ECO POWER
EQUIPMENT

Installation and User Instructions

CIPR-25K NG/LP Generator

Mobile Gaseous Generator

March 2021
Version 1.0

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The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Eco Power Equipment Ltd. nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information that is contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to observe this information can result in injury or equipment damage.

Eco Power Equipment Ltd.

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Product Modifications

Year	Type	Modifications
2022	V1	INITIAL RELEASE

Document Revisions

Date	Version Number	Document Changes
12-2021	1.0	INITIAL DRAFT

Table of Contents

1. Preface

1.1 Description of the User

This manual is intended to support end users of the Eco Power Equipment CIPR mobile power generator. Our products are designed and intended to provide site power solutions for temporary and prime rated power on a variety of applications including: construction job site, oil and gas job sites, pipelines, events, security, and government or military operations.

The user will deploy and set up the CIPR, and should be qualified and follow all instructions contained in this operating manual.

1.2 Conventions Used in This Manual

The following style conventions are used in this document:

Bold
Names of product elements, commands, options, programs, processes, services, and utilities Names of interface elements (such windows, dialog boxes, buttons, fields, and menus)
Interface elements the user selects, clicks, presses, or types

Italic
Publication titles referenced in text
Emphasis (for example a new term)
Variables

`Courier`
System output, such as an error message or script
URLs, complete paths, filenames, prompts, and syntax

User input variables
< > Angle brackets surround user-supplied values
[ ] Square brackets surround optional items
| Vertical bar indicates alternate selections - the bar means “or”

1.3 Explanation of Safety Warnings

⚠DANGER

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury

⚠WARNING

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠CAUTION

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related.

1.4 Retaining Instructions

Read and understand this manual and its safety instructions before using this product. Failure to do so can result in serious injury or death.

Follow all the instructions. This will avoid fire, explosions, electric shocks or other hazards that may result in damage to property and/or severe or fatal injuries.

The product shall only be used by persons who have fully read and understand the contents of this user manual and understand safe operation of the machine.

Ensure that each person who uses the product has read these warnings and instructions and follows them.

Keep all safety information and instructions for future reference and pass them on to subsequent users of the product.

The manufacturer is not liable for cases of material damage or personal injury caused by incorrect handling or non-compliance with the safety instructions. In such cases, the warranty will be voided.

Obtaining Documentation and Information

1.4.1 Internet

The latest version of the documentation is available at the following address: http://www.ecopowerequip.com

1.4.2 Ordering Documentation

Documentation, user instructions and technical information can be ordered by calling Eco Power Equipment Ltd. at 1-888-483-4843

1.4.3 Other Languages

This is the English user manual. Manuals in other languages are available upon request. Not all languages are covered.

1.4.4 Documentation Feedback

If you are reading Eco Power Equipment Ltd. product documentation on the internet, any comments can be submitted on the support website. Comments can also be sent to support@ecopowerequip.com

We appreciate your comments.

1.4.5 Support and Service

For information about special tools and materials please contact:

For other questions, information, technical assistance, ordering user instructions, and service related information please contact the manufacturer:

Eco Power Equipment Ltd.

Address: #8, 26004 TWP 544, Sturgeon County, AB, T8T 0B6

Phone: 1-888-483-4843

Web: www.ecopowerequip.com

2 Description of The Product

2.1 Intended Use and Reasonably Foreseeable Misuse

The machine is a mobile, skid-mounted mobile generator. The Eco Power Equipment CIPR unit consists of a gaseous generator, a control panel, and a sheet metal enclosure. As the engine runs, the generator converts mechanical energy into electric power. Receptacles are present to power auxiliary loads. The operator uses the control panel to operate and monitor the machine, with the digital display showing all operating characteristics.

This machine is intended for prime rated power requirements, and has been designed to operate 24/7. This machine is also intended for the purpose of supplying electrical power to connected loads. Refer to the product specifications for the output voltage and frequency of this unit, and for the maximum output power limit of the Generator.

This machine has been designed and built strictly for the intended use described above. Using the machine for any other purpose could permanently damage the machine or seriously injure the operator or other persons in the area. Machine damage caused by misuse is not covered under warranty.

The following are some examples of misuse:

- Connecting a load that has voltage and frequency requirements that are incompatible with the machine output
- Overloading the machine with a device that draws excessive power during either continuous running or start-up
- Operating the machine in a manner that is inconsistent with all federal, provincial and local codes and regulations
- Operating the machine outside of factory specifications
- Operating the machine in a manner inconsistent with all warnings found on the machine and in the Operator's Manual

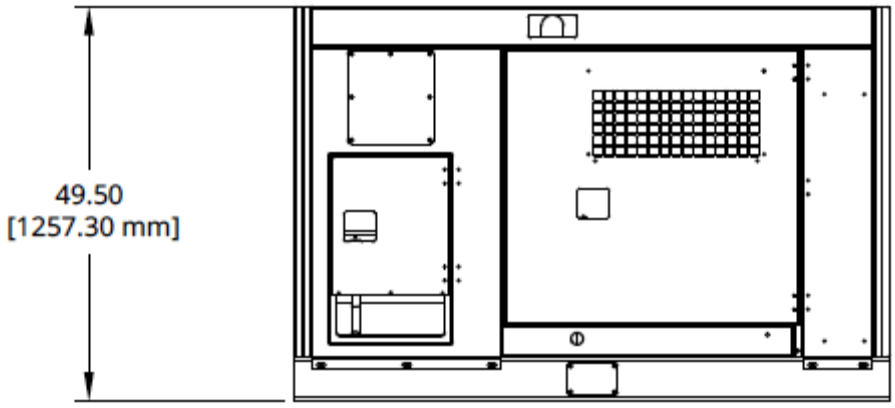
This machine has been designed and built in accordance with the latest Canadian safety standards. It has been engineered to eliminate hazards as far as practicable and to increase operator safety through protective guards and labelling. However, some risks may remain even after protective measures have been taken. They are called residual risks. On this machine, they may include exposure to:

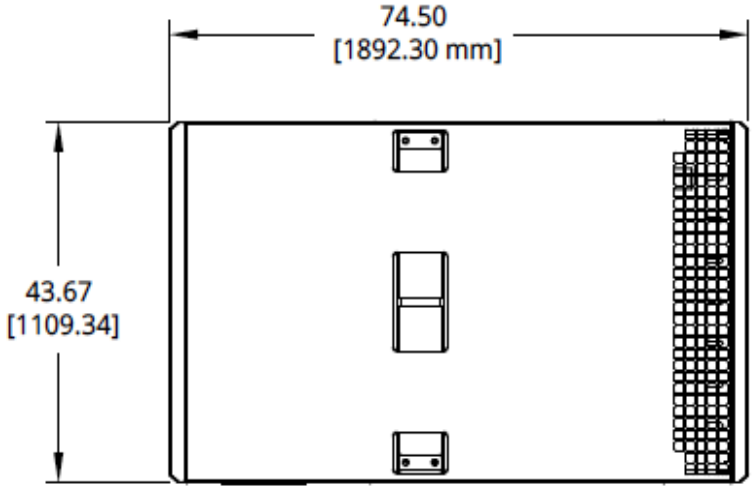
- Typical hazards related to towing a trailer on roads and highways
- Over speed transportation and chaining down the unit
- Heat, noise, exhaust, and carbon monoxide from the engine

