GXE250C-NG

OPERATION MANUAL

Natural Gas Unit

Product No.：1000028240

Engine Model：GX13k-LE02C

www.powerlinkworld.com

10-2020

EN

Revision Process

Index	Creation Date	Description	Creator	Remarks:
1	10/2020	Delivery of		First Draft

Powerlink Company's Original Operation Manual

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1.2 Safety Precautions

Important Explanation: Incorrect installation, operation and maintenance of electro-mechanical equipment such as genset, change-over switches, switching devices and accessories can lead to physical injuries and even life danger. It's a necessity to know the potential danger and safety operations so as to avoid accidents. Please read and abide by safety precautions and introduction. Keep this document in good condition. Illegal operation of equipment and its control cabinets are strictly forbidden, from which equipment many operate out of the prescribed function range and cause severe loss. Users or third party are not allowed to do any change to the delivered equipment, including revising preset programs or control softwares without Powerlink's approval, which will invalidate the rights of compensation or quality guarantee to Powerlink.

This manual includes several kinds of safety precautions and introduction: Danger, Warning, Caution and Notice.

DANGER=Risk (In accordance withISO DIS 3864-2)

Danger refers to the possibility that can bring out severe personal injury, death or a large amount of property loss.

WARNING= Alert (In accordance with ISO DIS 3864-2）

Warning refers to risks that can generate personal injury or a large amount of property loss.

CAUTION=Care (In accordance withISO DIS 3864-2)

Caution refers to risks that can lead to minor personal injury or property loss.

NOTE=Attention (Similar to ANSI Z535.2）

Notice is installation, operation and maintenance instruction, which is related with safety but without danger.

Instructions of Risk Labels, Warning Labels and Indication Labels must be followed

under any circumstance. If not, personal injuries and causalities or equipment damages may be generated.

Safety labels should be attached on the obvious place on the equipment in order to inform the operational staff or maintenance staff of the potential hazards and to tell them how to operate the equipment safely. Part of relevant safety signs are provided in this manual so that operators can recognize them. Please replace signs immediately if they lose or are damaged. Special tips: Followingsafety regulations or safety labels can help protect you. However, it cannot avoid any possible danger and risks related with gensets are indicated.

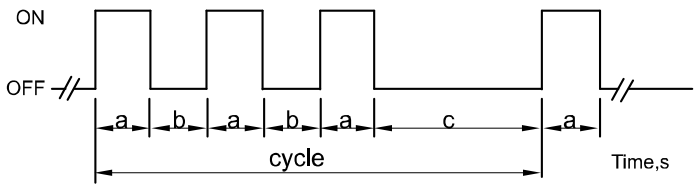
1.2.1 Safety Considerations in Operation and Maintenance Process

Operators and managers of gensets, should take all necessary measures tomake sure that operators (including genset commissioning staff and equipment service staff) are safe on sites. Furthermore, managers should also set relevant safety regulations and provide relevant training for operators so that operatorscan operate or remove dangerous materials properly and safely to avoid being harmed by these dangerous materials; Start up and shut down all electrical, mechanical and liquefied systems by ways of safe and efficient interlocking programs; Safety studies and discussions should also be held regularly.
Operators and managers willset out some safety regulations from time to time and these regulations should be carried out in factories or working areas.Operation personnel must abide by these regulations. Operation personnel can carry out safety review from time to time so as to ensure fullsafety conditions and that they can also propose suggestions to genset's operators and managers. No matter whether operation personnel carry out safety review and propose suggestion or not, operators and managers will have the responsibilities to offer safe sites.

1.2.2 Solutions to Alarming

Emergency EvaculationAlarm（gas warning,fire warning, carbonic oxide warning and gas early warning）

According to ISO 8201 Emergency Evaculation Signal/ keep at least 180m



Graph Illustration: a signal:“Open”（ON）,for 0.5s+/-10%
: b signal:“Close”（OFF),for 0.5s+/-10%
: c signal:”Close”（OFF), for 1.5s±10%（c=a+2b)
A cycle for : 4s±10%

Following conducts should be made:

- Immediately evacuate from relevant areas to outdoor to breathe fresh air.
- Close the safety blocking plug of gas in engine room and take measures to prevent accidental startup.
- Give an alarm by phone and wait for firefighters in safe area and warn others of dangers.

Please note that because environment conditions and working conditions vary among different equipment, operation personnel should set out a copy of "Contingency plan"with specific environment conditions and working conditions in consideration before operating equipment with poison gas. Meantime, the corresponding legal regulations should be paid attention to. It's necessary to make sure that each person responsible for operating equipment has understood contingency plans.

1.2.3Personnel Protection

Testing personnel must be trained with professional knowledge of gas genset and be authorized before carrying out their work. Independent operation is strictly forbidden so as to stop accidents. Please read carefully equipment operation manual before working. Meantime, be clear on the meaning of each safety instruction sign in testing room and abide by the instructions during operating.

Notice of wearing personal protective equipment and operation!

- It's a must to wear protective equipment approved by relevant authorities to protect bodies, heads, eyes, ears and respiratory system. It's not allowed to wear loose clothes and jewelry or let long hair loose when staying for time around engines.
- Such standard protective equipment as goggles, protective clothes, protective gloves and safety shoes are needed when entering staying close to engine rooms and operating equipment.
- Hearing protection earmuffs, helmets, anti-dropping devices, antigas masks or other personal protective equipment are needed under different operation conditions, environment conditionsworkingmanners or sites.
- The Leaked gas or exhaust can produce potentially explosive gases.Ventilation is doubly critical during those time of running.

1.2.4A must for you to abide by locally current safety regulations and legal provisions

Different running state or operations of equipment may lead to injuries, so please wear relevant personal protective equipment. Following examples are just for reference:

When equipment is running:

- Wear hearing protection earmuffs, goggles, protective clothes, safety shoes and protective gloves.

Assembling work during maintenance and service:

Note: Many spare parts of equipment and engines are of great importance. There is a potential risk that personnel may be injured by crashing parts or clipped for dead-weight of parts.

- Wear safety shoes, protective clothes and protective gloves!

During installing, being on construction sites and not easily accessible places:

Falling objects, tipping objects, flying objects, swaying objects and obstacles all can hurt heads seriously.

- Wearhelmets andsafety shoes.

High temperature surfaces and mediums (Engine oil and cooling water):

Temperature on surefaces of engines, pumps and so on can reach 150 °C.

- Wearheat insulating glovesand protective clothes!

Pipelines and containers with pressure:

Such mediums as cooling water and lubricating oil are of high temperature and with pressure.

- Wear goggles, protective clothes and heat insulating gloves!

Working when exposed to dust:

During regularly changing air filters to keep clean and replacing activated carbon.....

- Wear antigas masks, goggles, protective clothes and protective gloves!

When using acids, starter batteries, detergent, engine oil, anti freezing agents, preservative and chemicals:

- Wear acid-resistant or chemical-resistant gloves, protective clothes, goggles and safety shoes.

Working high above the ground:

Falling even from low height may cause severe injuries. When working high above the ground (above 1.2 meters) without the possibility or necessity to install anti-dropping devices (such as handrails, workbenches...）

- Personal anti-dropping devices made of safety belts and relevant devices (safety ropes,

latch catches, descent control devices, rappel devices or falling protectors) should be used!

Use gas with carbonic oxide (Please pay attention to gas analysis result):

- Take carbonic oxide sensor as personal protective equipment! Make sure of regular maintenance/adjust perconal protective equipment.

1.2.5 Fire

- It is strict forbid open flames.
- It is strict forbid smoking or doing jointing work around genset.

1.2.6 Accidental Startup

Accidental startup can cause severe injuries or even death.

It's essential to disconnect battery switch before checking gensets or connected equipment.

Methods are as follows:

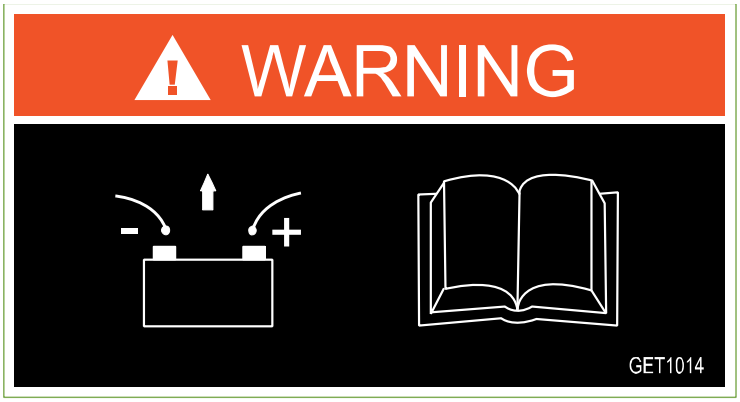
(1) Turn main switch of gensets to the position of (OFF).

(2) Disconnect the power of storage battery charger.

(3) Disconnecting cathode (-) line first whendisconnecting storage battery. Connect (-) line

lastly when powering on storage battery again. Following these precautions can prevent gensets from accidental starting up because of following equipment: automatic change-over switch, remote start-up/shutdown switches or startup command given by remote computers to engines.

1.2.7 Storage Batteries



Sulfuric acid in storage batteries: Sulfuric acid in storage batteries can cause severe injuries or even death.

- It's a must to wear goggles and protective clothes when operating work related to storage batteries. Acids in batteries can cause blindness and burn skin.
- Storage batteries can produce hydrogen and oxygen during charging, whilerelays in the chargers can produce electric arc or sparks, which can lead to explosion under certain conditions. Place storage batteries in areas with good ventilation. Battery chargers must be away from explosive smoke.
- Battery electrolyte is a kind of dilute sulphuric acid. Electrolyte can cause severe injuries or even death. Electrolyte can cause blindness and burn skin. It's essential to wear splash-proof goggles, rubber gloves and thigh boots when charging or carrying batteries. Don't open closed type storage batteries or damage the shell of batteries. If electrolyte splashes into eyes or on skin, it's essential to wash influenced areas with a large amount of water for15minutes. Seek help from doctors when electrolyte splashes into eyes. Don't add acid liquor to batteries being used, which will lead electrolyte to splash.
- Purge electrolyte. Electrolyte can cause severe injuries or even death. Electrolyte is

conductive ad corrosive. Add500g (1lb.) sodium bicarbonate (baking soda) into a container with 4L (1gallon) water and stir to neutralize solution. Pour out neutralized solution to the leaked electrolyte and add continuously neutralized solution until the indication of chemical reaction (foaming) completely stops. Rinse with water until it becomes liquor and then dry this area.

- Short circuit of storage batteries. Explosion can cause severe injuries or even death. Short circuit can cause personal injuries and/or damage equipment. Power off storage batteries before the maintenance and service work of batteries. Take off all jewelry before service work. Use tools with insulated handles. Power off (-) line first when disconnecting storage battery. Connect (-) line lastly when powering on storage battery again. Don't connect (-) pole line of batteries with (+) terminal of starter's magnet coil. Don't use the short-circuit method of terminals to test battery condition.

1.2.8Explosive and Flammable Materials

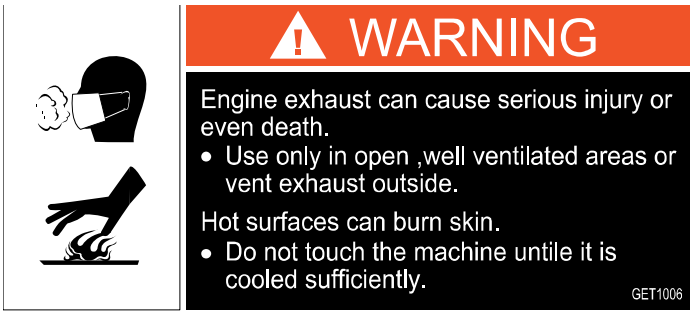
Explosion or fire can cause severe injuries or even death.

- Don't smoke, make open fire or sparks in areas close to such equipment as carburettors, fuel pipes, fuel filters, fuel pumps or other equipment that can leak fuel or fuel vapor. It's necessary to load fuel with regulated containers when taking down fuel pipes or carburettors.
- Fuels and fuel vapor of gensets are explosive and inflammable. Be careful when disposing these fuels and try to reduce the risk of fire disaster of explosion. Fire extinguishers with full materials should be equipped in equipment rooms or places nearby. Select fire extinguishers according to local fire safety standards or models recommended by governing bodies. All personnel should be trained how to use fire extinguishers and

how to take fire-prevention measures.

- Vaporized fuels are quite easy to explode. Take great care when disposing and storing fuels. Store fuels in places with good ventilation and be away from equipment that produces sparks. Don't add fuels into the oil tank when engine is running because splashed fuels will be on fire if they get into contact with hot parts or sparks. Smoking, open fire or spark are forbidden in places with leaked fuels or fuel vapor. Good airtightness should be kept on the connecting points of fuel pipes. Don't replace fuel hose pipes with hard fuel pipes. Hose pipes can prevent fuel pipes from damaging because of vibration. Don't operate gensets in places where fuels leak, fuels accumulate or spark exist. Repair fuel systems before operating genset again.
- Fuel leaking can result engines to explosion. Use soap-suds to examine whether liquefied gas backflow system leaks or not and the test pressure of fuel system should be at least621Kpa (90 pound/inch). Used soap-suds cannot contain ammonia or chlorine, both of which will prevent from foaming. Successful test is dependent on whether the solution foams or not.

1.2.9 Air Exhaust System



Exhaust gas of engines may be poisonous. If accidentally inhaling can be harmful to health and even give rise to death.

Exhaust gas conveying parts without insulation are of extremely high temperature, which can lead to severe scald or even death.

- Exhaust gas must be discharged out of rooms and airtightness of exhaust system shoule be examined regularly, which can be done by observing and check whether the seal rings crack, are eroded or damaged from outside or by the smelling the exhaust gas.

Dangerous parts that should be paid special attentions to are: flange connections, seal rings, expansion joints and welding points. Operators are responsible to make sure that exhaust systems will not leak.

- Carbonic oxide is a poison gas existing in exhaust gases. Indication of carbon monoxide poisoning includes but no limited to:

Dizziness

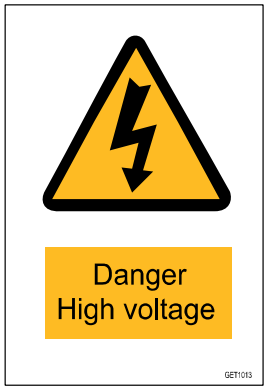
Physical fatigue, joint and muscle weakness, drowsiness, mental fatigue, not being able to concentrate on speaking or speak clearly, blurred vision

Stomachache, sickness, sicchasia

If you have the feelings above and there is a possibility of being carbonic oxide poisoning, you need seek for fresh air and keep exercising. Don't sit down, lie down or sleep. Warn others that there is a possibility of carbonic oxide poisoning. If the effected personnel don't get better during seeking for fresh air, they should seek doctors for treatment.

- It's a must to cool down engines and wear personal protective equipment (Wear heat insulating gloves and protective clothes), because exhaust gas conveying parts without being isolated are of extremely high temperature.

1.2.10Electrical System



Voltage in electrical cabinet can lead to life danger. Besides, direct or indirect electric shock can happen on all electrical connectors. Electric shock can give rise to severe consequence and even death.

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Machines must be connected to ground in accordance with professional norms so as to avoid illegally contacting voltage and electrostatics supercharging.

Firctional static electricity can cause damange to electronic component.

It only meets normal running conditions after the doors of electrical cabinets are closed. (Such as weather effect, hot, cool, dust, air-conditioners in electrical cabinets and so on)

- Wiring should be done by authorized professional staff (electrician licensed by relevant authorities) in accordance with technical specifications and relevant regulations.

  Please note that engines are connected to ground before startup.

  Please be extremely careful if equipment or surroundings are wet.

  If electric shock happens, please press emergency shutdown button.

  If the injured are hurt or unconscious, please call emergency number or send them to hospital.

  If generators are shut down by safety equipment, they should be restarted after excluding close reasons.

- Following items should be paid attentions to when working around generators:

  1. Make sure all personnel are trained with relevant knowledge and abide by current standards and safety principles in working sites. Specially remind following items should be paid attentions to:

  a) Users or operational personnel must evaluate risks and summarize all life dangers that may happen, and then tell them to relevant staff. Only staff with professional training can get close to generators when equipment is running.

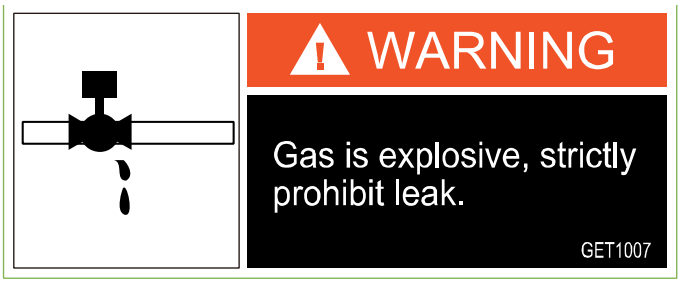
  b) Staff must wear suitable protective clothes and following protective equipment when staying around running generators: Hearing protection earmuffs head and face protective equipment, safety shoes and work clothes protecting forearms and legs.

  2. When working around cables, staff should follow all safety rules, including currently local and national safety rules for electrical works in corresponding voltage range. Besides,

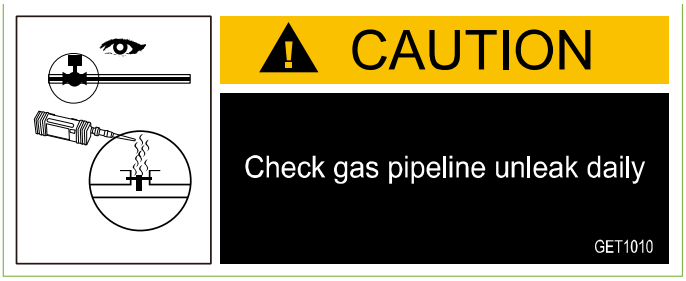
all regulations set out in working sites should also be followed.

- Make sure that all doors of gensets are closed, for only which meets normal running conditions. This requirement applies to all types of electrical cabinets, such as connectors switch cabinets, power parts, control cabinets and so on.
- Connect to ground according to professional norms and notice that engines should be installed on nonconducting rubber units.

1.2.11Gas Equipment



Gas-air mixtures (engine fuel) are extremely inflammable. Leaked gas can produce potentially explosive gases.



Regularly check gas pipelines, which can be done byobserving gas trains or using gas inspection gauges to check airtightness of pipelines. Powerlink strongly recommend that this check should be carried out once a day.

- If there is gas in pipelines, no wielding shoubd be done in relevant engine rooms. Working with naked fire and smoking are forbidden.
- Gases may be poisonous. Accidental inhaling can be harmful to health and even give rise to death. Please pay attention to gas analysis results! Smooth ventilation should be ensured in engine rooms. Make sure gases will not accumulate and a small amount of

overpressure should be kept in engine rooms. Pipelines and parts conveying gases should be of good airtightness. After leakage is detected or after repairing pipelines conveying gas-air mixtures/assemblies, it's necessary to check airtightness.

- A flashback arrestermust be installed in gas supply pipelines. Besides, a manual closing organ should be installed outside engine room. It's best to install the organin the inlet through which gas enter engine room to make it easy to close equipment (when repairing, servicing and under emergency circumstances). Manual closing organ should be structured properly to make sure that other people cannot operate without approval.Especially, make sure that it cannot be opened when locked.

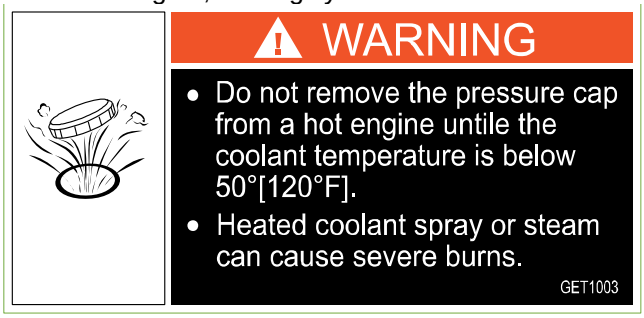
1.2.12Genset Units

Turbocharger

Since temperature on the surface of turbocharger can reach above 400°C, it's not allowed to place inflammable materials around it.

- Turbocharger should be operated with high temperature and isolated from inflammable materials. It's a must to close turbocharger first and then wearpersonal protective equipment (heat insulating gloves and protective clothes) to service it after temperature decrease to ambient degree.

Heat exchangers, cooling systems



When temperature reaches running degree, temperature of cooling water will be quite high and with pressure.Open pressure protective jacket of cooling water before it fully cools down becausehigh-temperature cooling water may hurt personnel.

- Decompress correspondingly before servicing assemblies. Servicing/checking parts in accordance with requirements. It's a must to immediately replace damaged or ageing pipelines, seal rings, hose pipes, lathedog and other fittings. If these parts crack, high-temperature cooling water may cause personal injuries and even fire disaster. Operational personnel should keep a certain distance from overpressure valve when genset is running.

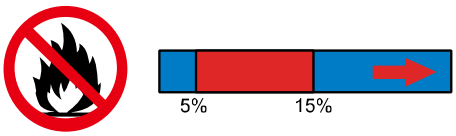
1.2.13Statement

Gas statement

CAUTION

METHANE NUMBER	LHV	INTAKE PRESSURE	INTAKE TEMP.	INTAKE HUMIDITY	SI COMPONENT	H_2S COMPONENT
MN > 80	> 18MJ/m^3	10~20kPa	< 40°C	< 60%	< 2mg/Nm^3CH_4	< 200ppm

DANGER

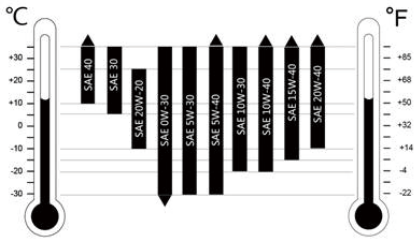


CH_4 is flammable gas. The explosion limits is about 5%-15% of air volume. (pay attention to ventilation)

- Gas components should meet the relevant demand.
- Mathane is flammability and 5% to 15% air volume easily explosion. NO open flames.

Lube oil statement

CAUTION



Recommend the following viscosity engine oil

LUBE OIL TYPE	SAE15W-40
ALKALI NUMBER	3.0~6.0mgKOH/g
SULFATED ASH VALUE	0.6~1.4%

- Using recommended lube oil.

Coolants and user water (for CHP unit only) statement

CAUTION

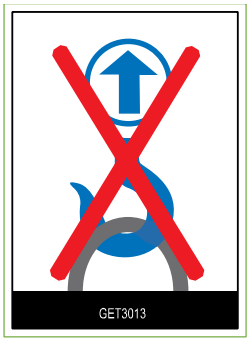
MIN. AMBIENT TEMP.	-37°C
SOFT WATER (DEIONIZED WATER AND DISTILLED WATER)	50%
GLYCOL	50%

CAUTION

OUTLET WATER TEMP.	< 95°C
RETURN WATER TEMP.	< 75°C

- Don‘t try to start-up genset when the ambient temperature below -37℃,it can cause serious damage.
- Recommended Antifreezeis the mixture of50% soft water mixture 50% glycol.
- The outlet and return water temperature should meet relevant redemands.

