAC

S/N	GENSET NOMENCLATURE	ENG WT (KG)		CS WT (KG)	
		DRY	WET	DRY	WET
1	S3.8 + UC 224 C	422	445	33.5	45.5
2	S3.8 + UC 224 D	422	445	33.5	45.5
3	S3.8 + UC 224 E	422	445	33.5	45.5
4	S3.8 + UC 224 F	422	445	33.5	45.5
5	S3.8 + UC 224 G	422	445	33.5	45.5
6	S3.8 + UC 224 C	422	445	33.5	45.5

Spec.)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DESIGNED BY: S. PATIL	DATE: 10AUG11		CURRIS POWER GENERATION OUTLINE, COOLPAC
CHECKED BY: K. BAND	DATE: 10AUG11		
APP'D BY: A. MEHTA	DATE: 10AUG11	SCALE: 3/32	PROJECT NO: A040U980

ANG TOL: ± 1.0°

PROPERTY OF CURRIS POWER GENERATION GROUP

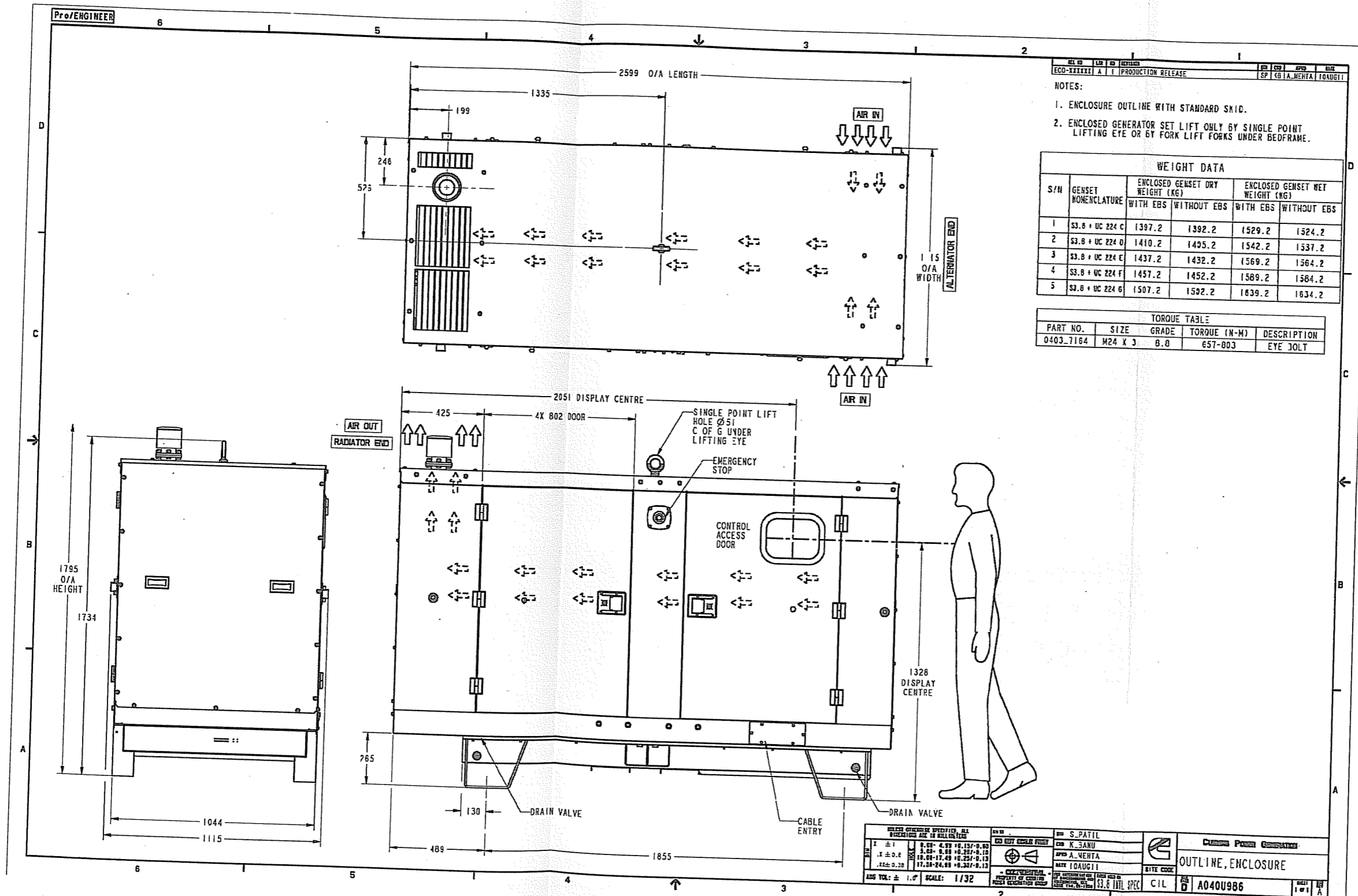
CONFIDENTIAL - NOT TO BE RELEASED TO THE PUBLIC

Appendix E. Lifting Drawings

Table of Contents

S3.8 COOLPAC LIFTING DRAWING	83
Figure 32. Sheet 1	83

S3.8 CoolPac Lifting Drawing



REV	DATE	BY	CHKD	APPD	REASON
ECO-XIIXXI	A	T			PRODUCTION RELEASE
			SP	KB	A. MEHTA / IOANGETI

- NOTES:
- ENCLOSURE OUTLINE WITH STANDARD SKID.
 - ENCLOSED GENERATOR SET LIFT ONLY BY SINGLE POINT LIFTING EYE OR BY FORK LIFT FORKS UNDER BEDFRAME.

S/N	GENSET NOMENCLATURE	ENCLOSED GENSET DRY WEIGHT (KG)		ENCLOSED GENSET WET WEIGHT (KG)	
		WITH EBS	WITHOUT EBS	WITH EBS	WITHOUT EBS
1	S3.8 + UC 224 C	1397.2	1392.2	1529.2	1524.2
2	S3.8 + UC 224 D	1410.2	1405.2	1542.2	1537.2
3	S3.8 + UC 224 E	1437.2	1432.2	1569.2	1564.2
4	S3.8 + UC 224 F	1457.2	1452.2	1589.2	1584.2
5	S3.8 + UC 224 G	1507.2	1502.2	1639.2	1634.2

PART NO.	SIZE	GRADE	TORQUE (N-M)	DESCRIPTION
0403_7164	M24 X 3	8.0	657-003	EYE BOLT

<p>DESIGNER: S. PATIL</p> <p>CHKD: K. BANU</p> <p>APPD: A. MEHTA</p> <p>DATE: 10/08/11</p>	<p>SCALE: 1/32</p> <p>DATE SPEC: 10/08/11</p>	<p>PROJECT: COOLPAC</p> <p>REV: 1</p>	<p>OUTLINE, ENCLOSURE</p> <p>DATE: 10/08/11</p> <p>BY: A</p>
--	---	---------------------------------------	--

FIGURE 32. SHEET 1