- Multiple heat sources: Engine, alternator end, etc
- Overhead hazards presented by items on location
- Fire hazards from improper refuelling techniques
- Electric shock and arc flash
- Gaseous fuel and its fumes

To protect yourself and others, make sure you thoroughly read and understand the safety information presented in this manual before operating the machine

2.2 Product Specifications





Enclosure	Unit
Gross Weight	1077 kg / 2375 lbs
Lifting Bail	1827 kg/ 4020 lbs Rated
Enclosure	Powder Coated Carbon Steel
Doors	Single Door Per Side, Heavy Duty Latch
Sound Attenuation	Aluminium Lined Foam, High Temperature Rating
Control	DEIF SCG 120

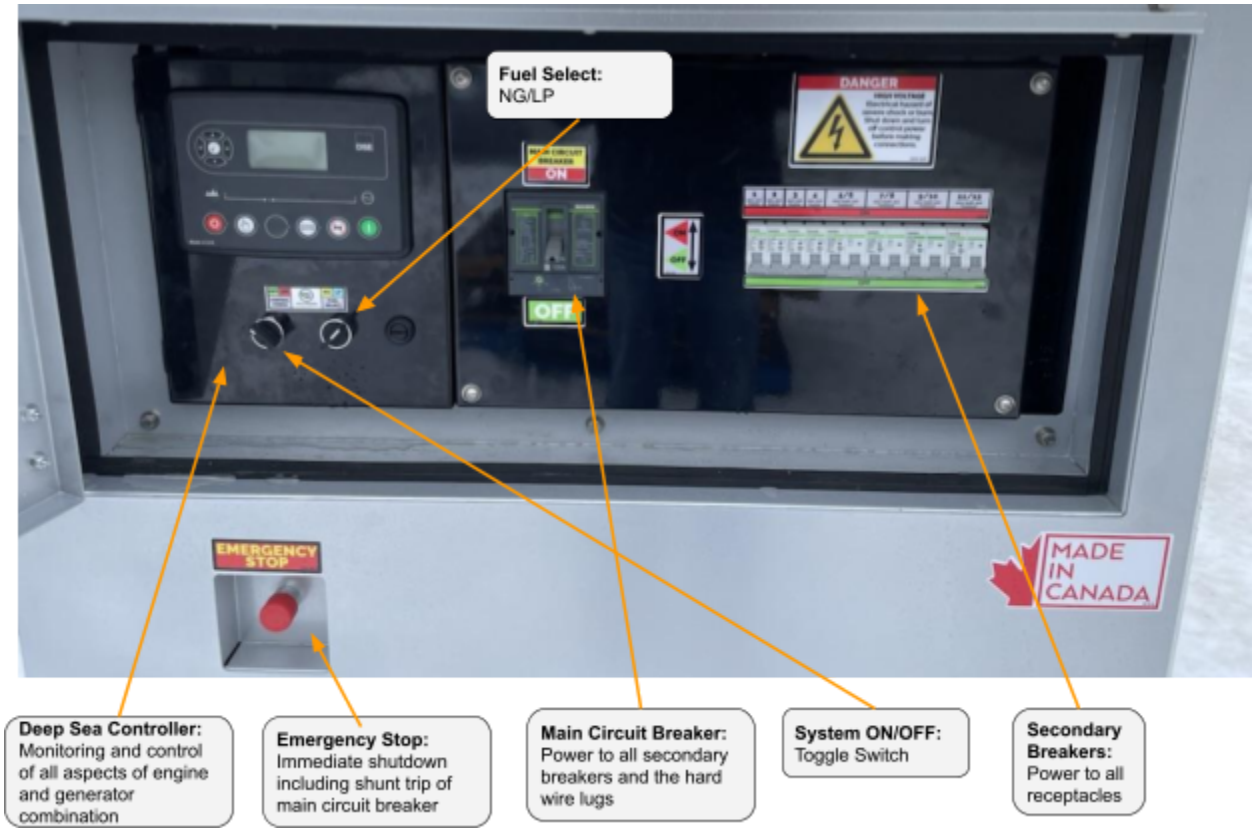
Generator End	Unit
Voltage	120/208v Three Phase
Main Circuit Breaker	100 Amp
Efficiencies @ 60HZ	89.8% @ 480V, Full Load
AVR	DSE DIgital Regulator
Pole	4
Overspeed (RPM)	2250
Protection Class	IP23
Altitude Rating	0-1000m
Winding Code	T0405S3
Standby H-163F/27C	28.2 kW / 35.2 kVa
Prime H-125/40	26.4 kW / 33 kVa

Engine	Unit
Engine Make/Model	Kubota
Configuration	Inline, 4 Cylinder
Fuel	Natural Gas or LPG Vapour
Radiator	Pusher Fan
Governor	Electric
Temperature	50℃ Ambient Rating

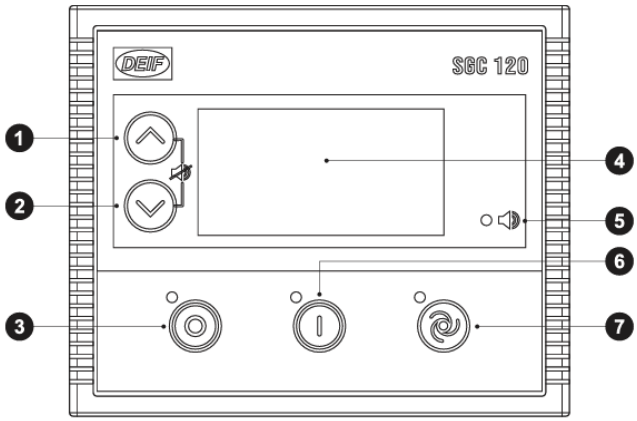
Oil Capacity	9.5 Litres (2.5 Gal)
Oil Type	10W-30 Above 0℃ , 5W-30 Below 0℃

2.3 Understanding the User Interface

The user interface is within the main control panel door. The control panel consists of a series of switches, buttons and a control menus to provide control of all operating systems - and provide the user with operating parameters.



Over view of controller:



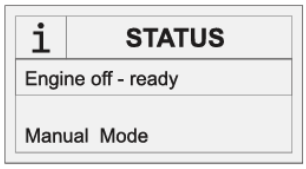
1. Menu navigation up button
2. Menu navigation down button
3. Stop/Config button
4. Display
5. Alarm LED
6. Start button
7. Mode selection button

Button functions

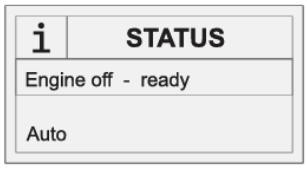
In Mode	Button input	Function
Manual	Start	Starts the engine
Manual	Auto	Enters Auto mode
	Stop	Stops the engine
	Stop (long press)	Enters Configuration mode
	Down + Stop (long press)	Enters Programming mode
Auto	Stop	Stops the engine and enters Manual mode
Manual Auto Configuration	Up Down	Scrolls through the views/parameters
Manual Auto	Up + Down (during Alarm view)	Acknowledges and clears the alarm
Configuration	Start	Selects/saves the parameter
Configuration	Up + Down (long press)	Enters the Event log page
Configuration	Stop (long press)	Back to Manual mode
Deep sleep	Any Key (for min. 1 s)	Back to Manual mode
Event log	Up + Down (long press)	Back to Configuration mode
Programming	Up + Down (long press)	Enters Manual mode

Monitoring mode

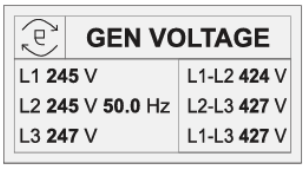
In Monitoring mode, the display views shift automatically after a pre-defined time. This delay time can be configured in the configuration menu. The views can also be changed manually with the Up and Down buttons.