1.2.14Safety during Lifting and Transporting



- Always shut down the engine before lifting and transporting.
- Check the fuel and oil cap, make sure they have been tightened.
- Close all doors and lock them before lifting and transporting.
- Only use the special lifting lugs located over the engine, alternator or other components.
- Check the lifting lugs before lifting, make sure they have been mounted correctly and welded firmly. In addition, the lifting devices should have enough capacity to lift the genset safety.
- Check the welding area of all lifting lugs. They could not be used if there is a crack.
- Do not stand nearby while lifting.
- Be careful during lifting or transporting to avoid the unnecessary damages and abrasions.
- It is totally forbidden to install or use the machine in a space storing dangerous goods.

1.2.15Waste Disposal Responsibility for Electrical and Electronic Ageing Equipment

Dangerous materials potentially existing in electrical and electronic equipment will threaten environment and human beings.

- As for all electrical and electronic equipment (fitted batteries, gauges, indication lights and

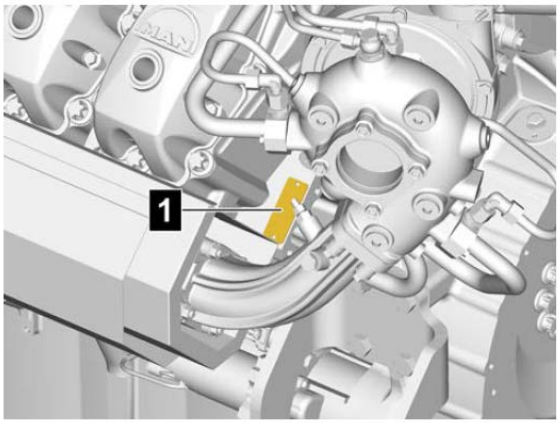
so on) indicated with this sign, you have responsibilities to dispose them as unclassified house refuse by collecting ageing equipment separately. Please use vertical recovery and collecting systems, which contribute to the recycling, cyclic utilization and other types of usage of electrical and electronic ageing equipment.

1.3 Data Plate Sign and Model Description of Powerlink Products

1.3.1 Data Plate

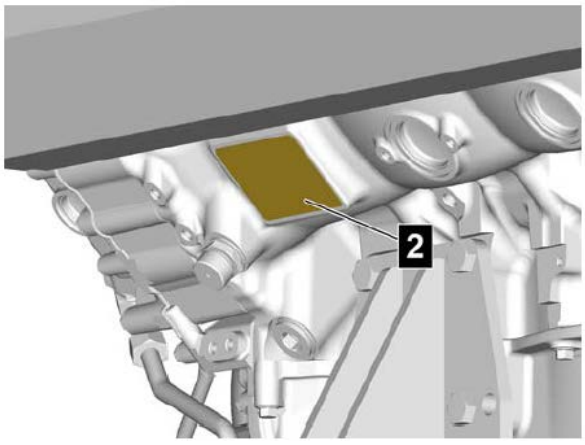
1.Engine's data plates

Engine's data plate is installed on crankcase



Mainy include

①	Type
②	Motor-nr. /Engine-no.

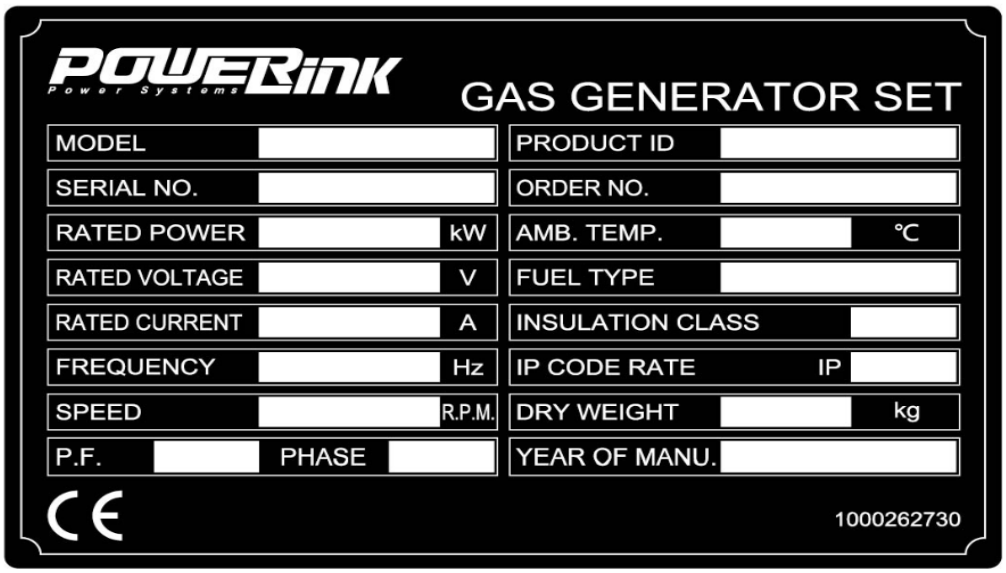


Mainy include

③	Model
④	Serial NO.
⑤	Work NO.

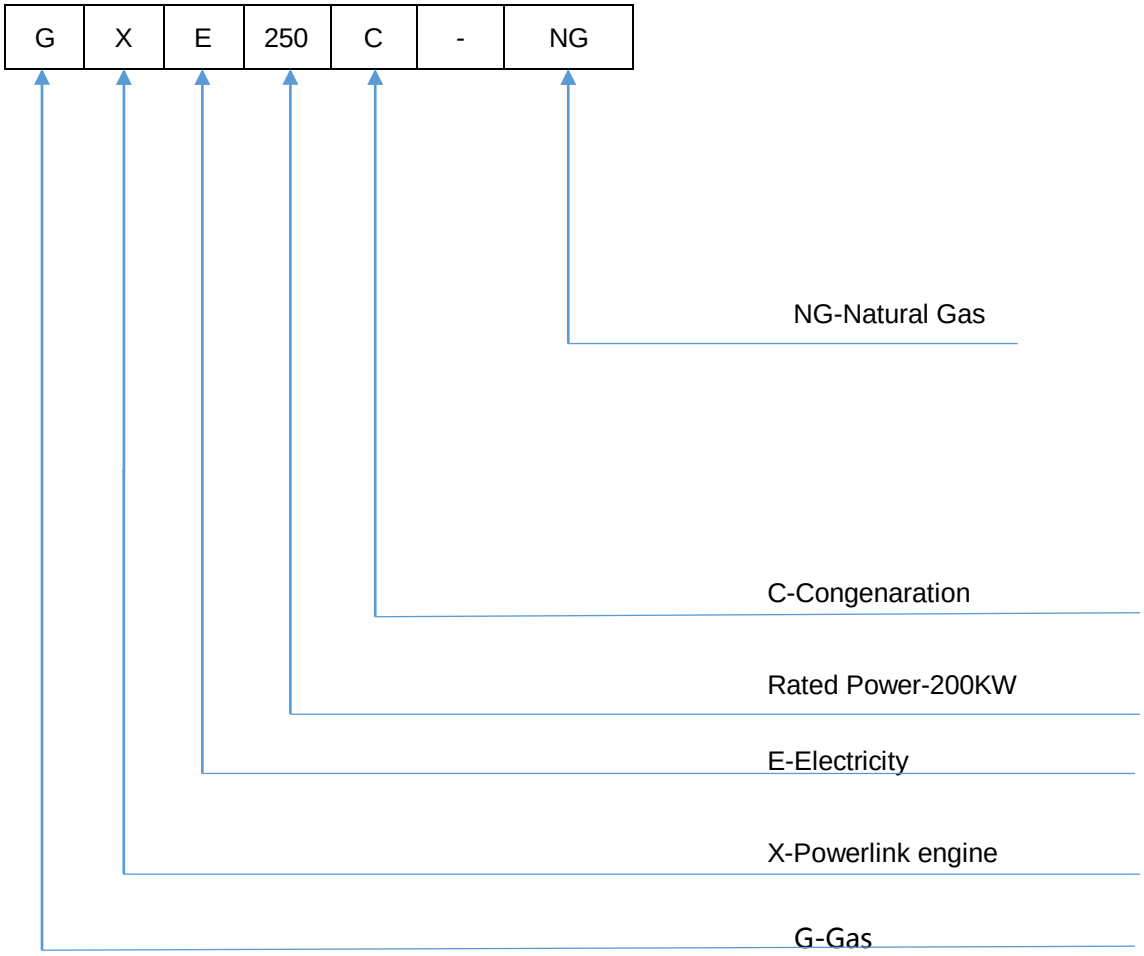
2. Equipment's date plate

Equipment's date plateis installed onthe control cabinet of gensets



1.3.2Model Description

Gas genset's model description



1.4 Publication Note

Powerlink ‘product data package’ contains following:

- Operation Manual
- Engine Operation-Maintenance Manual
- Generators' Installation, Usage and Maintenance Manual
- Part and Software Manual
- Control System Manual
- Warranty Service Manual

It's ccomplied by the Technical and Information Department of Powerlink.

Genset Requirements

2.1 Equipment Usage

1. Use equipment strictly in accordance with regulations

Using equipment in accordance with regulations means to use by following the instructions in operational manual. The function of Powerlink CHP generators and gensets is distributed generation. High voltage or low voltage alternators are driven by gas engines. CHP gensets can make use of engine's cooling water and thermal energy in exhaust gas. Any application beyond the scopes described in operation manual or maintenance manual is deemed as illegal operation. Powerlinkwill not be responsible for any consequence caused by illegal operation.

Powerlink equipment is customized by customers' actual demands, so it can only be used in its intended scope and permissible running conditions. Only approved by Powerlink approval, subsequent modification can be made to equipment, or it will invalidate the service right or compensation right to Powerlink.

2 Predictable Wrong usage

Predictablewrong usage meanspeople unintentionally operate wrongly machines which is easily predicted.

Analyzed remaining risks or wrong usage circumstances are reduced to the least degree by the principle of **'*Prevention-Protection-Warning*'**. As for unavoidable risks in design, danger label should be attached on equipment and also be warned in operation manual.

Wrong usage will harm operational personnel, third parties and even equipment.

Please look up processing prompt for avoiding remaining risks (Risk safety and health) in **'*Gas GensetTest Safety Instruction:PL20140504-06*'** and operation manual.

Remaining risks include high temperature surface, electric shock risk (high voltage), poisonous gases, pressure-bearing mediums, heavy parts, risk of being squeezed, wrong response to alarming, falling down from high, risk of slipping down, failing to follow plate and working on the unstably running devices.

Operating Powerlinkequipment by unqualified persons and they are also not allowed to enter engine rooms.

Please abide by the requirements in Safety Precautions, relevantechnical guidance and legal provisions about safety in working sites.

It's strictly prohibited to operatePowerlinkequipment beyond the safety scope, usage condition and technical feature range

Please pay attention to the requirements in '***PowerlinkGas Genset Test Safety Instruction***' and set product maintenance schedule and technical data (power, gas quality, gas type, explosion environment, temperature, ventilation, monitoring, and program and software version) in accordance with regulations.

When operating equipment, all safety devices ad monitoring devices regulated by Powerlinkand official authorities should be installed. It's not allowed to joint or dismount these devices.

Only materials, tools and fittings for operation, maintenance, ervice and cleaning approved by Powerlinkand official authorities can be used. Please pay attention to the requirements in Technical Guidance of "Operation and Maintenance" and official regulations and use materials (engine oil, cooling water additives, lubricating agents and so on) described in Operation Manual.

Powerlinkequipment must be installed in accordance with Powerlinkregulations. Please pay attention to the requirements in installation drawing, technical chart, circuit diagram, interface list, control system technical specification and information about installation, slinging and placing in technical guidance.

Take notice of waste disposal responsibility and professional methods of disposing hazardous articles (including materials should be disposed as waste forcibly).

Declaration of Consistency

Declaration of Consistency: Original copy

In accordance with service **II**，**1.A.** Machine order **2006/42/EG**.

Our company: Powerlink Machine Co., ltd.

specially announce that following products

GasCHP genset: GXE250C-NG

P/N： 1000028240

Electrical equipment, hauling-up devices and all directly-related electrical and mechanical devices offered together with equipment

Meet relevant basic protection requirements of EG specification: **2006/42/EG** (Machine order), **2004/108/EG** (Electromagnetic Compatibility), **2006/95/EG** (Low-voltage regulations-Use equipment in specific voltage limit value) and **97/23/EG** (Pressure equipment). Following standards and technical specifications are adopted in order to meet requirements described in CE order:

EN ISO 12100:2010	Machine Safety-General Design Principles-Risk Evaluation and Risk Reduction
EN 12601:2010	Gensets with reciprocating-piston explosive motors are equipped- Safety.
EN 60204-1:2006 +A1:2009	Machine Safety-Electrical Equipment of Machine.
EN 60439-1:1999+A1:2004	Device combination of low voltage switches
EN 61000-6-1:2007	Electromagnetic Compatibility (EMC)-Part 6-1: Professional basic standards-Anti-interference performance of residence area, business area and small-scale enterprises.
EN 61000-4-1:2007	Electromagnetic Compatibility (EMC)-Part 6-4: Professional basic standards-Disturbing radiation of industrial areas.

2.2Installation and Usafe Requirements of Gas Genset

Prompt

The prerequisite of operating equipment safely and economically is to follow relevant requirements in this technical guidance and to operate in accordance with instructions.Ignoring relevant requirements in this technical guidance or failing to follow or even violating instructions will invalidate the quality-guarantee right toPowerlink. Not applicable to following circumstances: If operators can ensure that faults have already existed before delivery or commissioning even though following the technical guidance. Equipment operators should carry out operations and abide by the requirements in this technical guidance. Not applicable to following circumstances: It's clearly defined that it's Powerlink responsibility by current technical guidance or operators and Powerlink have agreed safeguard provision in contract.

2.2.1 Prompts

Equipment's technical conditions: Refer to corresponding technical specifications.

Only if load is between50%and100%, the limit value of hazardous substances meets the defined parameters in relevant technical specification.

Please observe relevant technical guidance related with equipment and set maintenance schedules regularly according to professional norms and then carry out the schedules.

2.2.2 Emergency Shutdown Device

In Powerlinkmutted or open gas gensets, users need install manual emergency shutdown devices (Emergency shutdown button) both inside and outside engine room and interconnect them toPowerlinkgasgenset control system.

In Powerlink containerized gensets, users need install a manual emergency shutdown device (Emergency shutdown button) outside engine room and interconnect those toPowerlink gas genset control system.

Emergency shutdown buttonmust meet the requirements of ISO 13850 and IEC 60947-5-5 electrical equipment.

2.2.3 Installation

2.2.3.1General

When the genset is delivered,it is advisable to check that the received machine matches the order, and to compare it with the delivery note.also, check that the machine is not damaged.

If any flaw is detected,you must contact the ship-ping company immedidately in order to report the incident to the insurance company.

2.2.3.2Outdoor installation

The genset should be installed in an area that is protected from direct harmful gases or liquid,dust, metallic particles, shock,vibration.

The container type genset can be installed outdoors. There should not be a cool-ingproblem.The factory installed enclosure is designed to keep out undesirable weather elements while providing cooling and ventilation. In addition, several other facors should be carefully considered when selecting a location for installation.

- Access must be provided to allow the sound-proof bonnet or control cabinet to be opened or removed for service and maintenance.
- Installation should prevent water level from reaching the genset.Drainage must be adequate to keep concrete pad free from standing water.
- Installation should prevent obstructions by build upleves, gass, sand,snow etc. If these items pose a problem, consider building a small fence or other break to protect the unit from accumulation of debris.
- At least 1.2 meters(47.5 inches)clearance must be provided on all side for air flow. And be careful,the exhaust gas pipe and hot air exhaust pipe can’t face the doors or windows of the buildings.
- For effective cooling and maintenance,generator set should be carefully evaluated when selecting a location for installation.
- The safe loading capability of the geological material should be carefully evaluated when selecting a location for installation.

2.2.4 Hoisting of Genset

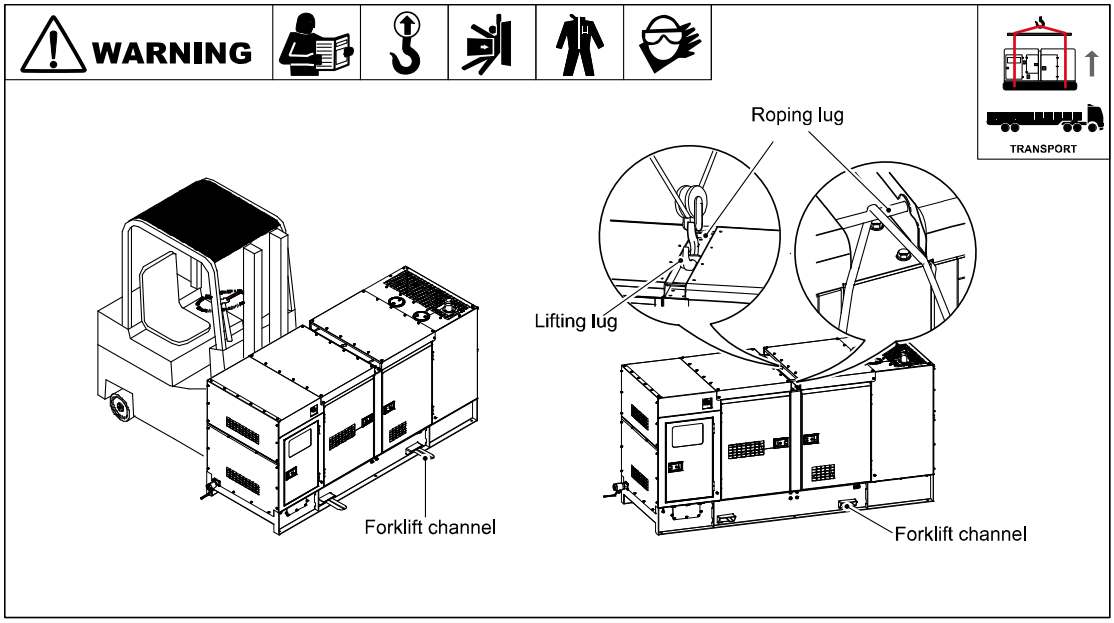
Prompt

Regulations must be strictly followed when moving or hoisting genset. Moving or hoisting genset wrongly can damage severely equipmen
This will invalidate the compensation right and quality guarrantee right to Powerlink.

2.2.4.1Preparations Before Moving and Hoisting Genset

Regulations must be strictly followed belowbeforehoisting genset.

- It's forbidden to lifting genset though engine or alternator lifting lug.
- Check the lifting lug before hoisting genset, if we found any fissure, lifting lug must be replaced immediately.
- Keep genset level when liftinggenset.
- Close all doors of genset.Completely discharging coolants in genset or closing the valve door of pipeline so as to avoid leaking.
- Anybody should be allowed to close genset, when hoisting genset.



2.2.5 Gas and Smoke Alarming Equipment

According toPowerlinkregulations about gas genset safety, soundable (Alarming trumpet) gas and smoke alarming equipment must be equipped on genset.

Operators are responsible for following relevant safety regulations and installing gas and smoke alarming equipment.

Sensors used should be not less than recommended amount prescribed in technical guidance.

·Using gas fuels: At least 1 sensor.

·Using non-gas fuels: At least 2 sensors.

·There is carbonic oxide in gas: Proper amount of carbonic oxide sensors (at least 2 sensors) should be equipped in accordance with equipment condition. Adjust these sensors according to gas elements (Be careful of poisonousness)! Please pay attention to gas analysis results!

Where gas alarming sensors should be installed should adhere to following principles:

·If natural gas engine is used; One sensor should be installed above gas control system.

·If non-natural gas engine is used; At least2 sensors should be used.

One sensor should be close to ground and the other one should be above gas control system.

·If gas contains carbonic oxide; Carbonic oxide sensor should be used under following circumstances:

- If gas does not contain odorous substances and carbonic oxide in it>0 %.
- If gas contains odorous substances and carbonic oxide in it>0.5 %.
- At corridors, especially corridors near dangerous areas (near gas-conveying parts)
- Dead angles without ventilation property (Bad-ventilated room).

▪Installed at breathing height.

2.2.6Gas

Please refer to and observe following: technical guidance:**'*Technical Guidance*：*PL20140505-06: Gas Quality Declaration***'.

In general, gas pressure-controling system is designed according to actual pressure requirements. Its must be ensured that gas pressure before connectors or valve trains (Not in the delivery scope ofowerlink) should not be overthe permissible maximum value.

Gases conveyed into genset through supply pipes by Powerlink mean gases outside engines (Mixture connecting point) and without explosive possibility. Accessory equipment should be installed when necessary in accordance with equipment condition and currently local regulations (Such as gas-density monitoring/adjusting equipment→emergency shutdown equipment).

Besides, a manual closing organ is recommended to be installed outside engine room. It's best to install the organ in the inlet through which gas enter engine room to make it easy to close equipment (when repairing, servicing and under emergency circumstances).

Manual shutdown equipment should be with proper structure. Make sure that nobody can operate it without approval and that closing equipment cannot be opened when locked.

If gas contains a certain amount of carbonic oxide: If the amount of carbonic oxide in gas**> 5 %**, nitrogen washing equipment should be installed.

Operators have the responsibility to install necessary devices for gs equipment to ensure gas equipment will be leak and to meet relevant regulations.

2.2.7 Than minimum methane amount

If methane is lower than the minimum amount agreed in contract (Refer to technical specification), engine's adjusting system will automatically adopt following measures to achieve zero-knock running, which will avoid damage to engine caused by knock:

1.Lower mixture temperature (Just install corresponding regulator and be allowed by environment).

2. Delay ignition timing in permissible scope (This will reduce efficiency meantime).

3. Engine's power decreases.

4. If measures above cannot prevent knock, knock-monitoring system will automatically shut

down genset so as to protect engine.

2.2.8Inhaling Air

2.2.8.1 Engine Room

As for ventilation system, pressure draught fans should be installed in engine room under normal circumstance. If this regulation cannot be followed, it's necessary to seekPowerlinkfor technical approval opinions.

Prompt

Atmospheric pressure change (For example, this is caused by switch operation of ventilation system) will affect mixture from forming in engine. It will abnormally start up or detonation!

a) Before starting up genset, you must start up the ventilation system in engine room. Only in this way, ventilation system can meet the running and using conditions when genset is starting up and loading (including stable running).

b) Ventilation system in engine room cannot be operated before during the startup and loadingprocess of genset and before genset becomes stable.

Engine Room Inhales Air：

Air without dust must meet the cleanliness degree regulated byEN 779 or meet 85% degree of separation regulated by ASHRAE. % Particle, dust and air filter of corresponding filtration degree should be equipped on genset when necessary.