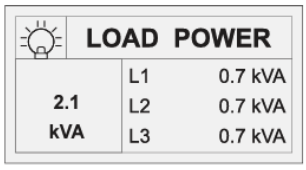
Manual mode



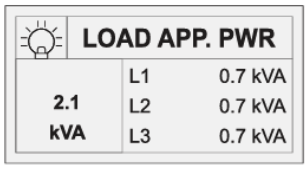
Auto mode



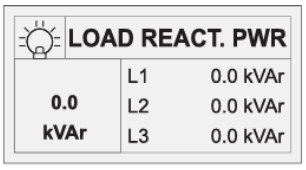
Generator voltage



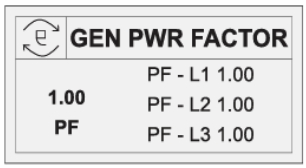
Load power[1]



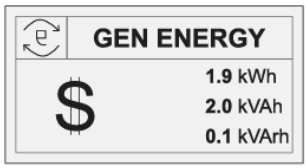
Load apparent power[1]



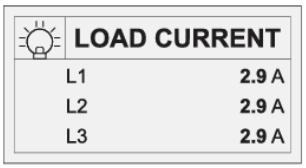
Load reactive power[1]



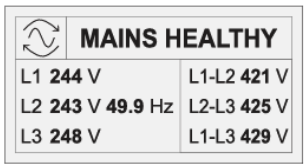
Generator power factor[1]



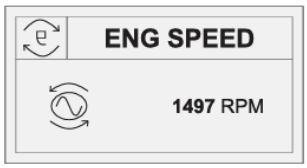
Generator energy



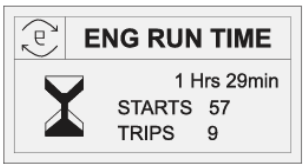
Load current[1]



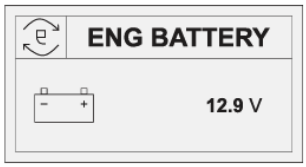
Mains status



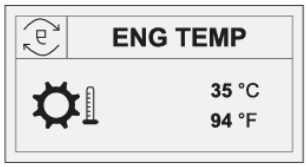
Engine speed



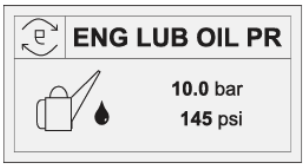
Engine run time



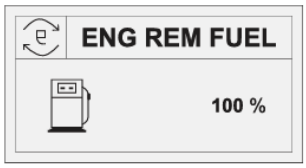
Engine battery voltage



Engine temperature[2]



Engine lube oil pressure[2]



Alarms:

Alarm types

No.	Alarm actions	Description
1	Shutdown	Load is taken off from the genset and the genset is immediately stopped by skipping the Engine cooling time.
2	Electrical trip	Load is taken off from the genset, the Engine cooling timer begins, after which the genset is stopped.
3	Warning	Warning alarms draw the operator's attention to an undesirable condition without affecting the genset's operation. The genset cannot be started without acknowledging the Warning alarms
4	Notification	The controller shows the message on the display. The genset start/stop operation is not affected.

Alarms and their causes

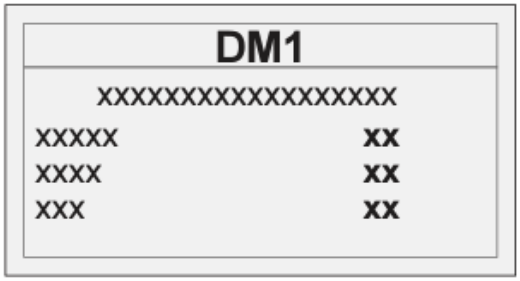
No.	Alarms	Causes/Indication	Actions
1	Low Oil Pressure (Sensor)	Indicates that the oil pressure measured is below the preset threshold.	Shutdown Warning
	Low Oil Pressure (Switch)	Indicates that the oil pressure measured is low through switch.	Shutdown Warning Electrical Trip Notification
2	High Oil Pressure (Sensor)	Indicates that the oil pressure measured is above the preset threshold.	Warning
	High Oil Pressure (Switch)	Indicates that the oil pressure measured is high through switch.	Warning
3	High Eng Temp (sensor)	Indicates that the engine temperature is above the preset threshold. This condition is detected only when engine is on.	Shutdown Warning
	High Eng Temp (Switch)	Indicates that the engine temperature measured is high through switch.	Shutdown Warning Electrical Trip Notification

No.	Alarms	Causes/Indication	Actions
4	Low Fuel level (Sensor)	Indicates that the amount of fuel level is below the preset threshold. This condition is detected only when engine is on.	Shutdown Warning
	Low Fuel level (Switch)	Indicates that the amount of fuel level measured is low through switch.	Shutdown Warning Electrical Trip Notification
5	Low Water Level (Switch)	Indicates that radiator water level is below the preset threshold.	Shutdown Warning Electrical Trip Notification
6	Auxiliary input/User defined name	Configured auxiliary input has triggered longer than preset duration.	Shutdown Warning Electrical Trip Notification
7	Anlg LOP Ckt Open	The oil pressure sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
8	Engine Temp Ckt Open	The temperature sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
9	Fuel Level Ckt Open	The fuel level sensor is not detected (circuit open).	Shutdown Warning Electrical Trip Notification
10	Fuel Theft	The fuel consumption has exceeded the preset threshold.	Warning
11	Emergency Stop	Configured as digital input has triggered longer than preset or when an immediate shutdown is required.	Shutdown
12	Fail To Stop	It is detected that genset is still running after sending stop command.	Shutdown
13	Fail To Start	Indicates that genset has not started after the preset number of start attempts.	Shutdown
14	L1 Phase Over Voltage	Indicates that genset (L1) phase voltage has exceeded the preset over-voltage threshold.	Shutdown Warning
15	L2 Phase Over Voltage	Indicates that genset (L2) phase voltage has exceeded the preset over-voltage threshold.	Shutdown Warning
16	L3 Phase Over Voltage	Indicates that genset (L3) phase voltage has exceeded the preset over-voltage threshold.	Shutdown Warning
17	L1 Phase Under Voltage	Indicates that genset (L1) phase voltage has fallen below preset under-voltage threshold.	Shutdown Warning
18	L2 Phase Under Voltage	Indicates that genset (L2) phase voltage has fallen below preset under-voltage threshold.	Shutdown Warning
19	L3 Phase Under Voltage	Indicates that genset (L3) phase voltage has fallen below preset under-voltage threshold.	Shutdown Warning
20	DG Phase Reversal	Alternator phase sequence (L1-L2-L3) is not correct.	Shutdown Warning Electrical Trip Notification