Inhaling flaming air from engine room:

Air supply system inhales combustion air from engine room for burning. F6 air without dust meetingEN 779 regulations should be designed. Besides, use engine room lining absorbing dust and fiber according to special requirement. Filtration precision should not lower than the requirements of air filters. If air conditioners are installed in engine room, air must be inhaled from outside room:

Maximum temperature in engine room:

Difference between temperature of cooling air and combustion air of engine and cooling air inhaled by generators and external temperature should be as small as possible. Temperature difference caused by this should not over10 °C. Inlet temperature of engine room should be lower than40 °C. If the actual circumstance cannot be met, its' necessary to conduct special adjustment after being approved by Powerlink.

Temperature in engine room caused by this should not be over 47 °C.

Temperature difference should be 10 K when setting air amount.

Highest inlet temperature (At engine's air filter):

Proper measures must be taken to keep combustion air at reasonable level(Based onISO 3046 standard regulation,temperaturecan decrease15°Cor increase20°C) and temperature can at most fluctuate ±1°C of limit value. Draught fans with adjustable speed should be used in order to meet conditions.

Prompt

Limit values of air pressure, air intake temperature and air humidity regulated by ISO 3046 standard should be observed: 1000 mbar , +25°C , 30% humidity. If actual number differs from those, engine power of different models will change correspondingly. All engine manufactures should abide by these standards when installing and operating equipment. However, you can agree other terms before placing an order! For instance, it's fully loaded when intake temperature is 40 °C. For this, it's a must to adjust supercharging system and modify relevant technical parameters. These agreements must be written in the specification letter.

Lowest intake temperature and temperature in engine room:

Startup features, starter's power and starter battery of engine are all designed according to lowest ambient temperature (+10 °C). Consumses can buy electrical preheating device for engine's cooling water fromPowerlink. When electrical preheating device is running, start up and shut down fans at intake points, doors and inlet points.

Air in engine room:

The maximum of sulfur density in air inside engine room< 1.5 mg/m^3

Dust content: ≤ 1 mg/m^3

Engine room's ventilation:

Engine room's ventilation system must be designed in accordance with following requirements:

·Good ventilation condition should be kept in whole room (Prevent gases and heat from accidentally accumulating).

·Directional airflow should be kept above engine to ensure the surface temperature of electronic parts on engine (such as ignition system, ignition coil, gas intake valve, knock-monitoring sensor and actuator) will not be over +70 °C！ Failing to meet this

requirement will greatly shorten life span of these parts and fault frequency can also increase considerably. Losses and shutdown caused by this are not in the range of quality guarantee. So, it’s necessary to control the speed of frequency modulation's fan (FM) so as to keep genset running stably.

Design Notes:

- Generator side-absorb air: Generator's cooling air + 1/2 thermal radiation
- Absorb air from inflation side:Combustion air + 1/2 thermal radiation

2.2.8.2Generator's Cooling Air

Air intake temperature: maximum 40°C

Relative air humidity: maximum 80 %

Dust Content: ≤ 1 mg/m^3

SO_2 Content≤ 1.5 mg/m^3

It's necessary to examine generator's technical requirement and make corresponding changes when air intake temperature is over 40 °C.

2.2.8.3Cooling air used on module/genset's switch cabinets

Ambient temperature of module/genset's switch cabinet is not allowed to be over47°C. Natural ventilation system or forcible ventilation system should be equipped for switch cabinet according to internal power loss. This can help ensure temperature of switch cabinet will not pass 55°C.

If ventilator cannot ensure the actual temperature is lower thanthe highest temperature of switch cabinet (47°C), then it's necessary to informPowerlink. When ambient temperature reaches53°C, air-conditioner can be installed to reach the goal.

2.2.9Lubricating Oil

Please refer to following technical guidance:

Prompt

Copper materials can resultengine oil in ageing!

Copper has as extreme oxidization effect on lubricating oil and accelerates ageing process, especially when temperature is high.

a) Pure copper cannot be used on oil inlet pipes to engine and valve door.

b) Use colomony with nickel content≥ 10 %. This alloy can replace normally used metal pipes.

- Technical Guidance:'***PL20140718-06: Oil selection***'

2.2.10Exhaust Gas

Running fault on engine can cause backfire to enter exhaust manifold. So, the whole exhaust system must be able to bear a short-time pressure peak value of 6 bar. Pressure of vacuum appearing following pressure peak may be over 200 mbar. This question should be taken into consideration when designing exhaust manifold.Special attention should be paid to buckling-resistant intension of internal pipes, especially when long double-wall chimney is used. As forthe permissible maximum exhaust back pressure, please refer to technical specification and technical chart. If one device is equipped with more than one engine, then exhaust systems are not allowed to be combined. Exceptional cases:

- Eachgenset is equipped with a double shutoff valve and middle ventilation device
- When there is always only vacuum on merge point (Such as ventilation pipe in chimney).

Condensate water produced on mufflers and exhaust pipes should be disposed with proper methods. It's not allowed to merge condensate water pipes.

2.2.11Operation and Maintenance

Shortest operation time

12 operation hours after each startup, except from commissioning, maintenance and emergency generation modes. If there is a difference, increased maintenance cost should be calculated.

Operating in idle

Control time via genset control system (Except from maintenance and regulation: Idle running should be as short as possible).

Isolated Network Operation

Daily Inspection

- Record running log
- Conduct maintenance according to Powerlink maintenance schedules.
- Observe all requirements regulated by Technical Guidance

All interior of pipelines must be washed clearly, especially wielded pipelines; For instance, gas pipes, oil pipes, cooling water pipes, control pipes. As for guidance instructions, please observe.

- Technical Guidance: '***PL20150624-06:Pipes***'

When signing contracts, latest modification contents are valid.

2.3Requirements for Gas Genset's Operation and Maintenance

Prompt

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Ignoring relevant requirements in this technical guidance or failing to follow or even violating instructions will invalidate the quality-guarantee right and compensation right toPowerlink. Not applicable to following circumstances: If operators can ensure that faults have already existed before delivery or commissioning even though following the technical,Guidance.,Equipment operators should carry out operations and abide by the requirements in this technical guidance. Not applicable to following circumstances: It's clearly defined that it's Powerlink responsibility by current technical guidance or operators and Powerlink have agreed safeguard provision in contract.

2.3.1Limited Supply of Connectors

Requirements for limited supply/connectors regulated in technical flowchart, circuit diagram and connector list and technical specification of control system must be followed, and necessary equipment must be equipped. If it is violated, product feature and operation reliability will be affected. And this will eventually influence or even invalidate warranty right.

2.3.2Maintenance Personnel

Maintenance personnel can only allow professional staff with relevant electrical and mechanical training to operate equipment. It's also possible tosign and service agreement with Powerlink.

2.3.3Safety Regulations

Safety regulations in operation regulation must be observed. Current safety and accident-prevention rules regulated by laws must be paid attention to. Before carrying out any work on equipment, entrusting party must assure the work meets current safety regulations. If the work can only be done when engine is shut down,it'e necessary to take proper measures to prevent machines from accidental starting in according to technical guidance.Operators must ensure enough light in maintenance and service sites.Mobile light must be provided when necessary.

2.3.4Keep Clean When Working on Powerlink Equipment

- When working on Powerlink engines, please note that cleanliness on equipment and components should be ensured under any circumstance.
- Working area must be cleaned completely and dirt and sediment on exterior of engine must be removed before opening its components or parts.
- Select suitable cover plate and protective devices according to the work to be carried out.
- When installing components, please note that components and all protective cover plates inside and outside of pipes must be removed again.
- Before commissioning again, please make sure that no foreign matter, dirt, loose bolts or remained tools exist in system.

Failing to observe these requirements will damage components, system and even people!

2.3.5Risk Evaluation

Equipment operators (Employers) are responsible for taking necessary measure through risk evaluation to ensure to safely use and operate equipment and working mediums. They are also responsible for observing current safety rules and laws and regulations related to equipment running. Employers must take essential measures to make sure working mediums used by staff are applicable to working sites. Using these mediums in accordance with regulations can ensure safety and health.

Risk evaluation involves inpermission, planning, installation, commissioning, operation, maintenance, service and blocking up.

Operators carry out risk evaluation to equipment and observe corresponding safety rules and laws and regulations. Operators have the responsibility to take and carry out these additional measures.

2.3.6Requirements for Start Operation

Powerlink engines cannot be loaded immediately in the beginning of startup. Only after engines run in idle for over10s, can they be loaded continuously;As for ambient temperature is low, it's necessary to use water jacket preheater (It can be bought from Powerlink) to heat cooling water in engines to over 40°C before starting up engines. Or, engines can be damaged.

2.3.7Faults

When engine goes wrong, genset monitoring system will automatically shut down engine. You cannot just handle fault information, without excluding the reasons, because this will cause components to be damaged or corrosively damaged.In this way, components will be replaced for early corrosion.

As for other shutdown faults, one and more times of trouble information shooting but without reason shooting, it will severely damage personnel and machines. Users (or operation personnel) will be responsible for any loss caused by this.

2.3.8Operation Data Log List and Maintenance Log

All operation data and special incidents must be recorded completely.

Note: Cases should not be recored just in written form; they should also be compared with commissioning data. Beside, reliability should also be checked. If there is a difference or abnormal noise, you should look for and exclude troubles. If it cannot be done, please consultPowerlink's customer service department immediately.

Users should manage operation data log tables by themselves (Maintenance log and operation data log). Operation data log book and data log table recorded according to requirements are of importance, which are helpful for analyzing and handling troubles. Besides, these documents are important ground for dealing with warranty problems.

2.3.9 Spare Part

OnlyPowerlink's original spare parts or those approved by Powerlink can be used (Note: such as oil filter). Defects and losses caused by not using original spare part or those without approved byPowerlink are not in the scope of warranty scope.

Important Notice: It’s strongly recommended to reserve frequently-used spare parts in order to avoid unexpected shutdown becaused of maintenance.

2.3.10Lubricating Oil

Powerlink has set out maintenance interval for lubricating oil. Users should shoulder the responsibilities to take necessary measures to ensure stable running of equipment

Service time of engine oil depends on environment condition,gas quality, average pressure, engine model, oil consumption, oil temperature, oil type and so forth. If a claim is raised for abrasion ahead of time, complete lubricating oil analysis result should be submitted, even after the warranty period.

2.3.11Spark Plug

Powerlink has set out replacement interval. Users should strictly follow replacement interval so as to ensure safe operation of equipment and available usage at any time.

2.3.12Elastomer Parts

Even though engine isn't started up, elastomer parts can also be ageing and tendering. Hence, service time of elastomer parts depend on not only the running time of genset but also cooling water temperature and pressure. Generally, when cooling water temperature is90°C, elastomer parts should be replaced according to prescribed interval in maintenance schedule every5000-6000 operation hours. If operation time is less than this, elastomer parts should also be replaced at most after5 years (O-type ring, elastic coupling and so on).

2.3.13Shutdown Preparation of Genset

If shutdown time within the plan or out of plan is quite long, corresponding preparation work (such as preservative treatment, replacing dated lubricating oil and disconnecting chimney) should be done for engine system as for different shutdown times in according to environment and usage conditions (such as weather, coastal area and gas type).

As actual circumstances vary a lot, it's recommended to take measures after consulting professional companies or entrust professional companies to handle.

Equipment only can be started up only after recovering to good working condition.

2.3.14Welding Working on Genset

When welding on genset, negative pole should be placed as close to to welding position instead of ground (Grounding cable).

In order to avoid damaging the ignition strip of genset, ignition strip should be dismantled and placed in dry places before welding on genset. Only after finishing welding on genset, ignition strip can be installed and connected in a right way.

2.3.15Spare Parts touching Exhaust Gas

All spare parts touching exhaust gas are made of materials up to latest technical standards, which can operate normally in prescribed time. As working ways and gas contents (including traces of hazardous substances) vary much from each other, it's not possible to definitely describe life spans of these spare parts (such as exhaust manifold). When a muffler without externally heat insulating function is placed out of room, condensate water (acid liquor and water) can form in exhaust gas heat exchanger (hot exhaust gas, which will shorten service life. This description also applies to internal insulating muffler placed in mineral wool below dew point.

2.3.16Operation Materials

Service life and operational reliability of equipment depend mainly on operation materials used. Only operation materials (such as gas, engine cooling water, antifreezing agents, anti-corrosion additive and lubricating oil) up toPowerlink relevant technical guidance requirements can be used.

2.3.17Requirements of Gas Quality

Users should regularly examine gas quality and analyze gas elements, such as calorific value, methane number and content of hazardous substances. If these values differ from those agreed in contract, please negotiate immediately with customer service department ofPowerlink and take proper measures. If contents of hazardous substances (such as methane and landfill gases) increase, lubricating oil can acidate severely during regular replacement interval and serious or unrepairable damages and excessive wear (such as cylinder jacket and bearings) can happen in a short time, or oil consumption amount will increase greatly.

If methane number fluctuates downward (in the range agreed in contract) control system willtake measures to prevent harmful knock (automatically regulate ignition timing and decrease power).

Remarks:

During commissioning, engine should be regulated to the most suitable condition according to the currently known methane number.

If methane number increases after commissioning (In long time of running or main time range), engine settings should be modified to optimize operation efficiency. Please consult Powerlink to seek treatment methods or entrust professional personnel to undertake this work.

2.3.18Maintenance Personnel

Interval period prescribed in maintenance schedule is average reference number. If operation and maintenance conditions differ from those prescribed (such as lacking in oil maintenance, dust existing frequently or other harmful circumstance), it's essential to think about maintenance ahead of time)

Users should be responsible for making judgement according to actual circumstances, especially when undertaking daily check in warranty period.If abnormal circumstance is detected (such as abnormal noise), users shoule take proper measures immediately to minimize potential losses (such as shut down engine, examine and trouble shooting or inform customer service department ofPowerlink .

In order to achieve trouble-free operation or avoid operational disruption (such as during

heat-supply period) because of maintenance, necessary maintenance work should be done before maintenance interval. During heat-supply season, maintenance interval is not allowed to be extended for avoiding shutdown.

2.3.19Manufacture Information Supplying Relevant Parts

User documentation offered by Powerlink contains not only relavant files related to Powerlink products but also information offered by purchased part supplier.

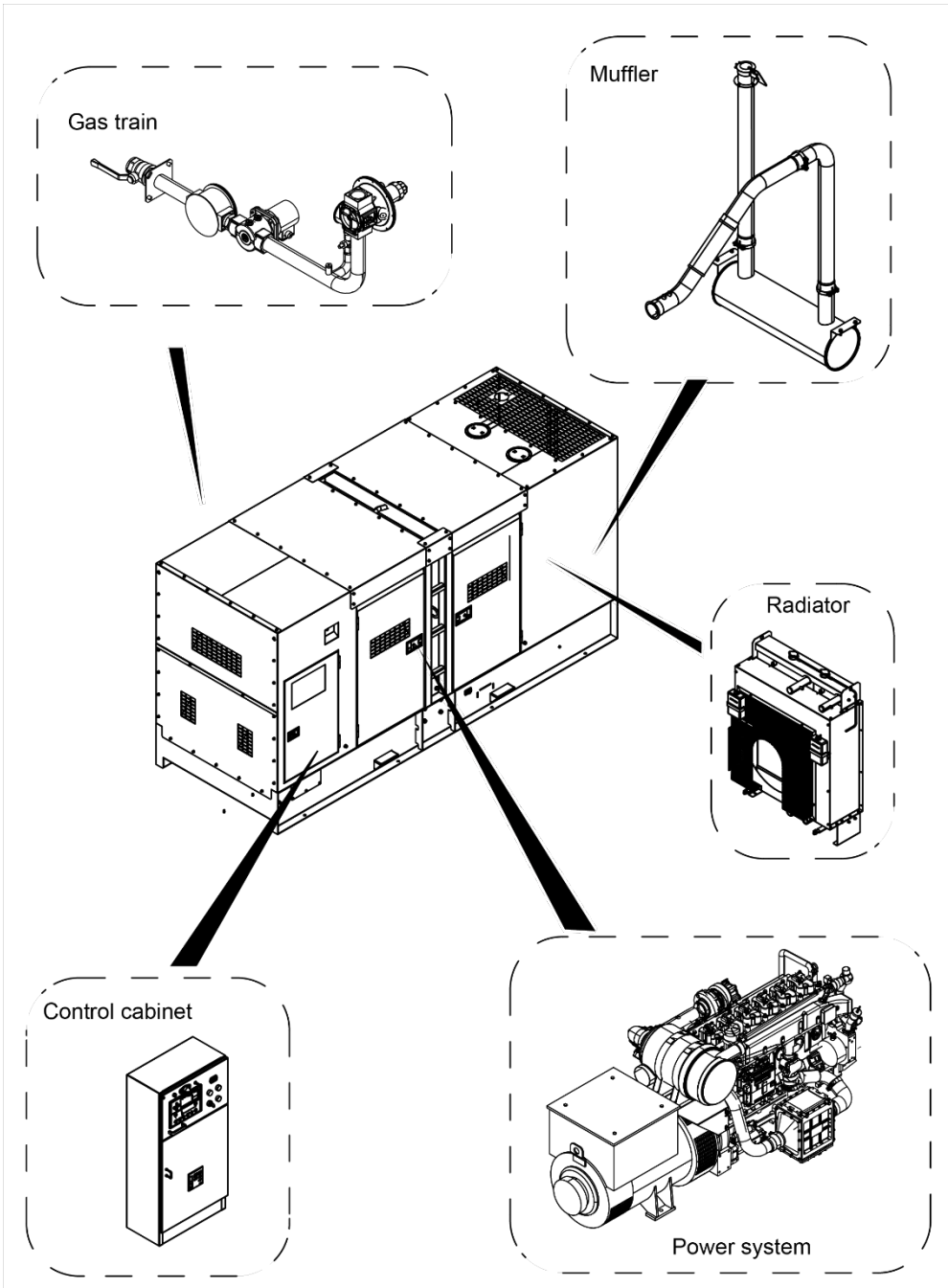
Please note:

- When compiling Powerlink documentation, we had already taken full consideration of relevant information and information offed by purchased part suppliers.
- When Powerlink documentation differs from attached information offered by purchased part suppliers, Powerlink documentation shall prevail (including relevant technical guidance, maintenance schedules and maintenance).
- Attached documentation offered by purchased part supplieris supplementary toPowerlink documentation and can be regarded as reference. It should also be paid certain attention.

Genset Equipment

3.1 Summary

A genset generally consists of a power system and a control system and also includes a control panel, a switch cabinet, a radiator, a gas supply system, startup and control storage batteries, protective equipment, a lighting system, muffler and a common base. The below figure is its structural indicator diagram.



3.2Parametes

1) Performance dataand manufacturing technology

Gas Unit performance data and manufacturing technology		
Gas unit model	GXE250C-NG	
Rated electric output power (kW)	250	**Manufacturing technology** ● Special welded base frame, inner vibration isolators and design for whole lifting ● With high quality paint, endurable brightness as well resistance against abrasion and defacing ● Installation manual, operation and maintenance manual circuit diagram **Standards and certificate** ● ISO3046 , ISO8528 , GB2820 ● BS5000PT99 , AS1359 , IEC34 ● ISO9001:2008 quality system certification
Ratedelectric efficiency	36.2%	
Overload runtime at 1.1xSe(hour)	1	
Steady-state voltage deviation	≤±1%	
Transient-state voltage deviation	-15%~20%	
Voltage recovery time(s)	≤4	
Voltage unbalance	1%	
Steady-state frequency regulation	±0.5%	
Transient -state frequency regulation	±5%	
Frequency recovery time(s)	≤3	
Steady-state frequency band	0.5%	
Recovery time response(s)	0.5	
Telephone interference factor(TIF)	≤50	
Telephone harmonious factor(THF)	≤2%	

2) Structure and Control Cabinet

Structure and Control Cabinet	
Structure Type	Soundproof canopy
Spraying Process	High quality powder coating
Electrical control cabinet	Integrated ,IP54
Noise level@7m,dB(A)	< 69

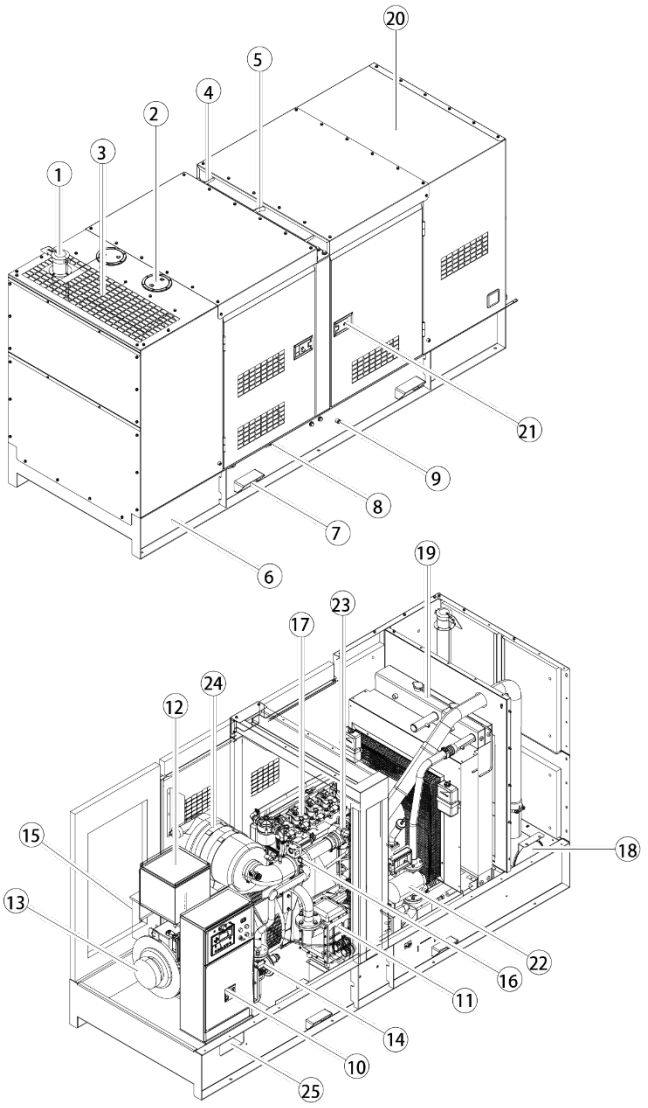
3) Dimension and Weight

Dimension (LxWxH) mm	
Dimension (LxWxH) , mm	4200X1478X2134
Weight, kg	3198
Note: Dimension and weight above are just for standard product, and may be subject to change. As this document is used only for presale reference, take the specification supplied by PowerLink before ordering as final.	