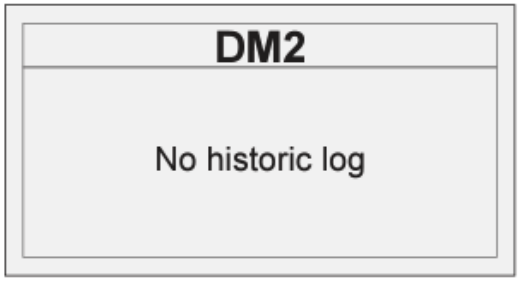
No.	Alarms	Causes/Indication	Actions
21	Over Frequency	Indicates that genset output frequency has exceeded the preset threshold.	Shutdown Warning
22	Under Frequency	Indicates that genset output frequency has fallen below the preset threshold.	Shutdown Warning
23	Over Current	Indicates that genset current has exceeded the preset threshold.	Shutdown Warning Electrical Trip Notification
24	Over Load	Indicates that the measured kW load rating has exceeded the preset threshold.	Shutdown Warning Electrical Trip Notification
25	Unbalanced Load	Load on any phase is greater or less than other phases by a threshold value.	Shutdown Warning Electrical Trip Notification
26	Over Speed	Indicates that genset speed has exceeded the preset overspeed threshold. The genset will shut down after Overspeed delay.	Shutdown
27	Gross Over Speed	Indicates that genset speed has exceeded the preset Gross overspeed threshold. The genset will shut down immediately without any delay.	Shutdown
28	Under Speed	The engine speed has fallen below the preset RPM.	Shutdown
29	Extended Over Load Trip	Indicates that there was 100 % load on the genset for one hour in the time interval of 12 hours.	Electrical trip
30	Charge Fail	The charge alternator voltage has dropped below the preset threshold.	Shutdown Warning Electrical Trip Notification
31	V-Belt Broken Switch	Indicates that there is a failure of the V-belt, which is driving the charging alternator.	Shutdown Warning Electrical Trip Notification
32	Battery Under Voltage	The battery voltage has fallen below the preset threshold.	Shutdown Warning Electrical Trip Notification
33	Battery Over Voltage	The battery voltage has exceeded the preset threshold.	Shutdown Warning Electrical Trip Notification
34	Filter maintenance	Indicates that engine running hours has exceeded the preset hours limit or maintenance due date has occurred and filter servicing is required.	Warning Notification
35	Mains Phase Reversal	Indicates the mains unhealthy condition.	Notification

Displaying Alarms:

The display can show J1939 diagnostic messages DM1 (active alarms) and DM2 (historic alarm log list). You can acknowledge these alarms from the display unit. For some engines, the display has a special alarm display (see the specific engine type). Press the Down button for 4 seconds to see the alarm log. By default, the alarm log shows the DM1 (active alarms). To see the historical alarm list, use Down button to select DM2.



Alarm log DM1 shows active alarms



Alarm log DM2 shows historic alarms

General troubleshooting

Fault	Action
The controller does not power ON.	• Check the battery voltage. • Check the fuse on the battery supply. • Check continuity between battery positive and controller terminal 2. • Check continuity between battery ground and controller terminal 1.
The controller display freezes or hangs up.	• Reset the controller power.
The controller fails to crank-start the engine.	• Check the battery voltage. • Enter the Configuration mode in the controller and verify the configuration for the Start output. Check that the Start output is working correctly by measuring its output voltage. • Enter the Configuration mode in the controller and verify the configuration of the Crank disconnect method. Verify the configuration of the LLOP Switch polarity. Ensure that the lube oil pressure switch and sensor are working OK. Check their wiring.
The Emergency Stop alarm is shown without the Emergency Stop is activated.	• Check if the Emergency stop switch is working OK, including the wiring. • Enter the Configuration mode in the controller and verify the configuration of the Emergency stop polarity.
The controller generates unnecessary Shutdown alarms or Warning alarms.	• Check the respective switch, sensor and wiring. • Enter the Configuration mode in the controller and verify the respective threshold configuration.
The controller shows Charge Fail alarm.	• To check if the controller's charging alternator terminal is working: ◦ Disconnect the charging alternator wiring to the controller's terminal 7. ◦ Short terminal 7 to the ground through a DC ammeter. ◦ Crank-start the engine. ◦ The DC ammeter should indicate the current in the range of 200 to 400 mA for ~30 seconds. ◦ If yes, the controller's charging alternator terminal is working OK. • Disconnect and re-connect the charging alternator ind connection to the controller's terminal 7. • Check if the charging alternator is working OK.
The controller shows Error C03.	Error C03 can occur if the controller is disconnected from the PC during a configuration. 1. Press and hold the *Stop/Config* button during a power cycle to reset the controller. 2. Re-send the configuration file.
The controller sends a Crank-start command immediately after power on.	• Ensure that the controller's output terminal is not directly connected to the starter relay. The controller's output should be given to an intermediate relay which should in-turn power the starter relay. The controller can get permanently damaged and will need to be replaced if this precaution is not taken. • Check start-relay connection with the suitable controller terminal. • Enter the Configuration mode in the controller and verify the configuration for Start mode and the Start relay output polarity.

Fault	Action
The engine runs, but the controller shows genset to be OFF.	• Check if the MPU signal (if used), and main alternator voltage signal (L1 phase) are received by the controller terminals. • Check if the LOP and LLOP are working OK. Check the wiring to the controller.
The controller shows incorrect PF value or kW or load current.	• Check wiring of the respective alternator phase voltage and the CT to the controller. • Check the CT ratio (if kW or current reading is faulty).
The controller shows incorrect mains voltage or incorrect main alternator voltage.	• Check the wiring of the respective phase to the controller. • If the problem is not resolved, replace the controller and try again.
The controller shows incorrect reading for any of LOP, fuel level or temperature sensors.	• Check the respective sensor and its wiring. • Enter the Configuration mode in the controller and verify the calibration for the respective sensor in the configuration.

Auto mode troubleshooting

Fault	Action
The controller does not start the engine when a Remote start command is sent from an external device.	• Check the wiring of the Remote start signal to the controller's respective digital input terminal. • Enter the Configuration mode in the controller and verify the configuration for the Remote start digital input terminal. • Check that the controller is in Auto mode. • Check for Mains monitoring disabled and Site mode disabled.
Controller does not stop engine even when a Remote stop command is sent from an external device.	• Check the wiring of the Remote stop signal to the controller's respective digital input terminal. • Enter the Configuration mode in the controller and verify the configuration for the Remote stop digital input terminal. • Check that the controller is in Auto mode.
While in Auto mode, the controller sends a Start command even if the Mains is present.	• Check the wiring of the mains L1, L2 and L3 phase to the controller's respective input terminal. • Enter the Configuration mode in the controller and verify the configuration for the Mains monitoring.

SGC 121 only troubleshooting

Fault	Action
The governor actuator chatters even after the engine stops. The controller shows genset ON while genset is at rest. Fail to stop alarm when genset is at rest.	• Enter Configuration mode in the controller and verify the configuration for the LLOP and LOP. Also check the wiring. • Ensure that Mains voltage wiring is not connected by mistake to the controller's genset voltage terminals.
The controller does not maintain the target RPM. The engine RPM is not stable or engine hunts. The controller cranks the engine but does not start the engine.	• Check that the mechanical linkage assembly is OK. • Enter Configuration mode in the controller and verify the configuration for GOVERNOR. • Check the PID control gains. • Check that the actuator moves to full throttle position when the engine is cranked.

2.4 Setup Process

The setup and deployment process involved for the CIPR generator involves locating the machine on level, suitable terrain, connecting earth ground and fuel source, and connected loads.

Before using the unit, be sure to read and understand all of the instructions. This equipment was designed for specific applications; DO NOT modify or use this equipment for any application other than which it was designed for. Equipment operated improperly or by untrained personnel can be dangerous.

NOTE: Before starting, visually inspect the unit for leaks or damage.

Quick Setup Guide:

1. Read and understand ALL safety sections at the beginning of this manual
2. Ensure all maintenance procedures are up to date
3. Ensure the unit is set up on firm and level ground, with the a clear area around the generator
4. Ground unit in accordance with local grounding requirements through ground lug connection
5. Warn personnel on site of pending start up
6. Connect the fuel source in accordance with local guidelines and safety requirements, note, we recommend that the fuel pressure is checked during each start up - and that primary, secondary or vaporizer regulators are tuned and set for this equipment (7-11" WC inlet pressure, even under load), leak test and operate with a high degree of safety
7. Ensure that main and secondary circuit breakers are in the OFF or Green position
8. Check engine oil and coolant levels, visually inspect the engine for leaks, inspect belts, electrical connections and wiring
9. Inspect all electrical cords & cables; repair or replace any that are cut, worn, or bare. This includes inspecting cords external to the generator connected to the load
10. Ensure battery connections are secure
11. Check the engine fan belt tension and condition. (See engine manual for tension requirements)
12. Check the engine fan belt guard
13. Check the engine exhaust system for loose or rusted components.
14. Turn ON the DeepSea control power switch
15. To initiate the cranking / run sequence press the manual button, then the green "Start" button once the DSE module has loaded
16. Verify voltage and frequency are correct before turning on the main circuit breaker, this machine is designed to operate at 120/208v - Three Phase, 60 hertz

17. Turn on the secondary circuit breakers as required, note if you are not utilizing the secondary distribution it is recommended to leave these breakers in the off position during normal operation

WARNING:

It is the operator's responsibility to ensure that the generator is properly and safely positioned at location.

DANGER:

Entering the electrical compartment while equipment is in operation can result in death or serious injury.

⚠WARNING

Read and understand this manual and its safety instructions before using this product. Failure to do so can result in serious injury or death.

2.5 How to Use the Product Safely

2.5.1 Safety information

- High voltage is present in the system while on, never attempt to service the electrical system while the engine is on, or the system is on - qualified technicians only
- Do not operate the generator if there are signs of wear or damage
- Never permit anyone to operate the machine without proper training
- Never modify equipment without the written consent of Eco Power Equipment
- Never transport or move the generator while running
- Explosion Hazard: Flammable gaseous fuel and combustible gases can be present in the generator
- Never charge a frozen 12V battery

2.5.2 Technical life span

- Gaseous Engine: 15,000+ hours
- Frame and Enclosure 5+ Years
- Eco Power recommends that our customers implement an inspection process

2.5.3 Personal protective Equipment

- Always wear personal protective equipment, including appropriate head protection, clothing, gloves, steel toed boots, eye and hearing protection as required by the task at hand when operating the generator

3 Fuel System

The primary components of the fuel system are the fuel supply, direct electronic pressure regulator (DEPR), fuel mixer, electronic throttle control (ETC) device, engine control module (ECM), and a catalytic converter. The system operates on a slightly positive fuel pressure. Fuel pressure command and actual fuel pressure is monitored by the ECM.

Bi-FUEL

The 4G Engine Controls System has full engine software control authority, therefore switching from Natural Gas (NG) to Propane (LPG/VPG) fuel is a software command from the operator console or a switch input into the 4G ECM. Weichai WP06GNA engine is capable of operating in bi-fuel mode starting from VPG/LPG and switching to NG after the NG pressure develops from operation. With the proper valve and sensor arrangement the fuel supply transition can be made while in operation, under full load, and automatically. NG/VPG is WP06GNA standard configuration. With added on option, WP06GNA can also support LPG, manual or automatic switching.

The 4G engine control system contains a highly configurable diagnostic list that can be tailored to each application's specific needs using the calibration spreadsheet. With each available P-code listed along with the short-name description. Note that not all DTCs necessarily apply to every application.

ECM: Engine Control Module: 4G 90 pin

The ECM is full authority, by this we mean it includes the ignition and air/fuel ratio control, contains all the I/O to interface the engine with the application and has a complete set of diagnostics. By implementing all functions in one box the overall system complexity is reduced as is the total system cost.

Some of features included in the ECMs are, lean burn or stoichiometric combustion control, continuous fuel injection control or standard digital injectors, ignition control electronic boost control for turbochargers – VGT or wastegate, drive-by-wire throttle control, oxygen sensor based closed-loop air/fuel ratio control (wide band (UEGOs) or switching (HEGOs)), adaptive spark and fuel control, EGR control, transmission / engine coordination, speed control/governing (idle, max speed, all-speed, cruise control) and vehicle network interface systems (CAN, J1708, J1850, Ford SCP).

DEPR: Direct Acting Electronic Pressure Regulator

Our fuel control device is referred to as a Direct Acting Electronic Pressure Regulator or D-EPR shown in Figure 2. Its benefits to our customers and the end customer are:

Figure 2 - Direct Acting Electronic Pressure Regulator (DEPR)

- It is a continuous fuel flow device. This allows the most homogeneous mixture of air and fuel to the engine yielding optimum combustion with minimum emissions and maximum fuel economy.
- It operates on low pressure fuel from 6 to 20 inches of water of inlet pressure, no pressure intensification system required.
- It does not wear in the case or dry fuels (NG) and it does not stick or clog due to heavy hydrocarbons or waxes found in LPG.
- It is fast and accurate, providing precise air/flow ratio control during transients (or load acceptance).

The DEPR is a single-stage microprocessor based electromechanical fuel pressure regulator that incorporates a high speed actuator. It communicates with the Engine Control Module (ECM) over a Controller Area Network (CAN) link, receiving fuel pressure commands and broadcasting DEPR operating parameters back to the ECM. The DEPR can regulate fuel pressure between +/- 17 inches of water column above the Mixer air inlet pressure, providing sufficient control authority to stall an engine either rich or lean. When the DEPR receives an output pressure command from the ECM, the valve is internally driven to attain targeted fuel pressure, the DEPR then closes the loop internally using a built in fuel pressure sensor to maintain target fuel pressure/fuel flow rate, until another external command from the ECM is received.