4) Fuel and Emission

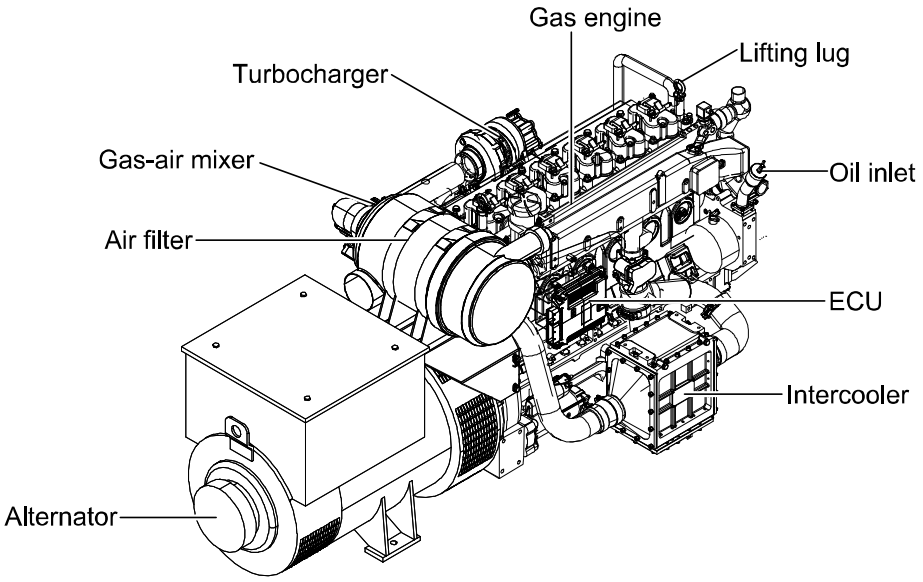
Fuel and Emission	
Fuel type	Natural Gas
Methane number	MN >80
Excess air factor（Lambda）	1.4
NOx，mg/Nm^3	<500mg/Nm³
CO，mg/Nm^3	<650mg/Nm³
HCHO（formaldehyde），mg/Nm³	<60mg/Nm³
NMHC，mg/Nm³	<150mg/Nm³
Fuel consumption @100% load, m³/h	73
Supply gas pressure range (gage pressure), kPa	10~20

3.3Genset Structure Overview



3.4Power system

Power system



3.4.2 Engine

Summary：This genset adopts 6-stroke，Turbocharged with intercoolered，lean burn, gas engine.

Gas engine			
Brand	Powerlink	Excess air factor	1.4
Model	GX13K-LE02G	Intake system	Turbocharged, intercooled
NO. of cylinders	6	Oil consumption（kg/h)	0.062
Cylinders arrangement	In line	Combustion type	Lean burn
Bore x Stroke (mm)	129x165	Battery voltage	24V
Displacement (L)	14.6	Coolant type	Glycol mixture
Cooling system	Water cooled	Gas consumption(m^3/h) @ 100%load	73
Rated speed (rpm)	1500	@ 75%load	54
Rated output power (kW)	265	@ 50%load	38

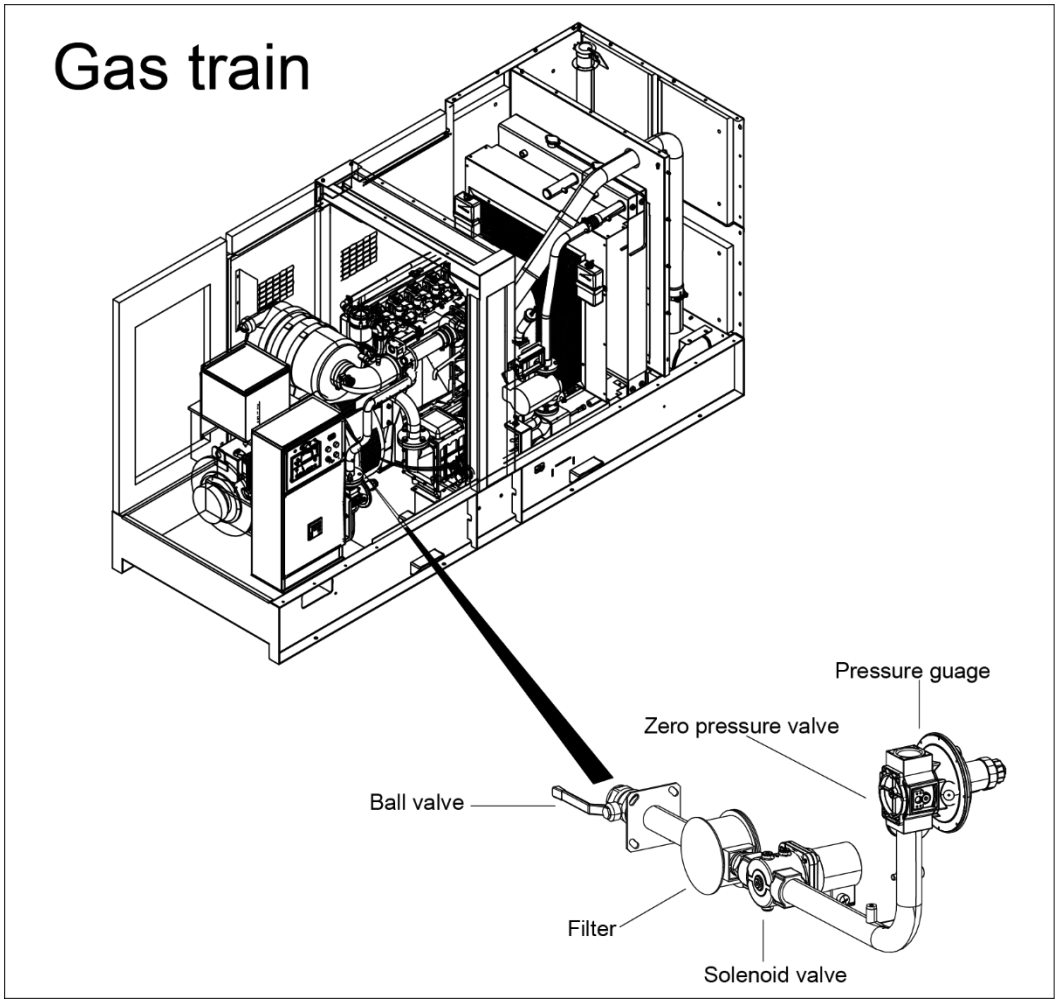
3.4.3Alternative current Alternator

Genset is equipped with alternator with well-know band, with reliable performance and high output efficiency.

AC alternator performance data			
Alternator brand	Leroy somer	Voltage	Power
Alternator model	PL4LS	400V	/
Rated output power @400V (kVA)	280	415V	/
Power factor	0.8	440V	/
Rated current @ 400V and 100% load (A)	505	A.V.R. model	MX341
Excitation system	PMG	Voltage fluctuation(no load to full load)	± 0.5%
THF (BS EN60034- 1)	<2%	Housing protection	IP23
Bearing number	1	TIF (NEMA MG 1-22)	<50
Winding material	100% copper	Excitation method	PMG
Wiring connection	Star	Rated ambient temperature(℃)	40
Rotor insulation class	H	Rated stator temperature rise(℃)	125
Winding pitch	2/3		

3.5 Gas Intake System

Gas intake system of genset is made of gas train parts and connecting pipelines.Gas mixes with air in at a certain ratio through gas train and then enters engine cylinder after being supercharged by turbocharger.



Operatoin of Control System

4.3 Software Operation and Display

4.3.1 Structure Instructions of Software Pages

- **Title Instructions**

①	Company Logo	②	Current Page
③	System Setup	④	Log out
⑤	Help Page	⑥	Communication Status (Click here to quickly enter alarm list page)

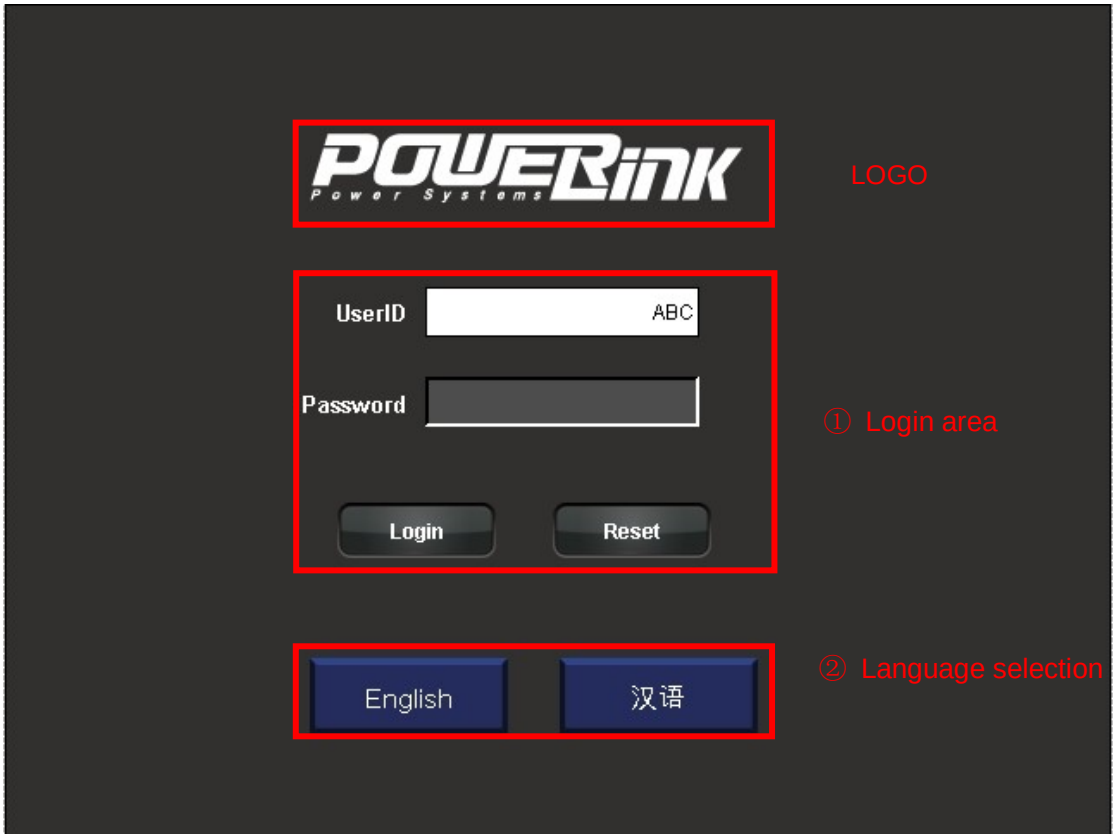
- **Button Instructions**

Click buttons will enter the corresponding pages or to pop up a page select box.

Only authorized engineers can enter the setup page.

4.3.2 Login Page

Insert the control power key, turn the control power switch to the open position, click the display screen switch, the screen lights up, the control system will start normally, the screen will automatically jump into the login page.

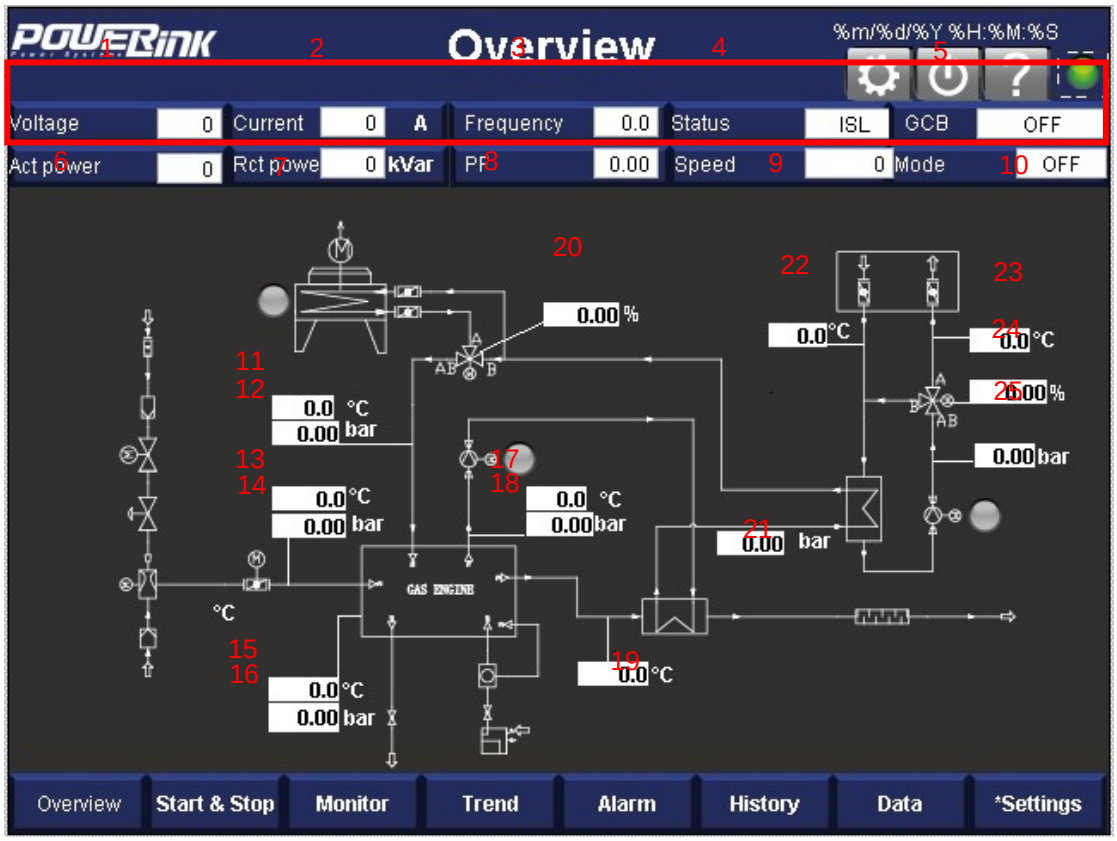


① Click the user name or code input window, the keyboard will pop up. After inputting the name and code, click the below login button. If an incorrect name or code is input, you can click the clear button and repeat the previous operations.

② Language select button. Click the button, and then words displayed on the interface will change to the corresponding language.

4.3.3 Overview Page

After the user enters the correct user name and password, click login, then enter the overview page as shown below.



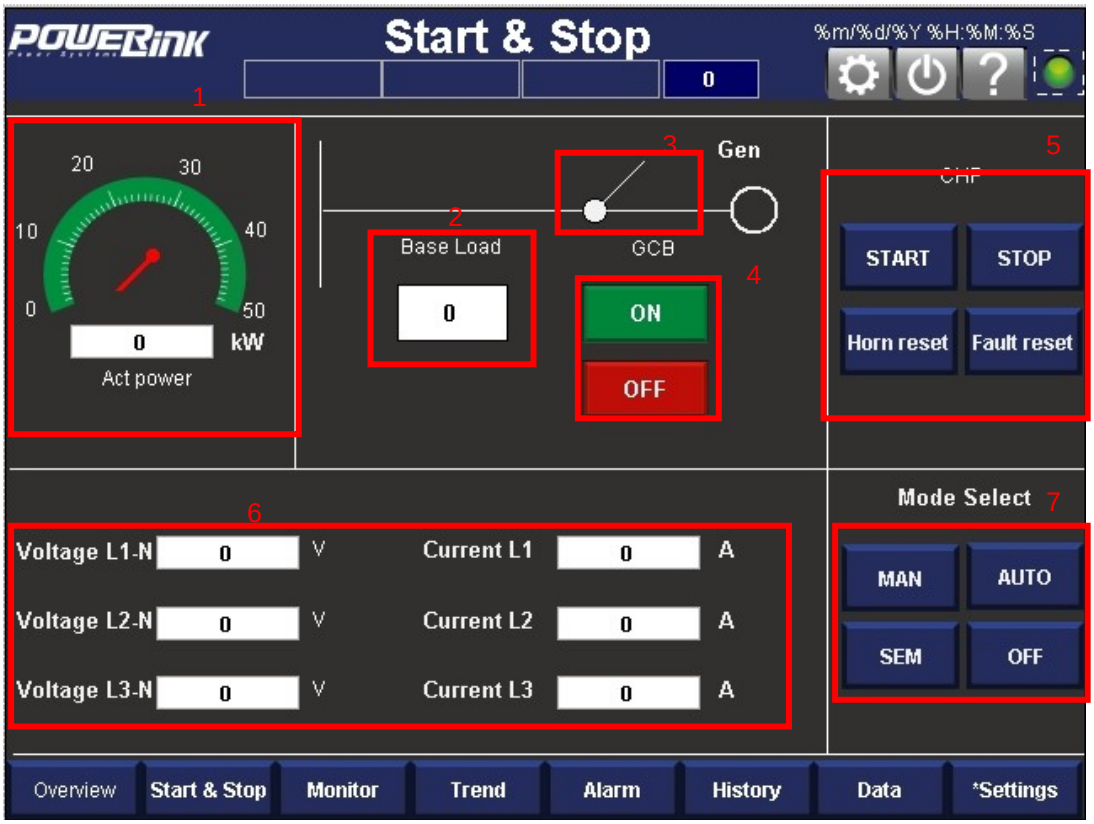
Following data items are on this page. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Genset L1-L2 voltage	display	Real-time display of engine'sL1-L2voltage
2	Genset's L1 voltage	display	Real-time display of engine'sL1current
3	Genset's frequency	display	Real-time display of genset's frequency
4	Genset's operating mode	display	Real-time display of genset's operating mode, parallel to grid/operate in island
5	MCB state	display	Real-time display of genset MCB status
6	Genset electric power	display	Real-time display of genset'sactive power
7	Genset's reactive power	display	Real-time display of genset's reactive power
8	Factors of genset's electric power	display	Real-time display of the factors of genset's electric power
9	Genset's rotating	display	Real-time display of genset's rotating speed

	speed		
10	Genset's control mode	display	Real-time display of current control mode, stop/manual/SEM/automatic
11	Jacket water inlet temperature	display	Real-time display of the jacket water circulation inlet temperature
12	Jacket water inlet pressure	display	Real-time display of the jacket water circulation inlet pressure
13	Manifold's temperature	display	Real-time display of the temperature in the engine's gas intake manifold
14	Manifold's pressure	display	Real-time display of the pressure in the engine's gas intake manifold
15	Temperature of lube. oil	display	Real-time display of the temperature of engine's lube oil
16	Pressure of lube oil	display	Real-time display of the pressure of engine's lube oil
17	Jacket water outlet temperature	display	Real-time display of the jacket water circulation outlet temperature
18	Jacket water outlet pressure	display	Real-time display of the jacket water circulation outlet pressure
19	Exhaust temperature	display	Real-time display of exhaust temperature
20	Opening of jacket water three-way valve	display	Real-time display of the opening of jacket water three-way valve
21	Jacket water pressure	display	Real-time display of jacket water pressure
22	Hot water inlet temperature	display	Real-time display of the hot water inlet temperature
23	Hot water outlet temperature	display	Real-time display of hot water outlet temperature
24	Opening of hot water three-way valve	display	Real-time display of the opening of hot water three-way valve
25	Hot water pressure	display	Real-time display of hot water pressure

4.3.4 Start & Stop page

Click the "start and stop" button to enter the start-and-stop page below.



Following data items are on this page. Specific data items will vary with different gensets:

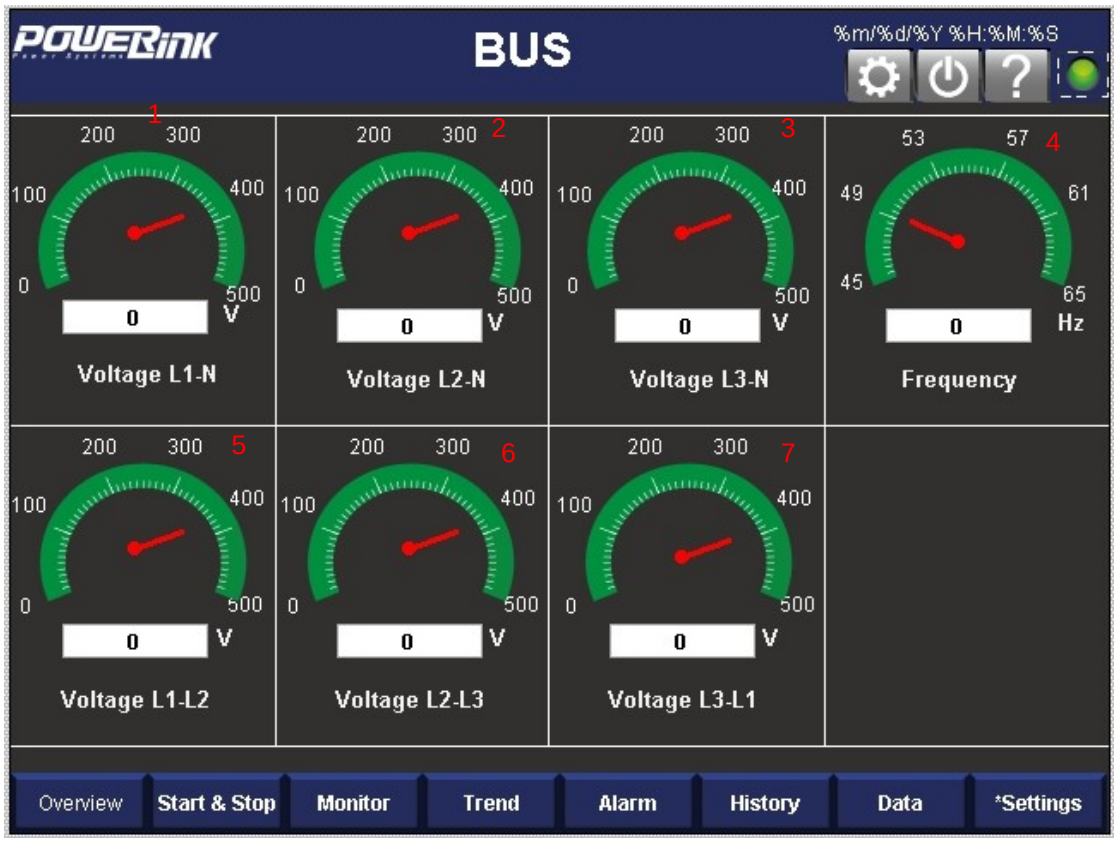
No.	Items	Function	Instructions
1	Genset's active power	display	Real-time display of genset output active power.
2	Elcetric power limits	control, display	Control: Click power limit box, and input the desired power on the pop-up keyboard window (cannot exceed genset's rated power). Click here to input the upper limit power of the limited loading genset; Display: display the upper limit power.
3	Status of genset circuit breaker	display	Connected status of genset's breaker;  Disconnected status of genset's breaker, 
4	Genset breaker ON (connected)	Control	When the genset is operating normally, click "ON", then the breaker will be in connected status.
5	Genset breaker OFF (disconnected)	Control	When the genset is operating normally, click "OFF", then the breaker will be in disconnected status.

6	Genset start up (startup)	Control	Click "Start" button, then the genset will enter the overcrank startup procedure.
7	Genst stop (stop)	Control	Click "Stop" button, then the genset will enter stop procedure.
8	Buzz to reset (buzz)	Control	When the equipment alarms in buzzing, click "Horn reset" button to release buzzing.
9	Fault reset (wrong)	Control	When the equipment alarms because something wrong, click "Fault" button. If alarming is released, the alarming information will disappear and the alarming light will become mute; If the alarming is not released, the alarming information will not disappear and the alarming light will appear again after the light becomes mute until the alarming is released.
10	Genset L1-L2 voltage	display	Real-time display of output voltage L1-L2
11	Genset L2-L3 voltage	display	Real-time display of output voltage L2-L3
12	Genset L3-L1 voltage	display	Real-time display of output voltage L3-L1
13	Genset L1current	display	Real-time display of output current L1
14	Genset L2 current	display	Real-time display of output current L2
15	Genset L3 current	display	Real-time display of output current L3
16	Mode: MAN	Control	When the genset is in stop status, genset will enter manual mode. Under manual mode, it's needed to control the stop, startup, connected status and disconnected status of genset.
17	Mode: AUT	Control	When the genset is under stop status, click "AUT" button, then the genset will enter automatic mode. Under automatic mode, the genset will automatically shuts down and starts up according to program's setup.
18	Mode: SEM (for testing)	Control	When the genset is under stop status, click "SEM" button, then the genset will enter automatic mode.This mode is mainly used for testing.
19	Mode: OFF	Control	When the genset is under stop status, click "OFF" button, then the genset will enter stop mode. Genset cannot control startup or stop.