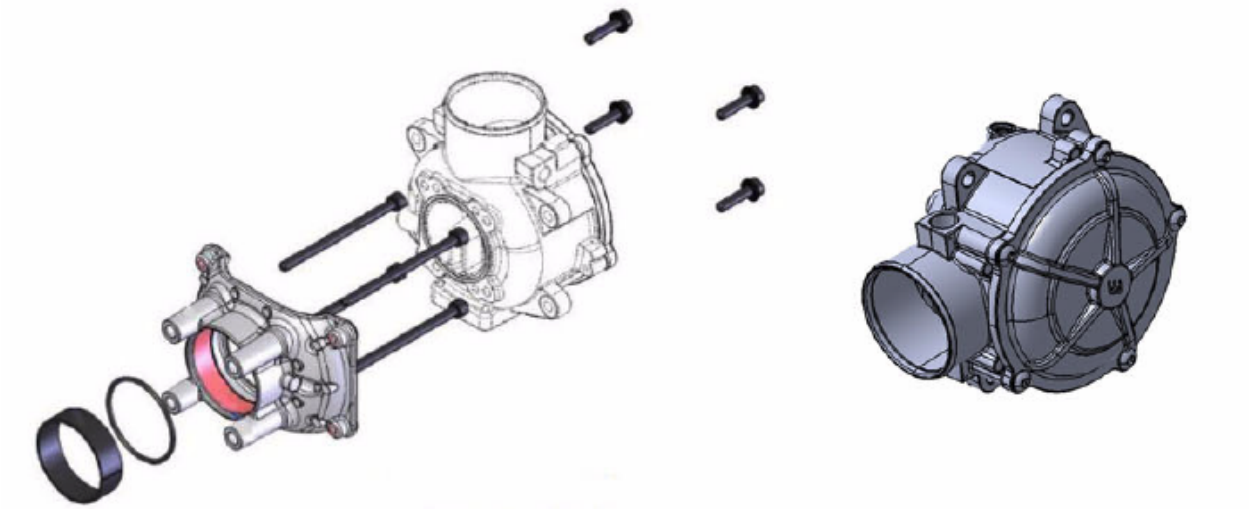


Figure 3 - E330 Mixer

MIXER: E330

We utilize a variable venturi mixer (E330 shown in Figure 3) when the DEPR is applied to an engine. The basic principle of the product is to introduce air and fuel into engine. It also aids in introducing turbulence into the air and fuel assisting in its homogeneity. The mixer also acts to increase or decrease the fuel entering the engine proportional to the amount of air flowing in the engine on a volumetric basis.

E330 MIXER provide the following benefits to the market:

- Superior fuel/air (phi) ratio accuracy, improving overall operation of the engine
- Reduced part to part fuel/air ratio repeatability improving overall operation of the engine
- Extended diaphragm life through material selection and design
- Performance over the -40 to +125C temperature range
- Eliminate LPG fuel contamination Issues
- Superior low flow resolution and repeatability, eliminates idle adjustment
- Backfire resistant through design enhancements

INTAKE AIR SYSTEM

The intake system should be sealed between the mixer inlet and the filter. Proper clamps should be used to ensure unfiltered air is not drawn into the system. Use piping with minimum diameter equal to mixer inlet. When in an enclosure it can sometimes be necessary to use an externally mounted filter. It can be beneficial to engine life and performance to draw in air from the coolest location possible

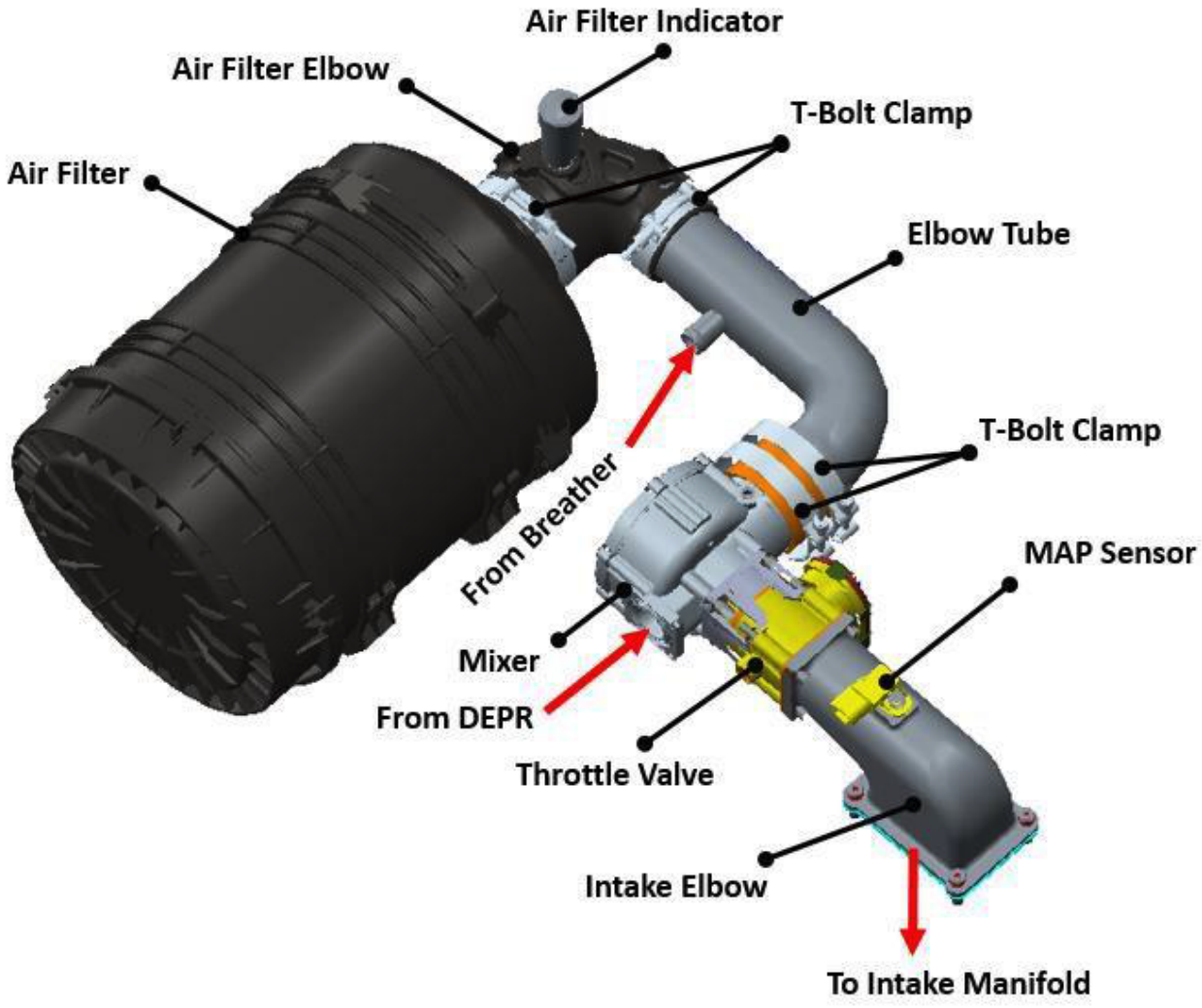


Figure 9 Intake Air System

NATURAL GAS/WELLHEAD GAS FUEL SYSTEM

The fuel first passes the fuel shut off when the engine starts cranking. Then it goes through the DEPR and comes into the mixer to be mixed with the air from the air filter as shown in Figure 11

Weichai WP06GNA are capable of running the NG or wellhead gas with energy content from 700 to 1800 BTU per cubic foot. Weichai recommends fuel analysis for any gas other than pipeline quality NG from customer to make sure the engine fuel and control system are calibrated to run the fuel. WEICHAI recommends a natural gas fuel filter at the inlet. Maximum allowable H2S is 55ppm.

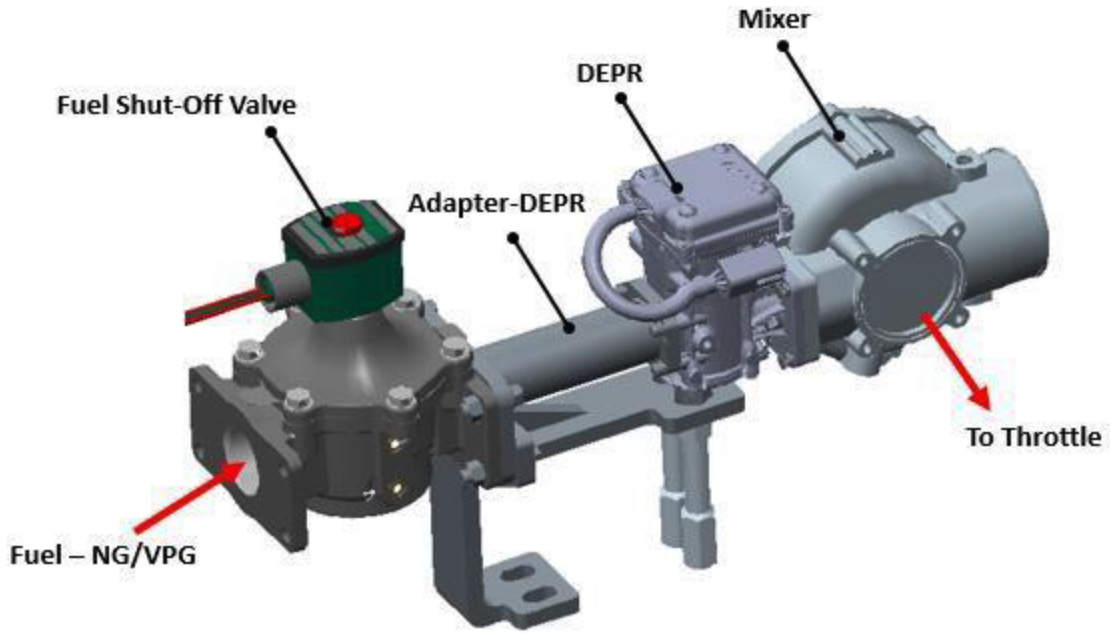


Figure 11 Natural Gas/Wellhead Gas Fuel System

PRE-CATALYST OXYGEN SENSOR

Apply an adequate amount of anti-seize compound to the threads of the oxygen sensor and install the sensor in the O2 sensor port located on the exhaust manifold elbow pipe. Tighten the sensor to the specified torque 29.5ft-lb ~44ft-lb (40Nm~60Nm). Anti-seize on thread only, don't put on the sensor.

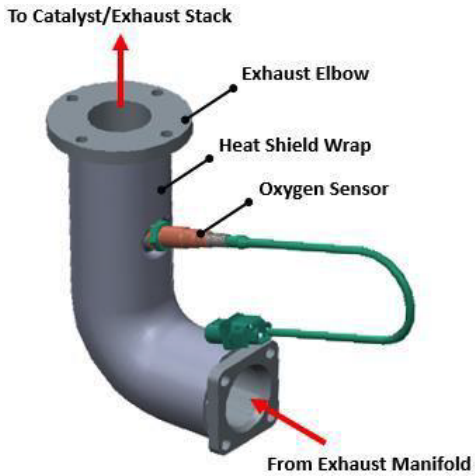


Figure 16 UEGO Sensor Installation

POST-CATALYST OXYGEN SENSOR

In general, the sensor installation point must be tested sufficiently by the customer for function and durability. There shall be no possibility of exhaust leaks upstream of the sensor as exhaust pulsations can draw in ambient air, leading to erroneous measurements.

Installation in the exhaust line must be at a point guaranteeing representative exhaust gas composition whilst also satisfying the specified temperature limits. The active sensor ceramic element is heated up quickly. This means that the sensor installation location must be selected to minimize exhaust-side stressing with condensation water in order to prevent ceramic element crack. This is helped by locating the sensor on the outlet of the catalyst assembly.

Design measures:

- – Locate sensor as close to the catalytic converter outlet as possible, without exceeding max.

Allowed temperature range

- – Attempt to achieve rapid heating-up of the exhaust pipes in the area in front of the sensor.

– The exhaust pipe in front of the sensor should not contain any pockets, projections, protruding or edges etc. to avoid accumulation of condensation water. A downside slope of the pipe is recommended.

–

The use of a sensor type with double protection tube can give a better protection of the sensor ceramic against condensation water drops. In this case make sure, that the front hole of the double protection tube does not point against exhaust gas stream

System measures:

- – Never switch on sensor heating before engine starting

– Delayed switch-on or power control of the sensor heater (e.g. as a function of engine and ambient temperature), so that the max. allowed ceramic temperature is not exceeded when there is condensation water present

Installation angle should be inclined at least 10° towards horizontal (electrical connection upwards), thus preventing the collection of liquids between sensor housing and sensor element during the cold start phase. Other installation angles must be inspected and tested individually.

Avoid inadmissible heating up of the sensor cable grommet, particularly when the engine has been switched off after running under max. Load conditions. The use of cleaning/greasing fluids or evaporating solids at the sensor plug connection is not permitted. Assemble with high temperature resistant grease on the screw-in thread. Tightening torque: 29.5ft-lb ~44ft-lb (40Nm~60Nm). material characteristics and strength of the thread must be appropriate. Recommended material for the thread

boss in the exhaust pipe is Temperature resistant stainless ferritic steel, e.g. X 5 CrNi 18 9, DIN 17440 1.4301 or 1.4303 or SAE 30304 or SAE 30305 (US standard)
The sensor's protection tube must protrude completely into the exhaust-gas flow.

Figure 17 TWC and Post HEGO Sensor Installation

There is to be no possibility of the sensor protection tube contacting the opposite side of the exhaust pipe. A waterproof electrical connector's version is required.
The sensor must be covered when underseal (wax, tar, paint etc.) or spray oil is applied to the vehicle.
The influence of contamination which enters the exhaust gas through the intake air or as a result of fuel, oil, sealing materials etc., and thus reaches the sensor is application specific and must be determined by customer tests.
The sensor must not be exposed to strong mechanical shocks (e.g. while the sensor is installed). Otherwise the sensor element may crack without visible damage at the sensor housing.
For physical reasons the sensor needs ambient air at its reference gas side. Replacement of the air volume inside the sensor must be guaranteed by a sufficient air permeability of the wires and the connectors between sensor and ECU. The breathability should be higher than 1 ml/minute at a test pressure of 100mbar.
Underfloor installation of the sensor remote from the engine requires an additional check of the following points
- positioning of the sensor with respect to stone impact hazard
- positioning and fixing of cable and connector with respect to mechanical damage, cable bending stress and thermal stress.