4.3.5 Monitor page

4.3.5.1 Monitor-mains

Click the "Monitor" button, and then select the "BUS" button to enter monitoring-mains page.

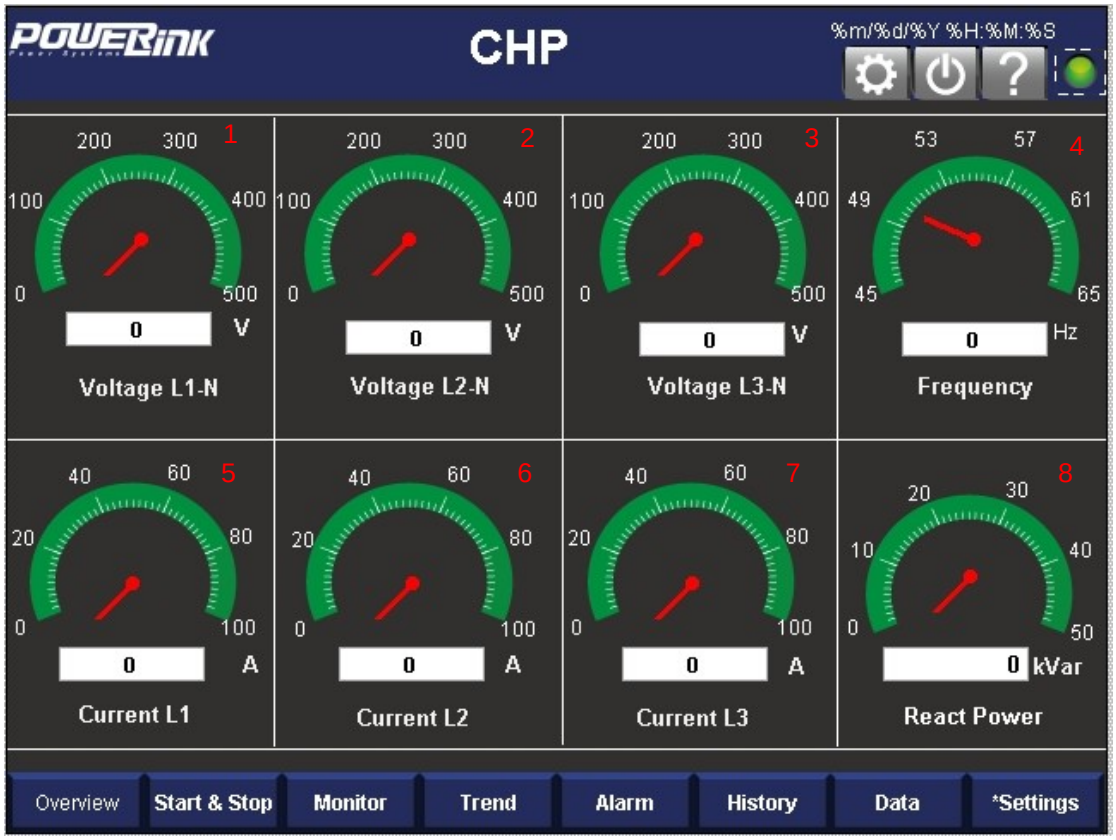


Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Voltage L1-L2	display	Real-time display of mains L1-L2 voltage
2	Voltage L2-L3	display	Real-time display of mains L2-L3voltage
3	Voltage L3-L1	display	Real-time display of mains L3-L1voltage
4	Frequency	display	Real-time display of mains frequency
5	Voltage L1-N	display	Real-time display of mainsL1-Nvoltage
6	Voltage L2-N	display	Real-time display of mainsL2-Nvoltage
7	Voltage L3-N	display	Real-time display of mainsL3-Nvoltage

4.3.5.2 Monitor- genset

Click the "Monitor" button, and then select the "CHP" button to enter monitoring-CHP page.

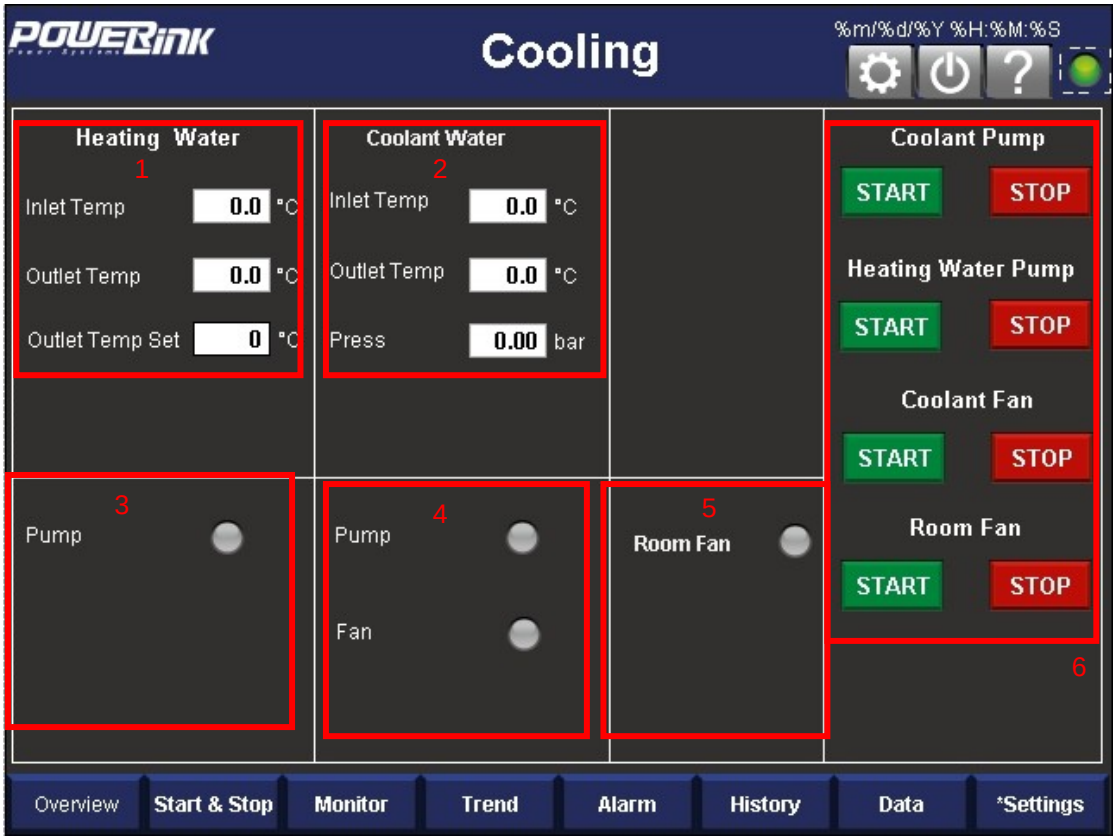


Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Voltage L1-L2	display	Real-time display of genset's generating L1-L2 voltage
2	Voltage L2-L3	display	Real-time display of genset's generating L2-L3voltage
3	Voltage L3-L1	display	Real-time display of genset's generating L3-L1voltage
4	Frequency	display	Real-time display of genset's generating frequency
5	Voltage L1 current	display	Real-time display of genset's generating L1 current
6	Voltage L2 current	display	Real-time display of genset's generating L2 current
7	Voltage L3 current	display	Real-time display of genset's generating L3 current
8	8 Reactive power	display	Real-time display of genset's reactive power

4.3.5.3 Monitor- cooling

Click the "Monitor" button, and then select the "Cooling" button to enter monitoring-cooling page.



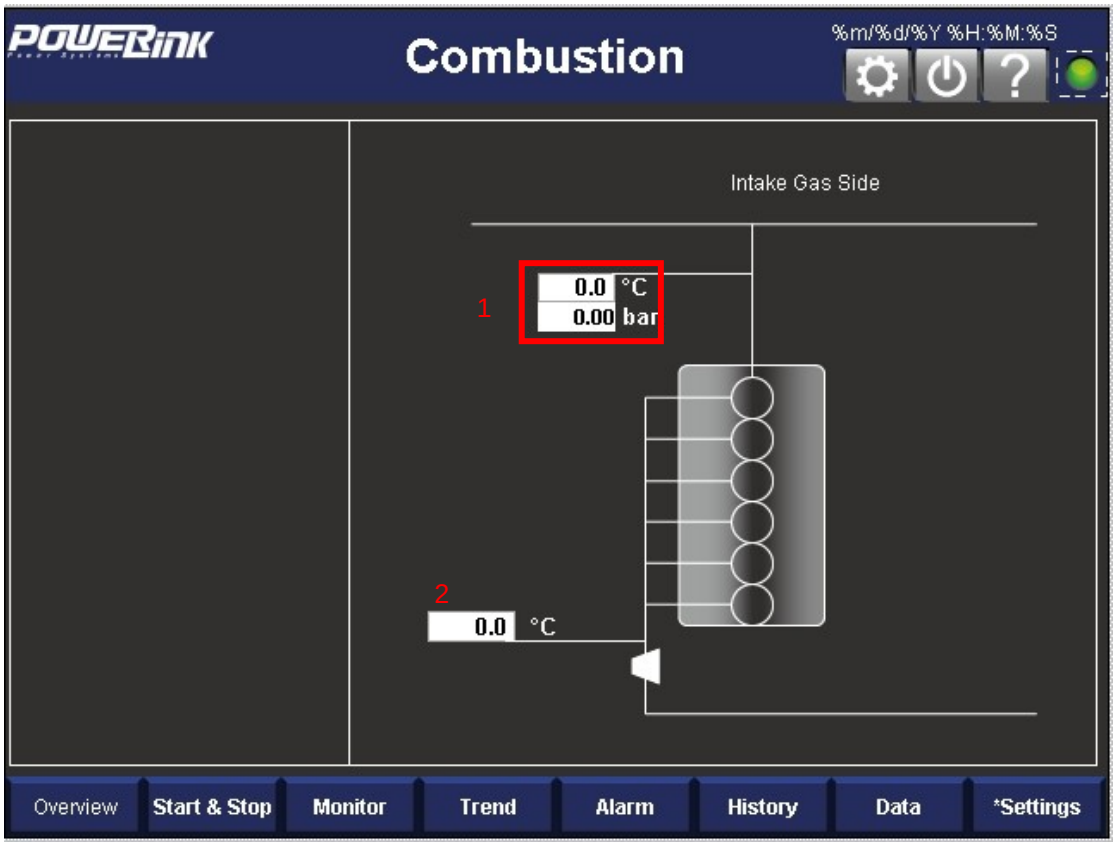
Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Hot water inlet temperature	display	Real-time display of hot water inlet temperature
2	Hot water outlet temperature	display	Real-time display of hot water outlet temperature
3	Setting hot water outlet temperature	display	Set hot water outlet temperature manually
4	Jacket water inlet temperature	display	Real-time display of the jacket water inlet temperature
5	Jacket water outlet temperature	display	Real-time display of the jacket water outlet temperature
6	Pressure of jacket water	display	Real-time display of the pressure of jacket water
7	Status of hot water pump	display	Real-time display of the startup and stop status of hot water pump
8	Status of jacket water pump	display	Real-time display of the startup and stop status of jacket water pump

9	Status of jacket water fan	display	Real-time display of the startup and stop status of jacket water fan
10	Status of room fan	display	Real-time display of the startup and stop status of room fan
11	Control of jacket water pump	control, display	When the genset is under stop status, click "startup" button, the jacket water pump will start up, and the startup button light will be on and the stop button light will be off.
12	Hot water pump control	control, display	When the genset is under stop status, click "startup" button, the hot water pump will start up, and the startup button light will be on and the stop button light will be off.
13	Jacket water fan control	control, display	When the genset is under stop status, click "startup" button, the jacket water fan will start up, and the startup button light will be on and the stop button light will be off.
14	Room fan control	control, display	When the genset is under stop status, click "startup" button, the room fan will start up, and the startup button light will be on and the stop button light will be off.

4.3.5.4 Monitor- combustion

Click the "Monitor" button, and then select the "Combustion" button to enter monitoring-combustion page.

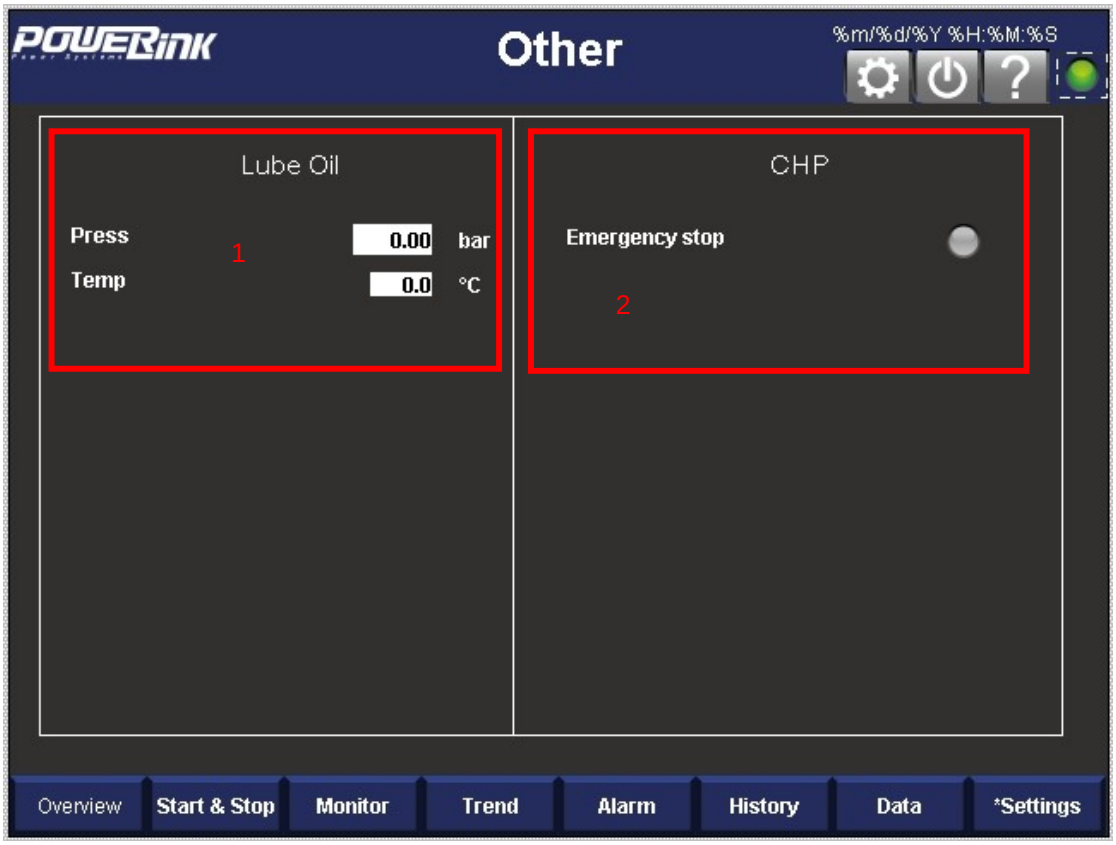


Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Manifold pressure	display	Real-time display of pressure in intake manifold of engine
2	Manifold temperature	display	Real-time display of Inlet manifold temperature of engine
3	Exhaust temperature	display	Real-time display of engine exhaust temperature

4.3.5.5 Monitor- others

Click the "Monitor" button, and then select the "Other" button to enter monitoring-other page.

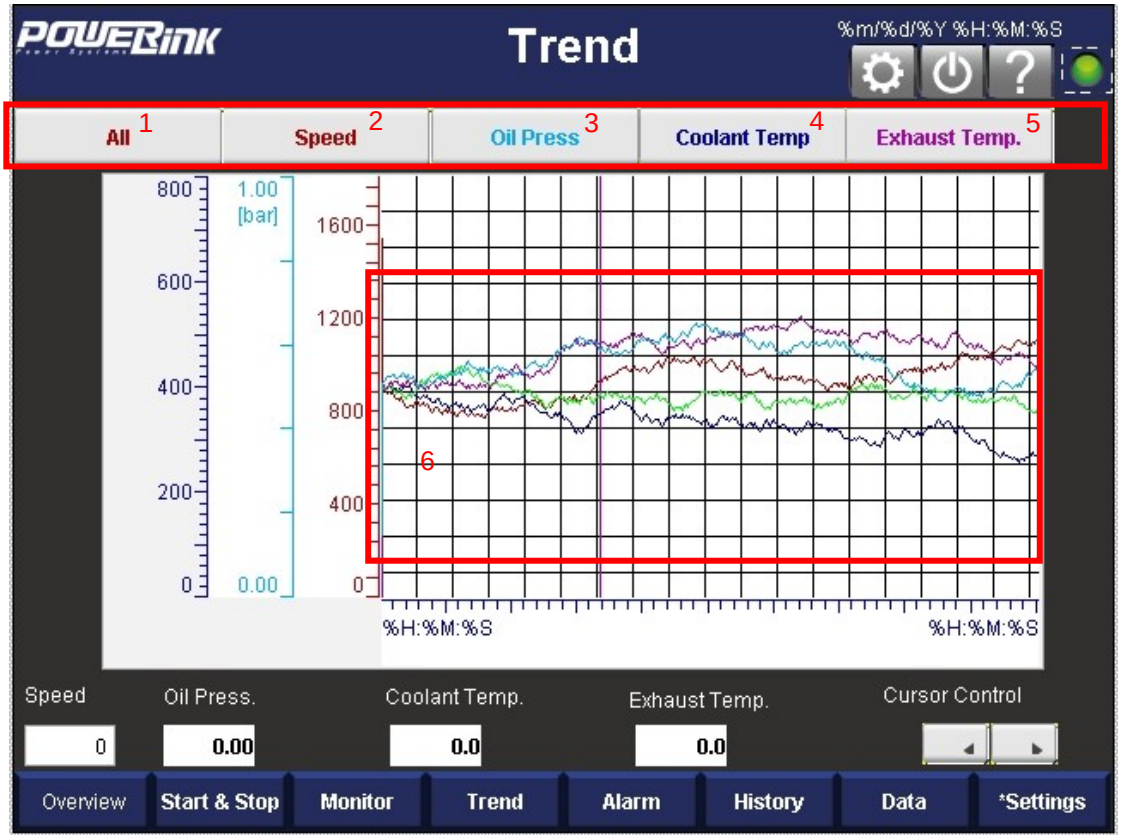


Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Engine's oil pressure	display	Real-time display of the engine's lube oil pressure
2	Engine's oil temperature	display	Real-time display of the engine's lube oil temperature
3	Indication of emergency stop	display	Real-time display of the status of genset's emergency button of

4.3.6 Trend Page

Click the "Trend" button, and then enter trend page.



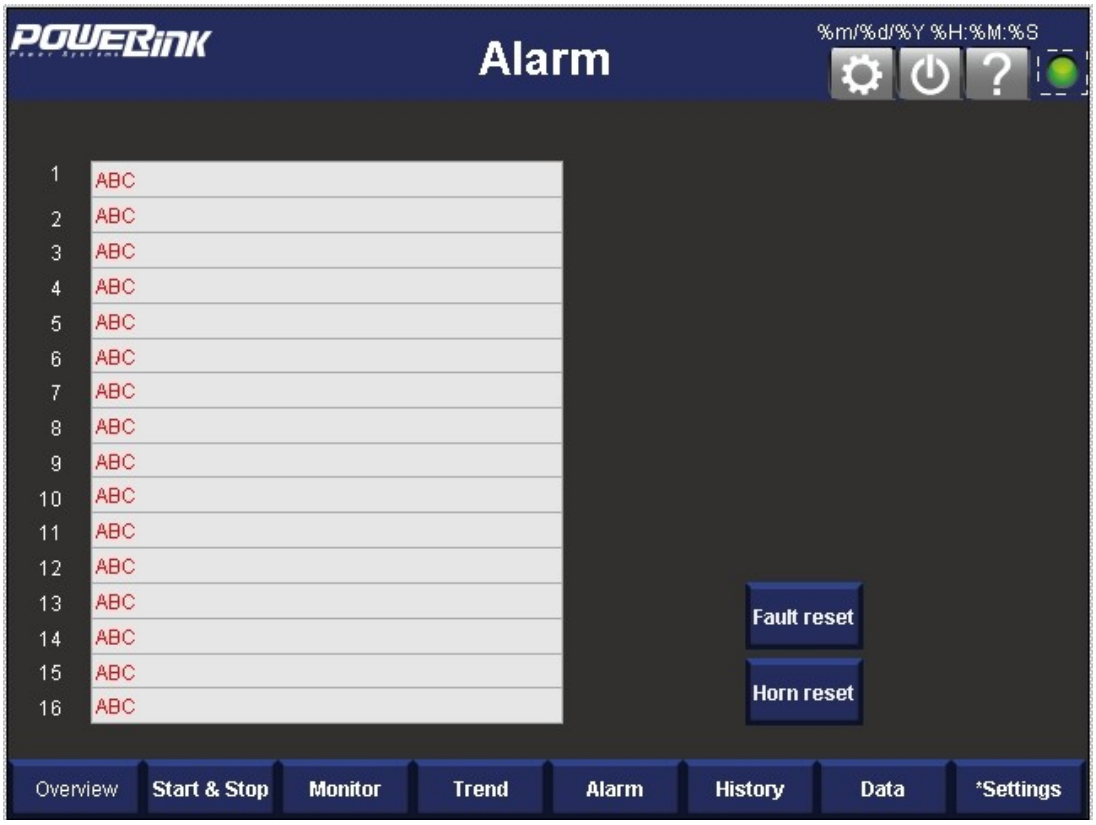
Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	All	control + display	Click button to display engine's history rotating speed, lube oil pressure, jacket water's outlet temperature, temperature in engine's combustion chamber, the temperature after vortex of engine's turbocharger
2	Engine's rotating speed	control + display	Click button to separately display engine's history rotating speed.
3	Oil pressure	control + display	Click button to separately display engine's history lube oil pressure
4	Jacket water temperature	control + display	Click button to separately display jacket water's history outlet temperature
5	Cylinder temperature	control + display	Click button to separately display the history temperature in engine's combustion chamber.

6	Exhaustion temperature after vortex	control + display	Click button to separately display the history exhaustion temperature of engine's turbocharger after vortex

4.3.7 Alarm Page

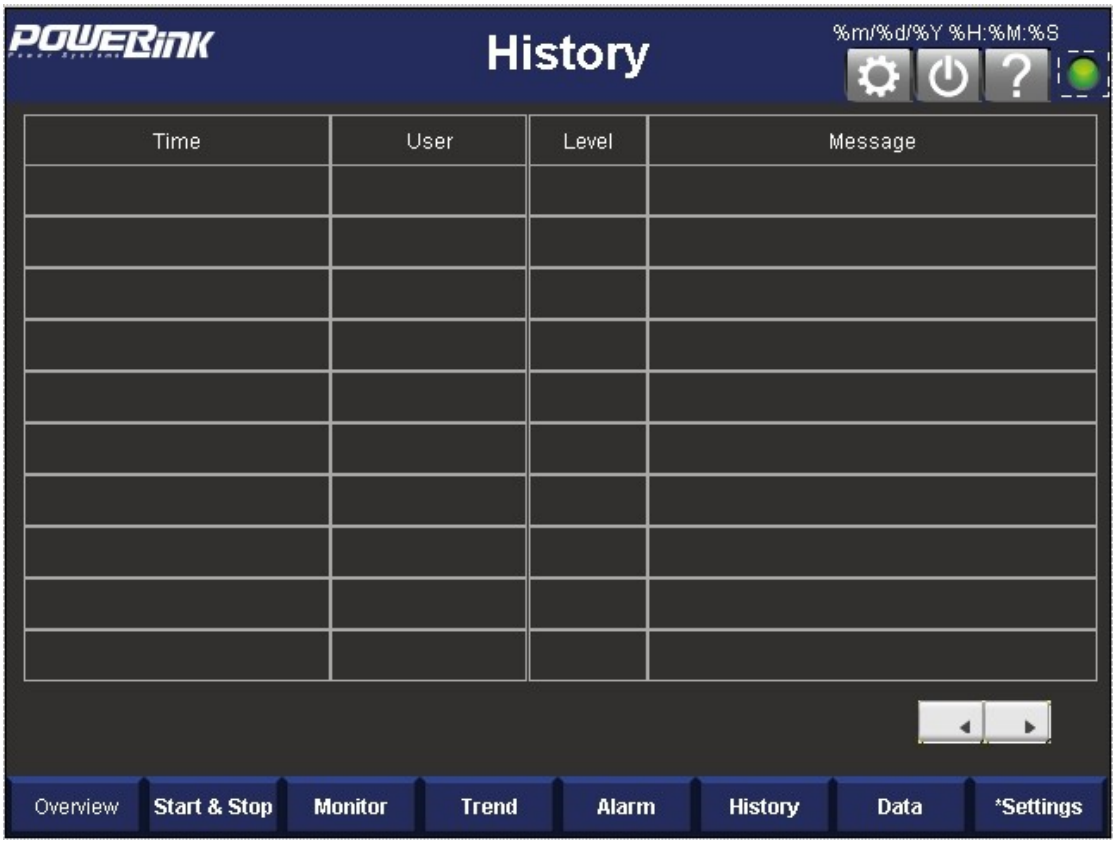
Click the "Alarm" button, and then enter alarm page.



16 alarm information is displayed. The alarm reset operation can be set. Click the “Fault reset“ and ”Horn reset“ buttons to eliminate the alarm information.

4.3.8 History Record

Click the "History" button, and then enter history page.



The page records all the operation events of the user, including the specific date and time of the user's login, exit, and the user's control over the genset, and the operating time. At the same time, the action content and input rewriting value of the user's operation are also recorded in detail.

4.3.9 Data page

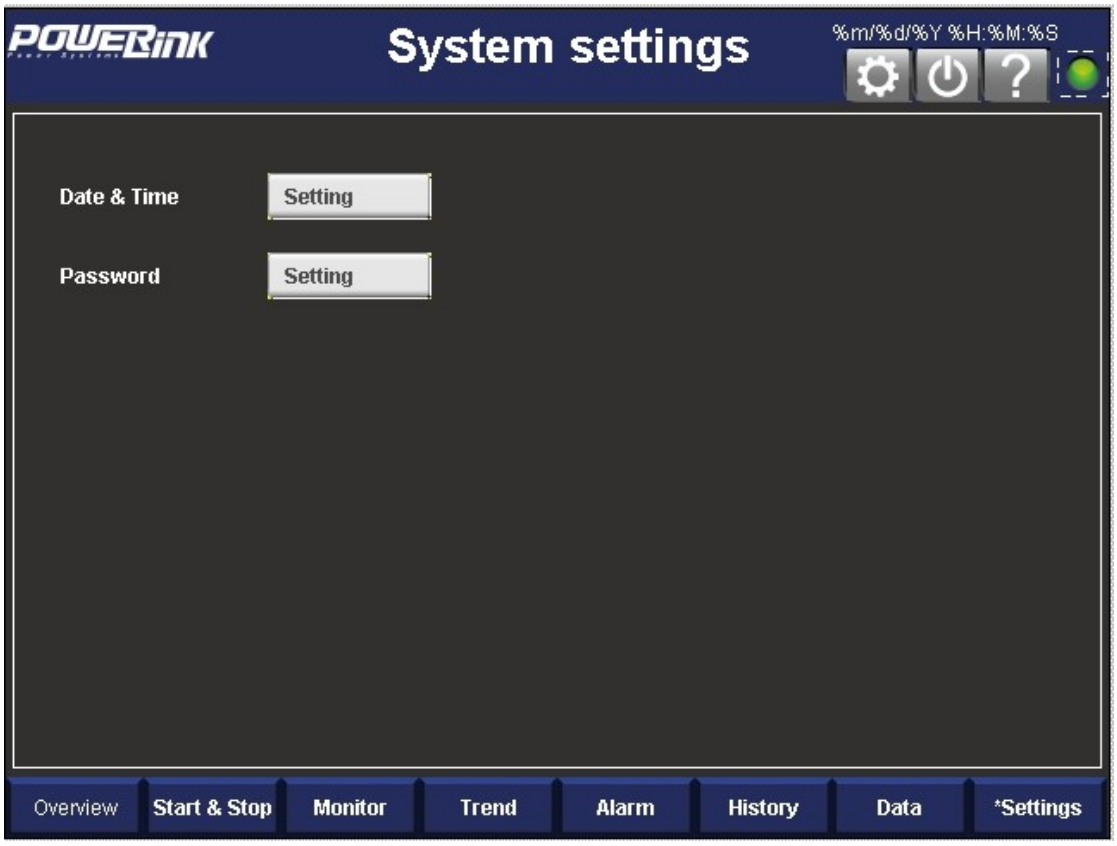
Click the "Data" button, and then enter data page.

Following data items are shown. Specific data items will vary with different gensets:

No.	Items	Function	Instructions
1	Active electricity	display	Display electricity generated when the genset is running.
2	Reactive electricity	display	Display reactive current generated when the genset is running.
3	Operating time	display	Display genset's operating time
4	Service time 1	display	Show the next maintenance time
5	Service time 2	display	Show the next maintenance time
6	Service time 3	display	Show the next maintenance time
7	Starting number	display	Display the number of startup
8	Starting failure number	display	Display the number of startup failure

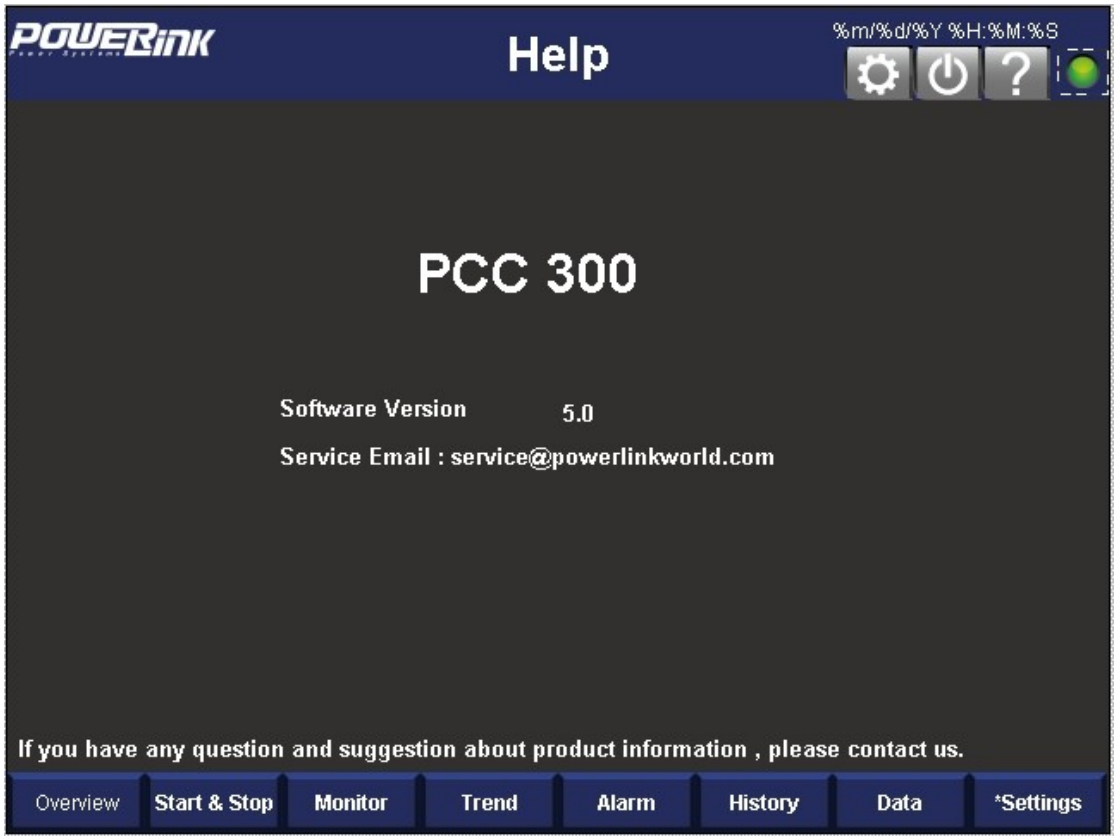
4.3.11 System settings page

Click the "**System settings**" button, and then enter s**ystem settings** page.This page can set display time and user password, the user only need to click on the relevant function key, according to the prompt to do related operations.



4.3.12 Help page

Click the "**?**" button in the upper-right corner of the page, and then enter help page.This page mainly displays system flags, software versions, service mailboxes, and copyright notices.



Toubleshooting and Removal

5.1Summary

Prompt

Troubleshooting should be done by engineers with relevant operation qualification. Once a trouble occurs, it should be handled immediately. Shut down engine; take off startup keys before removing any trouble. This can only be done after the engine completely cools down so as to prevent burning.

Whenperfoming any troubleshooting. Follow the guideline below

For detailed troubleeshooting about engine/alternator, refer to engine/alternator operation manual.

The three typical methods to troubleshooting：

- Eyeballing：Check the genset by your eyes.
- Control module：Control module will display the faults on the screen.
- Diagnosis tools：Using voltmeter, ammeter etc. to check faults

The operation as follows will contribute to shutdowns. Please contact our authorized distributor to ask for help for complicated maintaining and replacing operation.

- ✓ Keep genset level.
- ✓ Making battery connection clean and tight, checking gas suppy.
- ✓ Don’t overload.

5.2 Toubleshooting and Removal Table

TroubleShooting of Genset

Faults	Possible causes	Remedies
Low engine oil pressure	1. Oil pressure sensor is defective.	1. Repair or change the sensor.
	2. Lubricant oil is insufficient.	2. Add lubricant oil.
	3. Oil hose has leak.	3. Tighten or change oil hose.
	4. Oil filter is clogged.	4. Change oil filter.
	5. Improper kind of oil is used.	5. Change to proper kind of oil.
High coolant temperature	1. Coolant is insufficient .	1. Add coolant.
	2. Coolant pipe has leak.	2. Tighten or change coolant pipe.
	3. Fan belt is loose.	3. Tighten the belt.
	4. Radiator core is clogged.	4. Clean radiator core.
	5. Coolant temperature sensor is defective.	5. Repair or change the sensor.
	6. Engine thermostat is defective.	6. Repair or change the thermostat.
Low fuel level	1. Fuel is insufficient.	1. Add fuel.
	2. Fuel tank has leak.	2. Repair or change fuel tank.
	3. Fuel level sensor is defective.	3. Repair or change the sensor.
Power drops after running a period of time	1. Air filter element is clogged, and air is insufficient.	1. Clean or change air filter element.
	2. Fuel filter is clogged, and fuel is insufficient.	2. Drain water/sediment or Change fuel filter.
	3. Engine ignition time is incorrect.	3. Adjust the ignition time as required.
Ground metal part is electriferous	1. Ground connection is defective.	1. Check ground wiring.
	2. Insulating resistance is too low.	2. Measure insulating resistance.

TroubleShooting of Engine

Faults	Possible causes	Remedies
Engine does not start	• Shutoff solenoid valve of gas supply closed/does not open • Zero pressure regulator of gas supply not correctly set or faulty • Air filter clogged • Exhaust clogged (exhaust back pressure too high) • Electric circuit interrupted	• Set main switch to "on" • Replace faulty fuses • Repair any loose, corroded and broken wires and contacts
	• Battery dead • Starter/solenoid switch faulty	• See information at "Starter"
	• Ignition system control unit faulty • Impulse sensor faulty • Spark plugs faulty or worn • Spark plug connectors wet	• Clearance incorrectly set
	• Ignition timing incorrect • Gas inlets in gas mixer (venturi pipe) clogged/oiled	• A faulty tank system can cause oil to get into the pressure gas system. Clean entire system.
	• Valves do not close or are stuck • Crank assembly is externally blocked	• Remove objects that interfere with the movement of the fan, power output, alternator, etc.
	• Engaging lever/bearing pin of engaging lever broken • Internal engine damage (piston seizure, maybe due to incorrect oil type)	• Remedy from manufacturer service
Engine starts but does not reach idle speed or stalls	• Quality of gas does not meet the specifications or is contaminated	• See "Fuels, Lubricants and Coolants...."
	• Throttle valve does not open/actuation level sticks/actuator is de-energized or faulty • Air filter clogged	• Remedy from manufacturer service
Engine does not start or poorly starts in warmed up condition	• Spark plug faulty • Ignition cable faulty • Ignition coil faulty • Ignition timing incorrectly set • Insufficient compression in cylinder or more than 3-4 bar pressure difference between the cylinders	• Remedy from manufacturer service

Faults	Possible causes	Remedies
Engine does not start or starts poorly in cold condition	• Spark plug faulty • Ignition cable faulty • Ignition coil faulty • Ignition timing incorrectly set • Starter turns slowly • Check quality of gas	• Remedy from manufacturer service • Battery with insufficient charge or damaged • Voltage drop between battery and starter too high
Rough idling with engine warm, misfiring	• Spark plug faulty • Ignition cable faulty • Ignition coil faulty • Ignition timing incorrectly set • Valve clearance not OK • Zero pressure regulator of gas supply not correctly set or faulty • Insufficient compression in cylinder or more than 3-4 bar pressure difference between the cylinders	• Remedy from manufacturer service
Engine speed fluctuations during operation	• Spark plug faulty • Ignition cable faulty • Ignition coil faulty • Ignition timing incorrectly set • Shutoff solenoid valve of gas supply closed/does not open • Tachometer faulty • Gas pressure regulator faulty • Oxygen sensor faulty	• Remedy from manufacturer service
Poor performance	• Spark plug faulty • Ignition cable faulty • Ignition coil faulty • Ignition timing incorrectly set • Throttle valve not in full throttle position, actuation linkage sticks, throttle valve incorrectly adjusted • Zero pressure regulator of gas supply not correctly set or faulty • Gas metering valve faulty • Gas/air mixture too rich or too lean • More power than the engine can produce is demanded • Gas quality does not meet the regulations • Cross section of oxygen regulation valve is not set to the current gas quality • Oil level in oil pan too high	• See "Fuels, Lubricants and Coolants..." • Remedy from manufacturer service • Check whether the guide tube is correctly installed and the correct oil dipstick is being used • If coolant is discovered in the engine oil, check cylinder head gasket, cylinder liner gasket and piston rings

Faults	Possible causes	Remedies
Poor performance	• Air filter clogged • Exhaust pipe clogged • Air intake pipe leaks • Charge mixture cooler dirty/leaks • Charge mixture ducting leaks • Turbocharger leaks, faulty, dirty • Insufficient compression in cylinder or more than 3-4 bar pressure difference between the cylinders	• Remedy from manufacturer service
Coolant temperature too high, loss of coolant	• Coolant level too low • Air in coolant circuit • Radiator very dirty, fins clogged • V-belt for coolant pump not correctly tightened (slips) • Cap with work valves on expansion tank/radiator is faulty or leaks • Temperature display faulty • Coolant pump leaks, defective (bearing damage) • Thermostat faulty, does not open • Coolant lines leak, clogged or twisted	• Remedy from manufacturer service
Lube-oil pressure too low	• Oil level in oil pan too low • Engine temperature to high • Oil pressure indicator faulty • Selected oil viscosity is inappropriate for ambient temperature (too thin) • Oil in oil pan is too thin (contains condensation) • Bearing heavily worn • Oil pump gears heavily worn • Safety valve in oil circuit faulty (does not close, spring is worn or broken)	• See "Fuels, Lubricants and Coolants..." • Remedy from manufacturer service
Lube-oil pressure too high	• Engine cold • Selected oil viscosity is inappropriate for ambient temperature (too thick) • Oil pressure indicator faulty • Safety valve in oil circuit faulty (does not open) • Oil lines/oil ducts clogged	• See "Fuels, Lubricants and Coolants..." • Remedy from manufacturer service

Faults	Possible causes	Remedies
Lube-oil consumption too high	• Lube-oil quality does not meet the regulations • Oil level in oil pan too high • Leaks in lube-oil circuit especially at the turbocharger and oil cooler • Piston rings heavily worn • Valve stems heavily worn, bent • Crankcase breather clogged	• See "Fuels, Lubricants and Coolants..." • Check whether the guide tube is correctly installed and the correct oil dipstick is being used • If coolant is discovered in the engine oil, check cylinder head gasket, cylinder liner gasket and piston rings • Remedy from manufacturer service
Gas consumption too high	• Gas quality does not meet the regulations • Ignition timing incorrectly set • Charge mixture cooler dirty/leaks • Charge mixture ducting leaks • Valve seat leaks • Air filter clogged • Exhaust gas recirculation cooler dirty	• See "Fuels, Lubricants and Coolants..." • Check intake vacuum • Remedy from manufacturer service • Check exhaust back pressure
Blue smoke	• Lube oil penetrates into combustion chamber (pistons/piston rings worn or piston rings broken) • Turbine and compressor impeller in turbocharger dirty (rough running, out of balance) • Valve stem/guide worn	• Remedy from manufacturer service
White smoke	• Coolant penetrates into combustion chamber (cylinder head/gasket leaks)	
Engine knocking	• Ignition timing incorrectly set • Valve clearance not OK • Valves stick • Piston pin or crankshaft bearing loose • Piston ring broken	• Check thermostat • Remedy from manufacturer service
Engine too "loud"	• Intake or exhaust pipe leaks • Timing gears worn, gear backlash too large • Valve clearance too large • Turbine and compressor impeller in turbocharger dirty (rough running, out of balance) • Poly-V-belt slips • Engine bearing not suitable/worn	• Remedy from manufacturer service
Exhaust temperature/ exhaust back pressure too high (thermal overload)	• Unsuitable exhaust piping; heat exchanger and catalytic converter have too high resistance	• Remedy from manufacturer service

TroubleShooting of Starter

Faults	Possible causes	Remedies
		To be repaired by vehicle electrican or by the manufacturer service
• Pinion gear does not turn or turns slowly	• Battery has insufficient charge • Terminal is loose, oxidised, poor connection to ground • Starter terminal or carbon brushes are short circuited to ground • Carbon brushes stick or have poor contact	
• Pinion gear does not engage	• Pinion gear or starter ring gear are very dirty or damaged	
• Pinion gear engages, but stops turning	• Solenoid switch faulty • Overrunning clutch slips • Starter switch faulty	
• Pinion gear continues to turn after starter switch is released	• Solenoid switch faulty • Starter faulty	• Immediately shut down engine
• Pinion gear does not disengage after engine starts		

TroubleShooting of Control system

Trouble	Causes	Remedies
Main breaker cannot be turned to on	1. The main breaker position rests on the position between ON and OFF improperly.	1. First turn the breaker to off , and then turn it to on.
	2. Short circuit on the load.	2. Check and repair the load circuit or change it .
Control module cannot run	1. Control module cable is disconnected to the battery.	1. Connect the module cable to the battery.
	2. Battery power is insufficient.	2. Charge the battery with the utility power.
	3. The fuse is damaged.	3. Change the fuse.
	4. Control module is defective.	4. Repair or change the control module.
Voltage drops quickly when connecting to the load	1. Loads total exceeds the rated current.	1. Decrease the loads to meet the rated output.
	2. AVR. of alternator is defective.	2. Check AVR. and change it if necessary.
	3. Use wrong frequency.	3. Adjust the frequency to the load frequency.
Frequency is stable, but voltage is unstable	1. AVR. of alternator is defective.	1. Check AVR. and change it if necessary.
After connecting to the load, voltage and frequency is stable, but current is unstable	1. Customer load is unstable.	1. Check and adjust the customer load.
Voltage cannot go up to the rated value	1. AVR. of alternator is defective.	1. Check AVR. and change it if necessary.
	2. Frequency is low.	2. Adjust frequency as required
Voltage exceeds the rated value	1. AVR. of alternator is defective.	1. Check AVR. and change it if necessary.
Electric meter has no reading	1. The meter is defective.	1. Check the meter, and change if necessary.
	2. Circuit is disconnected, or terminal is loose.	2. Find the cut position and connect again.

TroubleShooting of Alternator

Trouble	Causes	Remedies
No voltage or voltage is insufficient while running	1. Winding is cut.	1. Intertwist the cut winding and weld firmly .
	2. Wiring terminal is loose.	2. Tighten the wiring terminal .
	3. Wiring terminal is defective.	3. Clean or replace the defective terminal .
	4. Speed is too low.	4. Adjust the speed and keep the rated speed.
Voltage is unstable	1. Speed is unstable.	1. Keep the rated speed.
	2. AVR is defective.	2. Check AVR, and change if necessary.
Alternator overheats	1. Overload running.	1. Reduce load.
	2. Vent-pipe inside the alternator is clogged.	2. Blow and clean the inner .
Voltage is too high	1. Speed is too high.	1. Keep the rated speed.
	2. AVR is defective.	2. Check AVR, and change if necessary.
Voltage is too low while running without load	1. Speed is too low.	1. Keep the rated speed.
	2. AVR is defective.	2. Check AVR, and change if necessary .
Voltage is correct without load, but too low under load	1. Speed setting is incorrect.	1. Check and adjust the speed.
	2. Short circuit on the rotor.	2. Check resistance of the circuit.
	3. Armature of excitation is defective.	3. Check resistance of the circuit.
Voltage disappears while running	1. Winding of magnetic field is cut.	1. Check the cut winding, intertwist and weld firmly .
	2. Rotor of excitation is defective.	2. Check rotor, repair it and change if necessary.
	3. AVR is defective.	3. Check AVR, and change if necessary.