The sensor cable must be routed so that it is free of bends, mechanical tension, and chafing points considering the movement of the exhaust system in relation to the vehicle body. The cable and connector should not be subjected to excessive temperatures that could cause damage.

Additional instructions for the installation downstream the catalytic converter

- Between catalyst and sensor location absolute gas tightness of the exhaust system must be ensured.
- When the sensor is installed in the exhaust pipe there should be no detachable connections between catalytic converter and sensor (e.g. flange, clamp-screw joint).

CATALYTIC CONVERTER

A very important component in a low emission engine is the catalytic converter. Weichai Engines use a TWC converter. For this type of catalytic converter to work properly, the following two criteria must be met:

- The air-to-fuel ratio must oscillate between rich and lean.
- The catalyst substrate (also known as a “brick,” located inside the converter shell) must be kept hot.

Strict compliance with these provisions, conditions, and operating limits for catalytic converters must be maintained. If these parameters cannot be met or are not known, additional engineering and validation are required.

Operation

- The continuous operating exhaust gas temperature must be between 1112degF (600°C) and 1562degF (850°C).
- The Product installer shall take necessary precautions to accommodate shell skin temperatures

- up to 1202degF (650°C).
- System backpressure must remain with +/- 5% of nominal conditions.
- Engine misfires and exhaust stream containments are not permissible.

Vibration

- Vibration isolation must be provided between the engine and the TWC
- Vibration isolation must be provided between the Product and the chassis.
- Vibration acceleration loads shall not exceed 10g.

Installation

- Product shall not support mounting loads from adjacent components.
- Product must be mounted within +/- 10° of horizontal. Any other orientation must be approved
- by the manufacturer.
- Product must be supported at a minimum of two mounting locations.

- Installer shall ensure mounting hardware, such as fasteners, is sufficient for the application.
- Manufacturer recommends use of graphite gaskets for flanged joints.
- Heat shields must be reviewed by the manufacturer.
- Product cannot be used in corrosive environments (i.e. salt water).

Mounting the catalytic converter in the proper location will control the substrate temperature. To quickly heat up the catalyst and to ensure an effective operating temperature, the center of the substrate must be located a minimum of 30 inches (762mm) downstream of the exhaust manifold flange. This measurement is made along the length of the exhaust pipe and must take all bends and curves into consideration. The Max distance allowed downstream of the exhaust manifold flange is 36inches (914mm).

4 Maintenance

4.1 Planned Maintenance of CIPR

Maintenance tasks shall be done according to the following plan:

Task	Frequency
Change Oil	Every 500 hours
Change Oil Filters	Every 500 hours
Inspect Air Cleaner	Weekly
Change Air Cleaner	Every 1000 hours, 100 hours in dusty environment, variable to operating location, inspect regularly
Replace Spark Plugs	Every 5000 hours
Replace Spark Plug Wires	Every 5000 hours
Inspec fuel lock off valve for leaks	Every 2000 hours
Leak check all fuel lines	Weekly
Inspect / clean debris from radiator core	Every 1200 hours
Check air induction system for leaks	Every 2000 hours
Inspect exhaust manifold and system for leaks	Every 2000 hours
Be Awesome	Daily

To achieve the proper engine performance and durability, it is important that you use only engine lubricating oils of the correct quality in your engine. Proper quality oils also provide maximum efficiency for crankcase ventilation systems, which reduces pollution.

It is recommended to use GM Specification GM6094M. To achieve proper engine performance and durability, it is important that you only use engine lubricating oils displaying the American Petroleum Institute (API) “Starburst” Certification Mark ‘FOR GASOLINE ENGINES’ on the container.

4.2 Inspection Tasks

4.2.1 Daily inspection tasks

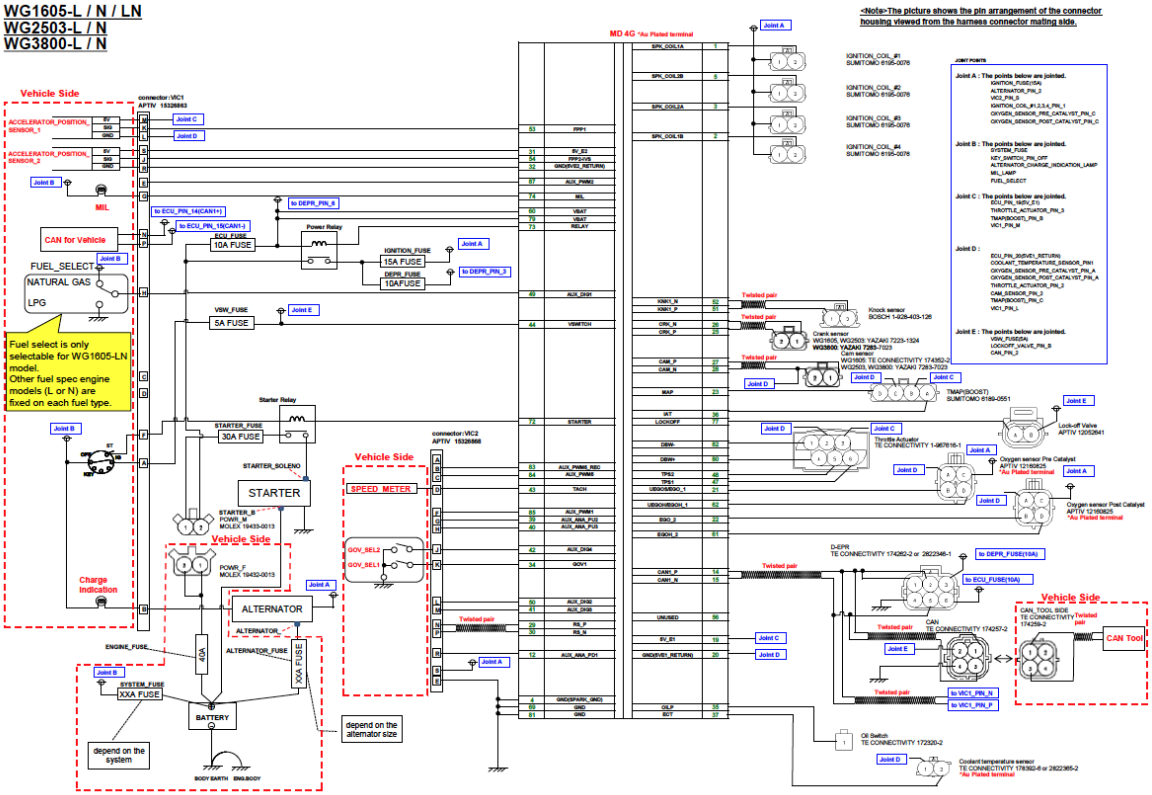
Task	Action
Visual inspection of engine	Visual check for leaks
Check engine oil level	Check coolant level
Inspect engine	Monitor oil pressure

4.2.2 Semi-Annual Inspection tasks

Task	Action
Inspect generator bearing	Remove end plate and inspect, check L dims
Load Test	Load Test Gaseous Engine (more in light load conditions)

5 Wiring Diagram

5.1 Engine Wiring Diagram



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