TroubleShooting of Battery charge

Trouble	Causes	Remedies
No charge current	1. Battery post is defective.	1. Check and clean the post.
	2. Battery post is connected incorrectly.	2. Check the connection post.
	3. No mains supply.	3. Check the wiring to the charger from mains supply.
	4. Power fuse is burned-out .	4. Change the fuse.
Display nothing on the charge current meter	1. Charge current meter is defective.	1. Measure the current with the standard amperemeter .
Charge rate is too low	1. Mains supply power is low.	1. Check mains supply.
	2. Plug of the charger transformer does not match with the mains supply voltage.	2. Check the plug of charger transformer.
	3. Battery post is loose.	3. Tighten the battery post.
Fuse of mains supply is burned-out repeatedly	1. Power of the fuse does not match.	1. Change the proper fuse.
	2. There is short circuit.	2. Check and connect all wiring.
Charge clip heats	1. Battery post is defective.	1. Check and clean the post.
	2. Bolt of the clip is loose.	2. Clean and tighten the bolt.
Battery voltage does not rise	1. Battery is deteriorated.	1. Change the battery.
	2. Battery has been damaged.	2. Check the battery, and change it if necessary.

Maintenance

6.1 Maintenance of Gas Genset before Startup

In order to ensure genset can run continuously without faults, genset should be maintained regularly and examined according to interval prescribed in maintenance schedule before each time of startup. Furthermore, some examinations should be done verified after startup.

- Air filter: It should be installed and clean to prevent unfiltered air from entering engine.
- Air inlet: It should be clean and unobstructed.
- Storage battery: Wiring of battery must be stable. Please refer to manufacturer's directions when maintaining and servicing storage battery.
- Controller: After storage battery is reconnected, date and time of controller should be set.
- Coolant level: Check coolant level according to the maintenance instruction of cooling system.

Note: Jacket heater damages. Jacket heater will damage if energized heating units aren't soaked in cooling agents. Top up cooling system before opening jacket heater. Operate generator until it becomes hot, and then add cooling agent into radiator so as to discharge the air in cooling system before jacket heater is powered on.

- Drive belt: Check belt condition and the tension degree of belts of radiator, water pump and battery-charged generator.
- Exhaust System: Exhaust system should not leak or be obstructed. Check the state of muffler and exhaust pipe and the tightness degree of connection parts in exhaust system.
- Check whether units (exhaust manifold, exhaust electrical connection wires, exhaust hose pipes, mufflers and exhaust pipes) of exhaust system cracks, leaks or corrodes.

Prompt

1. Metal parts cannot corrode or cracks. Replace them when necessary.
2. Clip and hook are not allowed to loose, corrode or fall off. Tighten or replace exhaust pipe clips and hooks when necessary.
3. Exhaust port should not be obstructed.
4. Examine visually whether exhaust system leaks and check whether there are accumulated carbon or carbon remnants on exhaust spare parts. If yes, then the exhaust system leaks. Seal off exhaust system when necessary.

- Fuel oil level: Check fuel oil level and keep fuel tank full to ensure sufficient supply of fuel.
- Engine oil level: Engine oil level should be kept to or near full oil degree, but not exceeds that degree.
- Working area: Check whether there are obstructions that affect the flow of cooling air. Keep inlet area clean. Don't put cloth waste, tools or fragments on genset or places nearby.

Keep genset running 1 hour/week under load. Operation personnel should at sites when genset isn't running under automatic program mode or when automatic change-over switch is at test run position.

- During test run period, at least35% load should be applied according to the standby power on data plate, unless there is other speculations on Operation Manual of engine.
- Before manual test run, operation personnel should check all items before startup. When genset is running, sound of engine sould be flat and stable. Check whether there is liquid or gas leaking from genset from its appearance.
- Running time of genset can be set automatically.

6.2Regular Maintenance

Prompt

Under normal working condition, generators of genset need no daily maintenance.***Please refer to Section of 6.1:Check before startup, understand daily checklist.***

Maintenance targets include storage battery, which must be conducted by proper and skillful personnel. These personnel must be trained and familiar with genset maintenance and service. Disconnect the cables of storage battery before examining and repairing gas genset.***Safety Precautions insection 1.2 must be strictly followed.***

Maintenance of Alternators

When generator is running in environment with much dust and contaminants use dry compressed air to blow off the dust. Blow the compressed air directly into open pore on the holder of genset.

Maintenance of engine

Maintain engine in according to the interval prescribed in the maintenance schedule of engine manufacturers. Obtain maintenance information from authorized distributors.

6.2.1 Maintenance and Service Schedule of Gas Engine

Activity	Running Hours（）							
	The first 50h	Every 500h	Every 1000h	Every 2000h	Every 4000h	Every 8000h	Every 16000h	Every 30000h
Check Engine Control System, check for diagnostic errors and rectify	√	√						
Oil & filter change	√	√						
Check, log & adjust bridge pieces / tappets	√	√						
Spark plug change	√	√						
Check drive belt & belt tensioner	√	√						
Filter element of gas filter - Change		√						
Air/oil separator- Change		√						
Filter element of air filter - Change			√					
Check emissions - (Adjust if necessary)	√			√				
Ignition coil change				√				
Recommend oil sampling required at every 250hrs initially to establish trends				√				
Spark plug HT leads change					√			
Charge cooler - Check and clean						√		
Check coolant antifreeze / inhibitor strength yearly or 8,000hrs	√					√		
Magnetic picks up - clean & adjust						√		
Check & calibrate ignition Timing						√		
Turbocharger - Change							√	
Clean and inspect Gas Mixer							√	
Remove 1 piston, inspect liner and ring wear							√	
Pushrods - Check for wear & straightness							√	
Valve train gear - Clean & inspect , change if necessary							√	
Exhaust mainfold - Check and change bellows and bolts							√	
Pistons, rings and liners - Change								√
Big end bearings & bolts - Change								√
Camshaft, Camshaft bushes & camfollower assy - Inspect & Change if required								√
Starter Motor - Inspect / change if required								√
Oil pump change								√
Jacket Water Pump change if fitted								√
Connecting Rod - Small end bushes change								√

The first 50h	● Check Engine Control System, check for diagnostic errors and rectify ● Oil & filter change ● Check, log & adjust bridge pieces / tappets ● Spark plugchange ● Check drive belt & belt tensioner ● Check emissions - (Adjust if necessary) ● Check coolant antifreeze / inhibitor strength yearly or 8,000hrs
Every500h	● Check Engine Control System, check for diagnostic errors and rectify ● Oil & filter change ● Check, log & adjust bridge pieces / tappets ● Spark plug change ● Check drive belt & belt tensioner ● Filter element of gas filter – Change ● Air/oil separator- Change
Every 1000h	● Filter element of air filter - Change
Every 2000h	● Drive belt change ● Check emissions - (Adjust if necessary) ● Ignition coil change ● Recommend oil sampling required at every 250hrs initially to establish trends
Every 4000h	● Spark plug HT leads change
Every 8000h	● Charge cooler - Check and clean ● Check coolant antifreeze / inhibitor strength yearly or 8,000hrs ● Magnetic picks up - clean & adjust ● Check & calibrate ignition Timing
Every 16000h	● Turbocharger – Change ● Clean and inspect Gas Mixer ● Remove 1 piston, inspect liner and ring wear ● Pushrods - Check for wear & straightness ● Valve train gear - Clean & inspect , change if necessary ● Exhaust mainfold - Check and change bellows and bolts
Every 30000h	● Pistons, rings and liners – Change ● Big end bearings & bolts – Change ● Camshaft, Camshaft bushes & camfollower assy - Inspect & Change if required ● Starter Motor - Inspect / change if required ● Oil pump change ● Jacket Water Pump change if fitted ● Connecting Rod - Small end bushes change

Notes:

-)***** Check filter element of air filter every 500 hrs and It must be renewed every 1,000 hrs whether there is any problems about it or not.
- All Sensors should last the life of the engine.
- Maintenance schedule from 30,000hrs to 60,000hrs same as 0hrs to 30,000hrs.
- At 30,000hrs operation consult POWERLINK, reference major overhaul - swing engine / service exchange engine components.

6.2.2 The first grade maintenance content (Engine run for every 150 hours)

1) Check whether the gas pipelines and gas valve bank damage or not.

2) Check pipelines in the system and their joints：

a. Whether pipe body abrades, crack; Use a detector or leakage detecting solution to test the leaking condition.

b. Whether the pipeline joints and its valves connect stably and leak.

c. Use a detector or leakage detecting solution to test whether the evaporation pressure regulator itself and its joints leak.

d. Check whether the holders of equipment loosen and tighten if necessary.

e. Check whether the warm water pipe is obstructed by sewage, and exclude if necessary.

f. Check whether the water pipe ages, cracks, damages or leaks.

g. Check the tightening condition of pipeline joints and tighten if necessary.

h. Check whether the entire solenoid valve functions normally, sensitively and reliably, whether the valve leaks, and whether the power ports are stable and contact well.

i. Check and tighten the holders of solenoid valves.

6.2.3 The second grade maintenance content (Engine run for every 400 hours)

1) High-pressure ignition system: Gum cover of ignition coil on each cylinder is in good insulation condition and don't leak electricity and the holder is stable and reliable.

2) Spark plug: Check whether the clearance of spark plug meets requirement and change it according to its condition.

6.2.4Daily Maintenance of Electronic Control of Gas Engine

Maintainers should pay attention to the following items when maintaining engine's control components:

1. Before pulling out or inserting the wiring harness and the connecting parts between harness and sensor/actuator, be sure to switch off the ignition switch and the battery switch first and then perform the daily maintenance to engine's electrical part.

2. Wipe the accumulated oil stain and dust on engine's wiring harness with soft cloth regularly and keep the connecting parts between the harness and sensor/actuator clean and dry.
3. Be sure to cut off the general switch of battery and inform maintainers to settle it right now and don't voluntarily operate engine when the electrical parts are accidentally watered, for example the controller or wiring harness gets wet or soaked by water.
4. Use compressed air to blow off the dust on engine regularly, especially dust on the controller（≤3bar）
5. Engine's electrical controlling part must be kept dry, with no water, oil or dust.

6.2.5 Daily Maintenance of Engine's Gas Supply System

Daily maintenance of gas supply system should take account into the following aspects:

1. Check the tightening condition of installation holders of gas pipelines, solenoid valve, pressure regulator and so on and tighten the loose parts.
2. Check air pressure, switch on the power and ignition switch (Don't start up the engine.) and check the gas pressure value showed on the pressure meter.
3. Check whether gas supply system and its connecting parts leak (Conclude by judging whether there is gas odor in the surroundings); If it leaks, operation staff should not close the general gas ball valve and inform professional staff to maintain.
4. Check whether ignition system and generator leak power, spark. Repair in time if necessary.
5. Clean gas filter in gas supply system regularly.
6. Clean hot water circulatory system of pressure reducer regularly;
7. Check and clean engine's air filer regularly.

6.2.6 Engine Air Cleaner Service Indicator – Inspect

Engine Air Cleaner Service Indicator - Inspect

Some engines are equipped with a differential gaugefor inlet air pressure. The differential gauge for inletair pressure displays the difference in the pressurethat is measured before the air cleaner element andthe pressure that is measured after the air cleanerelement. As the air cleaner element becomes dirty,the pressure differential rises.

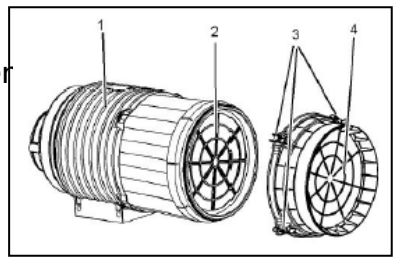
The service indicator may be mounted on the air cleaner element or in a remote location.

Replace the air filter element if the indicator is triggered by the following event:

• The red piston locks in the visible position.

Air Cleaner Element –Replace

① Remove the retaining clips (3). Remove the cover (4).
② Remove the old element (2). Dispose of the old elemer
③ Install a new element into the air filter housing (1). Install the cover (4). Fit the retaining clips (3).



TechnicalGuidance

Technical Guidance: PL20140504-06: Commissioning Safety Instructions of Genset

Overview: Temperature of exhaust system of gas engine is high and it is easily flammable and explosive, with much risks. It may give rise to severe disasters with a little carelessness. Thus, please follow strictly following safety instructions when testing gas genset in engine room.

Operation Training

Testing personnel must have the specialized training knowledge and must be authorized before operating this system.It's strictly forbidden to operate equipment with approval so as to prevent accidents. Please read carefully the operation manual before operating,Meantime,be clear on the meaning of each safety instruction sign in testing room and abide by the instructions during operating.

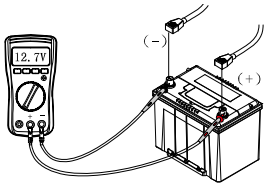
Safety Precautions:

Non-operation personnel are forbidden to enter engine room during test-run time. Operation personnel should wear protective equipment approved by relevant authorities to protect heads, bodies, eyes, ears and respiratory system. This protective equipment includes safety hats, safety shoes, goggles, protective earmuffs, and protective gloves and so on. When staying around engines, clothes, hairs and jewelry should be avoided from approaching engine to prevent accidents. Notice: Before entering engine room, operation personnel are not allowed to drink or take anesthesia drugs, which will hurt themselves and even others.

Checking Engine Oil and Coolants:

It's a must to fill engine oil and coolants before the first time of startup. Method: First, fill engine oil through engine oil-filling port to the degree of where oil scale is at under static condition, and recheck the oil after 15-20 minutes. Pay attention to the selection of oil quality degree. Second, fill coolants up to requirements to water tank and squeeze the rubber pipe near the bottom of water tank to discharge the air in the tank. If it isn't the first time of test, it's necessary to check whether engine oil and coolants in genset is sufficient and whether they leak.

Check Storage Battery and Connecting:



Voltage of storage battery should be checked before test. Check whether the electrodes of battery are stable and whether acid liquor level is between the lowest mark and the highest mark position. Smoking, naked fire and spark are prohibited during checking and protective measures should be taken. When wiring battery, please connect positive pole first and then negative pole. Connect startup motor first and then battery.

Checking Genset Parts:

First, check all data on the data plate of genset: rated power, voltage, frequency and rated current. Second, check and ensure that the radial clearance of butterfly door journal doesn't leak and that connection of solenoid valve and pressure-regulating valves should not loose.All easily fusible and explosive diaphragms of explosion-preventive equipment must be installed according to technical design requirements. It's not allowed to replace or thicken materials. The connection between generators and control screen and cable connection point must be tight and reliable. Finally, check whether oil pressure, oil temperature of engine and water temperature are normal.

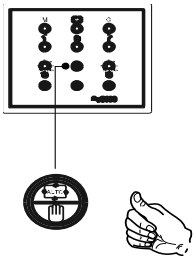
Checking Gas Supplying Pipelines:

Before testing, it's a must to check whether gas pipeline in engine room are in good condition and ensure they don't leak.It should also be ensured that there is no pore at welding position, connection point between gas pipeline and inlet port is tight and reliable, emergency manual shutdown valve doow functions well and that air source emergency valve doow and solenoid valve is reliable.

Surface Inspection of Genset:

Before startup, surface of genset should be examined and all sundries (such as barring over bridge, tools and screws) should be removed so as to prevent workpieces from flying out to cause severe harm when genset is running.Focus your examination on whether swinging parts, high-temperature surface and wheel gears are stable and reliable. Make sure that all doors of gensets are closed, for only which meets normal running conditions.

Safe Startup：



When genset is starting up, press down startup button and then open gas valve door. It's strictly forbidden to supply gas and then press startup button. Each time of startup should be no more than 10S and interval between two startups should be no less than 20S. If three times of continuous failures of startup, please find out the reason and then start up. (Note: If each time of startup is too long or interval between two times of startup is too short, storage battery and generator can be damaged.

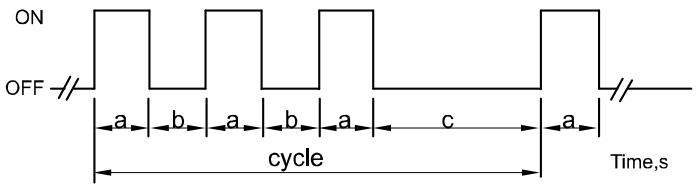
Matters Needing Attention During Running Time of Genset:

- Engine oil pressure gauge. If there is no engine oil pressure or it is two small after startup, engine should be shut down immediately for check.
- Exhaust gas produced when genset is running is poisonous. Please ensure good condition of ventilation and exchanging of air in engine room.
- High temperature of cooling water will cause burn, so it's strongly forbidden to open the cover of radiator to add coolants when water is hot.
- If there is a suspicion of engine oil leakage during operation, kindly please don't feel it with hands or face and to check with paperboard or wooden board.
- If genset shuts down during test, please close gas valve door and examine the reasons. Then, restart and test after excluding faults.
- During test, it's strictly forbidden that regulating level is blocked by any object and to regulate or move the regulating level without approval, which can cause engine to race.
- During the startup period of genset, operation personnel must be at sites. That is engine room should not be under unwatched state.

Emergency Evacuation Warning：

Emergency EvaculationAlarm（gas warning,fire warning, carbonic oxide warning and gas early warning）

According to ISO 8201 Emergency Evaculation Signal/ keep at least 180m



Graph Illustration: a signal:“Open”（ON）,for 0.5s+/-10%
: b signal:“Close”（OFF),for 0.5s+/-10%
: c signal:”Close”（OFF), for 1.5s±10%（c=a+2b)
A cycle for : 4s±10%

Following conducts should be made:

- Immediately evacuate from relevant areas to outdoor to breathe fresh air.
- Close the safety blocking plug of gas in engine room and take measures to prevent accidental startup.
- Give an alarm by phone and wait for firefighters in safe area and warn others of dangers.

Safe Shutdown:

Shutdown can be normal shutdown and abnormal shutdown. Normal shutdown is divided into normal shutdown with load and without load. When shutting down engine with load, please unload (Unload from big power to small power) and operate genset in idle for 3 to 5 minutes. Then, shut down genset when some parts of genset cool down and the whole genset is thermal balanced. If there is no load, then operate genset in idle directly for 3 to 5 minutes and shut down when some parts of genset cool down and the whole genset is thermal balanced. When there is necessity to shut down under emergency, please immediately to "bar the engine over and pump engine oil"until the temperature of water and oil decrease under 60℃. Then power off air source and shut down.

Checking and Maintenance after Shutdown:

After shutting down genset, pleaseturn the switch of "solenoid valve" to "OFF" and close the main gas valve. Check whether there is oil or water leakage from genset and other abnormal circumstances, such as damaged and loosed parts. When undertaking each test, test report should be made, especially the detailed records of fault information during test.

***Note*:**When genset needs maintenance and service, please take down the negative pole of storage battery or take other measures to prevent accidents because the automatic startup of engine.

Technical Guidance: PL20140505-06: Gas Quality Anouncement

Prompt

The prerequisite of operating equipment safely and economically is to follow relevant requirements in this technical guidance and to operate in accordance with instructions.
Ignoring relevant requirements in this technical guidance or failing to follow or even violatinginstructions will invalidate the quality-guarantee right and compensation right. It's not applicable to following circumstances: If operators can ensure that faults have already existed before delivery or commissioning even though following the technical guidance.
Equipment operators should carry out operations and abide by the requirements in this technical guidance. Not applicable to following circumstances: It's clearly defined that it's Powerlink responsibility by current technical guidance or operators and Powerlink have agreed safeguard provision in contract.

1. Summary

Different from gasoline or diesel, gas fuels have no strict specification or classification in general. Engines should be in perfect match with fuel elements prescribed in the contract. Generally speaking, abnormal gas elements or value of abnormal element exceeds gas limit value will have a negative impact on genset running.

Polluted gas can cause lubricating oil to lose anti-corrosion property. Gas manufacturing equipment must meets technical standards. Meantime, content of methane must be constantly observed when engine is running. When the volume of methane is lower than 25%, gas supply should interrupted so as to prevent generating explosive and dangerous mixture in the conveying appliance.

2、Technical Index Requirement of Gas

Parameter	Symbol	Limit value	Unit	Remarks
Methane number	MN	＞80		As for lower methane number, please consult our company.
Calorific value	H_u,N	＞5	kWh/Nm^3	As for lower calorific value, please consult our company.
Chlorine	Cl	＜100	mg/Nm^3CH4	Chlorine exists in form of unstable compound.
Fluorine	F	＜50	mg/Nm^3CH4	Fluorine exists in form of unstable compound.
Total content-chlorine-fluorine	∑(Cl,F)	＜100	mg/Nm^3CH4	Total content-chlorine-fluorine
Dust＜5μm		＜10	mg/Nm^3CH4	
Oil gas		＜400	mg/Nm^3CH4	Mixture doesn't condense.
Silicon	Si	＜5	mg/Nm^3CH4	If silicon content is higher, please consult our company.
Sulfur	S	＜300	mg/Nm^3	
Hydrogen sulfide	H_2S	＜200/＜306	ppm/mg/Nm^3	If hydrogen sulfide content is higher, please consult our company.
Ammonia	NH_3	＜50/＜38	ppm/mg/Nm^3	
Volatile organic compounds	VOC	< 25	mg/ Nm3CH4	As for higher concentration of dissolved matter, please consult our company.
Relative humidity	φ	< 60	%	No condensate exists in mixture.
Gas temperature	T_G	0℃<T_G<30℃		For special circumstance, it a must to check other temperature..
Gas supply pressure	p	10＜p＜20	Kpa	

3. Gas Elements and Features

Gas is composed of two (or more) classes of elements, which are its main element and trace substance.

Its main elements are decided by the fuel features related with engine's physical operation (such as calorific value, air ratio in combustion, combustion temperature, spreading speed of laminar flame, explosive limit and anti-knock value). Under normal conditions, elements are described with %.

In most cases, trace substance and associated substance go into fuel flow during the process of generating gas. Generally speaking, trace substance or associated substance are pollutes in ppm areas. Compared with main elements, the influence of trace substance or associated substance can only be detected after the engine runs for a period of time (Accumulated influence).

Since this influence is negative in most cases, people hope that gas doesn't contain any trace substance or associated substance. If gas contains much associated substance, the best way to assure gas' effective utilization is to clean gas properly.

It's necessary to know well of gas analysis when assessing whether the gas is suitable for engine.

4. Condensate water

If operation trouble occurs because the gas used contains condensate water, quality warranty will be invalid. Since, delivery scope prescribed in the contract includes specific gas dry equipment.

Gas	Condensate water
Methane, boigas and landfill gas	Acidic water has or hasn't mixed with cylinder oil of gas compressor in form of emulsion.
	Liquid and highly purified hydrocarbon and/or crude oil
oil field gas	Liquid and highly purified hydrocarbon
propane/butane (Vapored liquefied petroleum gas)	Liquid and highly purified hydrocarbon and/or crude oil
Special gases (such as wood gas)	All substance above of the same type

If gas is not dried fully, it will cause outside, valve, equipment and interior pipes of engine to runs with faults. Such operation faults can cause severe faults engine! Possible influences on engine are follows:

- Decrease oil quality and damage lubricating oil film(decrease pH value)
- Corrode
- Sediment forms in valve.
- knocking combustion

5. Detection and Analysis of Gas

1) Accompany gases contained in gas affect greatly the reliable operation of gas engine. Organic halide, sulfide and organic silicide are of great harmfulness. These accompany gases should be detected and excluded from combustible gas before being supplied to engine.

2) It's recommended to conduct gas detection and analysis every 6 months and record the results in checking table. If a fluctuation of gas element is detected, there is a need to shorten gas detection intervals and analyze engine oil regularly. If gas elements exceed the limit value, you should stop the engine immediately, shut down genset and contact our company.

Notice:

1) The minimum performance of gas supplied to engine must meets the requirements of gas technical index above.
2) In order to deal with peak gas usage demand, some gas companies will fill liquefied gas or air mixture into gases. It's recommended to confirm with gs companies they won't fill liquefied gas or air mixture into gases at any time before using.
3) Our company will not responsible for equipment defects or damages caused by using unqualified gases that are out of our agreement or aren't approved by our company in written.

Appendix1. Checklist of Gas Quality Description

User information	
Project or equipment name:	
Name of user contact person:	
Contact Number	
Types of gases:	
Gas source:	

Physical feature of gases		
Feature Name	**Measured Value**	**Unit**
Gas pressure (from* to):		mbar
Gas temperature (from to):		℃
Relative gas humidity (from to):		%
Barometric pressure (from to):		mbar

Chemical feature of gases		
Main elements	**Main elements**	**Main elements**
Methane CH4		
Ethane C2H6		
Propane C3H8		
Butane C4H10		
Pentane C5H12		
Hexane C6H14		
Carbonic oxide CO		
Hydrogen H2		
Carbon dioxide CO2		
Nitrogen N2		
Oxygen O2		

Additional information			
Trace substance	**Measured Value**	**Unit**	**Measuringmethods**
Ammonia NH3		mg/Nm3CH4	
Total content of chlorine		mg/Nm3CH4	
Total content of fluorine		mg/Nm3CH4	
Hydrogen sulfide H2S		ppm/mg/Nm3	
Total content of silicon		mg/Nm3CH4	
Total content of sulphur			
Content of dust <5μm		mg/Nm3CH4	
Other information			

Technical Guidance: PL20140718-06: Engine Oil and Coolants Used on Gas Genset

Prompt

The prerequisite of operating equipment safely and economically is to follow relevant requirements in this technical guidance and to operate in accordance with instructions.
Ignoring relevant requirements in this technical guidance or failing to follow or even violating instructions will invalidate the quality-guarantee right and compensation right. It's not applicable to following circumstances: If operators can ensure that faults have already existed before delivery or commissioning even though following the technical guidance.
Equipment operators should carry out operations and abide by the requirements in this technical guidance.
Not applicable to following circumstances: It's clearly defined that it's Powerlink responsibility by current technical guidance or operators and Powerlink have agreed safeguard provision in contract.

Proper Usage of Lubricating Oil

Overview: When selecting lubricating oil suitable for Powerlink gas engine, you should not only consider the requirements of engine but also requirements of gases. Aftertreatment requirements of gases should also be considered when necessary.

Trace substances and impurities contained in gases may cause sediments for form and spare parts to be corroded by acid and be worn.

According to the judgment of recent experience level, following hazardous substances have the greatest influence on the service life of lubricating oil and engine oil:

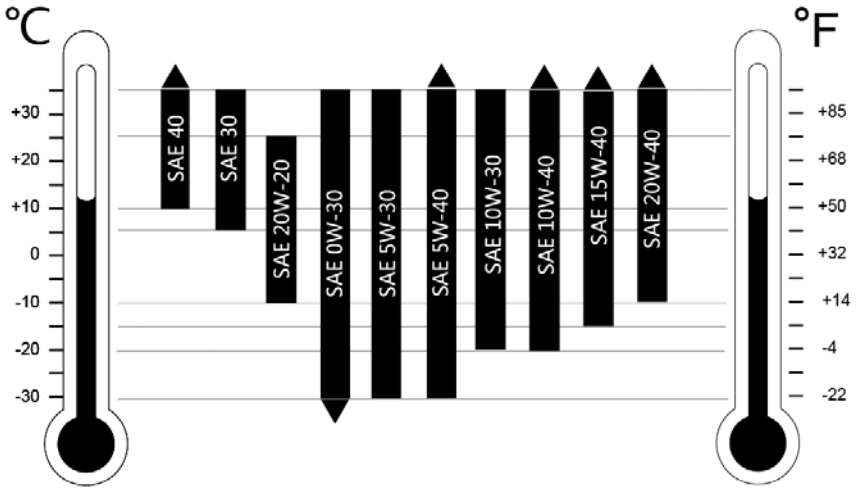
Chlorine, fluorine and sulfur cause lubricating oil to acidate.

Organic silicide causes corrosion.

Polluted gas can cause lubricating oil to lose anti-corrosion property. Gas pollution instruction can be obtained from the regular analysis results of lubricating oil.

Selection Types of Engine Oil

- In order to meet requirements, it's a must to select right engine oil and make regular sample analysis and replacement.
- Viscosity degree of engine oil should be selected according to specific ambient temperature. Table below shows the temperature scope suitable for different SAE viscosity degrees of engine oil:



Filling Engine Oil

- When filling engine oil, you must fill slowly with a small amount to avoid filling excessively.
- After filling, extract engine oil scale and insert it again into engine after cleaning. Check the refueling amount of engine oil.
- There are one maximum degree and one minimum degree on engine oil scale and it's suitable that the fueling amount should between these two degrees.

Disposal of Exhaust Engine Oil

- Used engine oil can only delivered to the waste oil processing company to be disposed.
- Please make sure that the engine oil doesn't leek into the Sewage treatment systems or on the ground.
- The used filter core and filters extinguishers should be disposed as wastes.

Note: Please prevent polluting drinking water when disposing the engine oil.

Lubricating oil Recommended by Powerlink:

Manufacturer	Oil type	Viscosity grade
Addinol Lube Oil GmbH	Gasmotorenöl MG 40-Extra LA Gasmotorenöl MG 40-Extra	SAE40
EniSchmiertechnikGmbH	Autol Gasmotorenöl ELA40	SAE40
AVIA Mineralöl-AG	Gasmotorenöl LA40	SAE40
Castrol Ltd.	Duratec HPL Duratec XPL	SAE40
Zeller &Gmelin GmbH & Co.	DivinolSpezial MA	SAE40
EUROLUB OIL·CHEMIE·CARCARE EUROLUB GmbH	LA SAE 40	SAE40
FUCHS Petrolub AG	Fuchs TITAN Ganymet LA	SAE 40
Exxon Mobil Corporation	Mobil Pegasus 1	SAE 15W-40

Exxon Mobil Corporation	Mobil Pegasus 1005 Mobil Pegasus 705	SAE 40
NILS AG	BURIAN LIGHT,SAE 40	SAE 40
Petro-Canada	Sentron LD 5000 Sentron LD 8000	SAE 40
Kuwait Petroleum Research & Technology B.V.	Q8 Mahler MA	SAE 40
Kuwait Petroleum Research & Technology B.V.	Mahler MA SAE 40	SAE 40
Kuwait Petroleum Research & Technology B.V.	Mogas/40	SAE 40

Shell International Petroleum Company	Mysella S5 N 40	SAE 40
BayWa AG	MethaFlexx NG	SAE 40
Total	Nateria MP 40	SAE 40

Note: Single grade oil of SAE 40 can be used only when cold start can be avoided (Ambient temperature cannot be under+10℃).

Proper Usage of Coolants

Usage Requirements

- Antifreeze selected should not only sufficiently prevent frost, corrosion and cavitations, but also avoid damaging seal rings, hosepipes. Furthermore, the antifreeze will not foam.
- Cooling system of engine must be filled with mixture of 60% water and 40% antifreezing agent with the minimum of frost-preventive function under -27℃.

water

Drinking water up to following requirements can be used on natural gas genset and CHP genset:

Appearance	Colorless，Transparent no mechanical impurities
Maximum hardness	20° DIN Hardness≈35.6°NF hardness≈25°BS hardness≈358ppm USS hardness
Maximum content of chlorine	100 ppm
Maximum content of sulfur	150 ppm
pH value@20°C	6.5~ 8.5

Note: As for water quality analysis, please consult local competent department. If there is no tap water up to the requirements above, you can mix demineralized water with distilled water or condensate water to reach prescribed value.

Antifreeze

The volume of antifreezing agent must be at least 40%. In the beginning of cold seasons, it's necessary to increase the content of antifreezing agent in cooling agents so as to prevent outdoor temperature from declining. As for specific mixing ratio, please refer to the table below

The lowest outdoor	water	Antifreeze
-27℃	60%	40%
-31℃	55%	45%
-37℃	50%	50%

Permissible prefab coolants: Deionized water must contain at least 40% approved antifreezing agent in volume.

Announcements

- Before starting up engine, you should open water tank to have a check. If there are water contamination, incrustation and sediments in water tank, please replace coolants in time.
- Human bodies should not contact antifreezing solution. Antifreezing solution and other additives are poisonous. So, please keep away from them and put them in safe places.
- Undiluted antifreezing agent and corrosion inhibitor should be disposed as special exhaust waste. Unused coolant liquid (mixture of antifreezing agent and water) must be disposed in accordance with regulation set by local competent department.

Recommended coolant liquid by Powerlink

Manufacturer	type
MitanMineralöl GmbH	Alpine C 48 Langzeitkühlerfrostschutz
Aral AG	Aral Antifreeze Extra
AVIA Mineralöl-AG	AVIA Antifreeze APN
OOO TOSOL-SINTEZ	AWM 11 AWM G11
BP Southern Africa (Pty) Ltd.	BP Isocool CT
Caltex Oil SA (Pty) Ltd	Caltex CX Antifreeze Coolant
Castrol Ltd.	Castrol Antifreeze NF Castrol Radicool NF
CLASSIC Schmierstoff GmbH & Co. KG	Classical kolda UE G48
EnGMPn Petroleum Limited	EnGMPn Antifreeze and Summer Coolant
Unico Manufacturing Co.(PE) (Pty) Ltd	Engmans Super Antifreeze & Coolant
EUROLUB GmbH	EURPLUB Kühlerschutz D-48 Extra PROCAR Kühlerschutz Extra
FUCHS Petrolub AG	Fuchs MAINTAIN FRICOFIN
GMPNOL GMPsellschaftm.b.H. &Co	GMPNOL Antifreeze Premium
ORGANIKA SA	GLIXOL EXTRA PLUS
BASF SA	Glysantin G 48
INA MAZIVA Ltd.	INA Antifriz Al Super
Mobil Oil SA (Pty) Ltd.	Mobil Antifreeze Extra
BVG Blume GmbH	MOFIN LangzeitKühlerschutz Premium Protect M 48
Bucher AG	Motorex Coolant G48
Nalco Australia Pty Ltd	Nalcool NF 48
Lukoil Lubricants Austria GmbH	OMV coolant plus
OMV Petrol Ofisi A.S.	PO OzelAntifriz
Sasol Coolant Conc 100	Sasol Oil Ltd.
TECTROL COOLPROTECT	BayWa AG
TOTAL South Africa (Pty.) Ltd	Total Antifreeze and Summer Coolant
Total	Total GLACELF MDX
Valvoline	Zerex G 48

Technical Guidance: PL20140513-06: Transportation and Storage of Gas Genset

Overview: As heavy duty equipment, operation personnel must abide by strictly relevant regulations when transporting and storing. Or, operation personnel can be hurt easily or genset equipment be damaged severely. Gas genset is designed with genset being separated from control switch cabinet, the transportation and storage of which are independent. Relevant instructions about transporting and storing control switch cabinet and gas genset will be illustrated in following.

Transportation of Control Switch Cabinet

After control switch cabinet is manufactured, it should be packed with thin film and transported in vertical. If transporting inside factory, you can erect the transportation lifting lug on the upper side of cabinet or move switch cabinet. What you should pay attention to is that you must hook on two lifting lugs with in symmetric positions. You can also select suitable forklift to move or lift at short range the switch cabinet and put it on the tray. Specific method to transport control switch cabinet for long distance is: Keep switch cabinet vertical after packing,put it on a one-off tray, screw the landing legs of switch cabinet with the tray,and then use strip to fasten the whole switch cabinet on the tray to put it into the container.

The storage of Control Switch Cabinet

If control switch cabinet is not to be installed for the time being, it must be placed in dry and cool places, with temperature between 10℃ and 50℃. Desiccant should be used when necessary. If it is to be stored for a long time, please use insulated strip to seal off all holes and gaps on the control switch cabinet.

Transportation and Storage of Gas Genset

Instructions of Load Equipment

Only trained personnel can use load equipment. Following items need you attention for each time of usage:

▪Personnel is strictly to stand under lifting plug with lifting engines. Keep lifting devices arranged in order.

▪It's not allowed to affect safety performance and functional damages should not occur (such as, breakage, scratch, crack, shear mark, abrasion, deformation and damages caused by thermal effects).

▪Don't knot or twist to avoid excess load because of collision.

▪Don't pass from sharp edges if no precaution is taken.

▪Avoid of overloading because of collision.

▪It's prohibited to exceed the bearing capacity regulated on label (effective load tag, data plate and tag).

▪It's prohibited to bear asymmetric load if no precaution is taken.

▪Use shortening methods and add load in a right way.

▪Neglecting principle or using illegally can cause personal injury and property loss.Meantime, please be careful that responsible professional personnel should examine the load equipment at least once a yearto see if there exist external trouble, deformation, abrasion, corrosion breakage, crack. If illegal faults occur, they must be removed. It's strictly forbidden to do any change that may affect the function and loading capacity of load equipment during maintenance. Besides, the bearing capacity of load limiting equipment will decrease correspondingly under high temperature condition. Reliability must be checked when used in corrosive environment. If there is a possibility that load may unhook, then it's not allowed to use load equipment.

Transportation of Genset

When transporting with vehicles, you should put a packing block made of wood, rubber or similar materials between the rack and bearing surface of genset. Fasten a fastening belt in according to regulations to prevent sliding and turning over.

In principle, gensets are not allowed to be transported by trains, because it will hit against tracks fiercely during transportation. Especially when the train is commissioning, genset may strike the carriage, which will cause danger to the bearing of engine, especially the main bearings. However, train transportation cannot be avoided in some regions, so it's a must to ensure shock absorbing strip or other shock absorbing units be put under the rack of genset. Besides, tranportation companies must ensure carriages with engines/gensets must not collide during commissioning.

Moving of Genset

1) Install genset to idler wheel.

Delivery idler wheel should be placed a distance from I-type rack.

Install a spacing wooden block on idler wheel. Use cranes to sling

genset and place it into a building as far as possible (warehouse or engine room).

If there is some limitation and the crane cannot reach installation engine room or warehouse, then you need to use delivery idler wheel to move genset.

2) Idler wheel moves genset.

You can use following two methods to move genset with idler wheel.

▪ Use a forklift or a winch to pull it. Use a woven ringto fix the chain, pull rod and ropes onto the beams of genset.

▪ Use a forklift"man-powered"to push it. If you need to move engine with a forklift, please put a square timber on the end face of rack. Move the engine by pushing the square timber with a fork. Experience shows that three or four strong and powerful workers will move genset. The prerequisite is that genset is on a flat base, which can be done by putting a metal board under the base.

⚠ Notice: Such components as module connectors and ignition devices are never allowed to be used as points of application).

3) Move genset on a steel roller.

If you need to move genset with a steel roller, please lift genset at right lifting point with hydraulic lifting equipment. Roll a proper steel roller or a steel pipe under the rack of genset, remove the delivery idler wheel in front and then put genset onto the steel roller. Move genset on the steel roller after transferring genset from the idler wheel to steel roller. Transfer from the steel roller to the idler wheel in the same way.

Storage of Genset

For various reasons, genset and relevant components are usually stored for a period of time before installation. Following points need your attention in storage process:

Storage place must be dry and in good ventilation condition, with temperature between 0℃ and 50℃ and relative humidity below 80%.

•In places where temperature is lower than dew point because of temperature difference between day and night or seasonal change, antifreezing measures must be taken.

• If storing for a long time, it's necessary to use antioxidant and preservative on engine body.

• Make sure that all power supply switches and relays are at "OFF" position during storage process.

• As for some specific gensets, their storage environment depends on their materials, so please examine the technical parameter table when storing them.

Following points need your attention when storing engines, the power source of genset:

•Wipe and clean engine. Smear lubricating oil on the surface of all moving parts when necessary.

•Disconnect the terminal line of storage battery and check regularly the capacity of battery.

•Loose all driving belts.

•Use water-proof tarpaulin to cover engine and keep good ventilation condition to prevent condensation.

•Use suitable cover or insulating strip to seal following holes and openings: air inlet, exhaust pipe opening, groove of flywheel, vent hole of lubricating oil and oil scale.

•Hang labels: Note storage date and words of "Not allowed to use".

•Top up oil tank with lubricating oil suitable to storage (According to manufacturer's requirements).

Warning!

Every engine manufacturer has his own specific steps and regulations to store engines. Failing to observe the regulations will let the quality right be canceled; If having known that the storage time exceeds 6 months, then users should store engines according relevant documents offered by engine manufacturers.

Slinging of Genset

▪Before slinging genset, operation personnel should examine carefully the labels ongenset and load equipment.

When slinging, please ensure that the permissible maximum vertical inclination angle of genset cannot exceed5°. If the angle exceeds this value, please be sure to stop slinging. easure again the center of gravity and change position and the holders on the rack of lifting equipment when necessary.

▪ In order to sling genset again, it's a must to set a lock point on lifting equipment to prevent exceeding permissible inclination angle. Lock point on the label of lifting equipment is just for reference.

Technical Guidance: PL20150624-06: Pipelines

Objectives:

This technical guidance describes acid treatment and preservative treatment of steel pipes.

Outline:

It's a must to clean by acid washing the pipes with oxide skin because of welding or other thermal reactions.
Fasten all pipelines in a knock-preventing method. It's a must to connect engine by flexible connecting pieces.

Seal the screw connecting pieces with fiber (twine) by relevant licensed screw sealing pieces.

Acid washing of pipes

Use the mixed liquid of sodium acid sulfate and water or hydrochloric acid and water as pickling agent.

Mixing ratio of water and acid liquor:

Hydrochloric acid	1：1	
sodium acid sulfate	1：20	Pay attention to the mixing ratio set by pickling agent manufacturer.

Seal the end of pipe and add in pickling agent or put pipes into acid washing pool if allowed.

Pay attention to the temperature instruction set by pickling agent manufacturer.

Action time of pickling agent:

hydrochloric acid/water	about1 hour
sodium acid sulfate/water	about10 hour

When the action time is over, empty the pipe or take it out from acid washing pool and rinse it completely with low-temperature washing agent.
Confirm that the pipe is cleaned completely.

Dispose pickling agent waste according to regulations.

Preservative treatment of acid-washed pipes

After acid washing, use proper mediums to conduct preservative treatment of pipes.
For example- engine oil; cooling water pipe- cooling agents.

Technical Guidance: PL20150710-06: Installation Surface

Objectives:

Requirements of smoothness, size, and load capacity about Powerlink equipment are described in this technical guidance.

Outline:

Powerlink has a high requirement of smoothness about installation surface.

Installation Surface

- Load capacity of installation surface

  Installation surface must be able to bear both the dynamic and static load of Powerlink equipment.
  Static load=Weight of equipment
  Dynamic load≥ 103% Weight of equipment

- Size of installation surface

Installation surface can be base, fixed surface or the ground in engine room.

As to genset, the size of installation surface must meet standard and equals to (Length of rack + 200 mm) x (width of rack + 200 mm). When selecting engine oil collectors, please make sure that the size of installation surface must be at least equal to the size of engine oil collector.

As for genset container, the installation surface of it should be bar-shaped baseboard or base plate. Please check the size of installation surface from base plane graph or base structure drawing.

- Installation surface

  Surface slope for genset＜2°
  If the commissioned party uses cement paste to meet balance standard, then he must meet the minimum requirements below at the same time:
  1. Swell increment≤ 0.1%
  2. Volume stability
  3. Solidity; 24hours later, compressive strength must be 25 N/mm².Delcine of solidity cannot be detected 6 and 90 hours later. If it is still irregular, you can modify it by inserting a metal board in the installation surface of genset.

- Surface Treatment of Installation Surface

  It's recommended to use oil-proof and water-proof protective coating to handle the installation surface.
  Many self-leveling mortar products are water-proof and oil-proof, so there is no need to use protective coating.

Technical Guidance: PL20140709-06: Torque Wrench

Setting

- Set prescribed torque tightening value according to application instructions set by relevant manufacturers.

Installation Regulation

- Make sure to clean bolts, nuts and connecting surface. It's not allowed to use expansion bolts with rust, stria and incision. If piston or bearings damage, it's essential to use new expansion bolts. You can check the completeness of bolts with regulated methods.
- Use fresh engine oil to lubricate screw and connecting surface.
- It's a must to pull the torque wrench equably from the beginning to the end. It's necessary to revolve the wrench to the right smoothly and equably all the way. Stop tightening after bending the wrench.
- When tighten parts on the upper side of seal ring, the revolving degree of each bolt should not be over from60° to90°and each bold should be screwed in the same angle. Bend the wrench after resetting and tightening every bolt. After being tightened, the opposite bolt must also be screwed so that the wrench can be bent in the same angle.

  If the second bolt need larger angle, then please don't tighten bolt equably and rotate it back the same angle until bending the torque wrench according to described methods. Then, tighten all bolts one after another.

  Exchange and tighten crosswise bolts all the way.
- When tightening parts without seal ring being placed, it's recommended to tighten crosswise before reaching the biggest screwing torque. After tightening, it's recommended to shortly hit heavily the bolt head or workpieces for several times. Than, tighten again the bolts. If the bolts can be tightened again, please repeat this process.
- When tightening the torque wrench, please be careful. Please stop immediately tightening after bending because the bolts can be tightened again with a wrench.

Loosen Expansion Bolt

- Among bolts arranged in pairs oppositely, loosen each bolt one after another instead of loosening the second bolt after having loosened the first one completely. When more than one bolt are arranged nearby, please loosened them in a cross way.

  In this way, bolt can be prevented from occluding.

  For the first time of loosening, each bolt should be moved rotationally for1/4 circle until the screwing torque is dismissed and then the bolts can be revolved again.

- Special attentions:

  It's definitely necessary to open the expansion bolts still with high temperature.

  After shutting down engine and if it's necessary to dismantle it immediately, please open covers of all crankcases to cool down quickly the engine. Only after the expansion bolts to be loosened cool down, especially bolts of cylinder heads (This can be confirmed by touching constantly, with temperature40°C - 45 °C)

Calibration of Torque Wrench

- Torque wrench should be calibrated once a year. When the calibration accuracy is influenced because the torque wrench is used with overload or misconducted.