

	Model : 12M55G10D2/5	Date : 01-01-25
	Exhaust Emission Datasheet	Page : 1 / 1

Engine Basic data

Engine model	12M55G10D2/5
Max. test power @1500rpm (kWm)	2700
N° of Cylinders / Valves	12 / 48
Cylinders arrangement	At Vee
Displacement (L)	65.65
Thermodynamic Cycle	Diesel 4 stroke
Cooling System	Liquid (water + 50% antifreeze)
Injection System	Direct
Fuel System	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled
Fuel type	Diesel

Test information

Test Date	15/11/21
Test Cell n°	B08
Test Procedure	ISO 8178 ^{*(1)}

Measured data^{*(2)(3)}

Load % of ESP	Power (kWm)	Ambient Temp (°C)	Exhaust Temp (°C)	Exhaust Flow (kg/h)	Nox (g/kWh) / (mg/Nm ³)	HC (g/kWh) / (mg/Nm ³)	CO (g/kWh) / (mg/Nm ³)	PM (g/kWh) / (mg/Nm ³)
100%	2701	24.4	493	13385	9.3/ 3107	0.1/ 21.7	0.2/ 90.0	-/ -
75%	2026	24.2	463	12575	5.6/ 1777	0.1/ 33.2	0.5/ 164.1	-/ -
50%	1350	24.1	434	10063	4.1/ 1322	0.2/ 61.2	0.7/ 183.5	-/ -
25%	675	23.4	402	6043	4.0/ 1279	0.4/ 108.7	0.6/ 184.2	-/ -
10%	270	23.2	309	4336	5.3/ 1131	1.0/ 226.5	1.8/ 366.0	-/ -
Weighted Value					5.16/ -	0.20/ -	0.51/ -	0.073/ -

* Notes: 1. Steady-Stage emissions recorded per ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rates stabilized.

2. mg/Nm³ values are measured dry and corrected to 5% O₂ content.

3. This data was taken from a single engine test according to the Test Methods and Conditions specified. This data is subject to instrumentation, measurement, and engine-to-engine variability. Field emissions test data is not guarantee to these levels. For air permit programs, please contact Application Engineering for expected site variation.

Generator

***Technical
Submittal
TS02***

***E2024-3031
Saunderton***



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

1.0 – Technical Submission Front Page

Trade Contractor:	AVK-SEG (UK) Ltd	From:	L.Spenst
Trade Contractor Sub No:	TS02	Date:	12/02/25
Revision:	0		
Reason for Revision:	First Issue		

Approval for the following equipment is required:

Equipment:	Diesel Generating Set	Make:	AVK
Equipment Reference:	WPG3750B7 Generating Set	Areas Used:	
Description:	Supply and installation of 2 no. DataCenter Rated with UTI Letter Diesel Generating Set comprising: • 16M55G6D2/5 (Tier 2) Emissions Optimised Diesel Engine • Leroy Somer LSA 54.2 ZL17 / 4p Brushless Synchronous Alternator • Mechanically Driven Cooling Package • DeepSea Generator Controller		
Planned on Site Date:	TBC		

Attached detail documents:

(Tick if included and insert references within boxes identifying supporting documentation included within this submission)

Section	Description	Tick	Section	Description	Tick
1.0	Technical Submission Front Page	✓	6.0	Interfaces and Dependencies Schedule	✓
2.0	Equipment Description	✓	7.0	Builders Work Requirements	X
3.0	List of Exceptions & Clarifications	✓	8.0	Schedule of Comments	✓
4.0	Manufacturers Documents	✓	9.0	Appendices	✓
5.0	Certified Drawings	X			

Signed by:	L.Spenst / Head of Engineering
Date:	12/0/2025

Approval:

Company	Name	Date	Status	Comments

Note: If client sign off and/or comments have not been received within 2 weeks of the date stated on this technical submission then the products and/or services detailed in the technical submission are deemed to be acceptable and final technical submission from AVK Projects will be based upon the scope covered within this document.



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

2.0 – Equipment Description

2.1 Requirements

We are required to provide of 2 no. 3500kVA/2800kW net, emission optimised (Tier 2), Datacenter rated with UTI letter, LV diesel generating set. Complete with mechanically driven cooling package and generator mounted controller

2.2 Generator

WPG3750B7 diesel generating set with 16M55G6D2/5 turbocharged diesel engine and Leroy Somer LSA 54.2 ZL17 / 4p brushless synchronous alternator.

Generating set sized to support a standby rated load of 3500kVA/2800kW net, at 400V, 3-phase, 50Hz, 1500 rev/min, for an unlimited number of operating hours per year with varying load conditions (average load factor <100%), as stated in the UTI letter, in accordance with ISO 8528-1 and ISO 3046-1. No overload capability for this rating.

Generating set designed to performance class G3.

Generating set supplied with:

- Integrated digital automatic voltage regulator (AVR)
- Dual 24V electrical starter motor with battery charging alternator (redundant operation)
- Dual 24V low maintenance lead acid starting batteries.
- 24V battery chargers
- Air, fuel, and lube oil filters
- Electronic engine management
- Common rail electronic injection system
- Low lube oil pressure protection switch
- High water temperature protection switch
- Low coolant level alarm
- Common skid frame with spring type anti-vibration pads between base frame and floor to provide a degree of isolation.
- Thermostatically controlled water jacket heater and circulating pump.
- Flanged exhaust bellows
- CE label

See the following appendices for further details:

[Appendix 9.01 – Generator Datasheet](#)

[Appendix 9.02 – Engine Datasheet](#)

[Appendix 9.03 – Alternator Datasheet](#)

2.2.1 Engine

Vee Configuration, liquid-cooled, four-stroke 16M55G6D2/5 (Tier 2) emissions optimised turbocharged diesel engine. Electronically controlled common rail fuel injection system with electric fuel pump, fuel pressure accumulator, high pressure fuel lines, duplex fuel filter.

Forced-feed lubrication system with piston cooling, lube oil circulation pump with lube oil filter, lube oil heat exchanger, oil filler neck and oil dipstick for measurement on non-running engine.

Thermostatically controlled water jacket heater with coolant circulation pump and coolant thermostat for charge air cooling circuit.

The power output is based on the below, site conditions:

- Designed ambient temperature – 40°C
- Altitude above sea level – <150m
- Exhaust Back Pressure – <140bar

See the following appendices for further details:

[Appendix 9.02 – Engine Datasheet](#)

2.2.2 Alternator

Leroy Somer LSA54.2 ZL17 / 4p brushless self-excited, self-regulating, double bearing, p2/3 winding type, IP23 drip proof, class H/F alternator sized to support a standby rated load of 3000kVA/2400kW net, at 400V, 3-phase, 50Hz, 1500 rev/min, for an unlimited number of operating hours per year with varying load conditions (average load factor <100%), as stated in the UTI letter, in accordance with ISO 8528-1 and ISO 3046-1. No overload capability for this rating.

Integrated digital type automatic voltage regulator (AVR) included to maintain alternator output voltage of 400V $\pm 5\%$ from no load to full load, unity to 0.8 lagging power factor, 3-phase, 50 Hz, 400V, 1500 rev/min and a total harmonic distortion (THD) of < 3.5%.

See the following appendices for further details:

[Appendix 9.03 – Alternator Datasheet](#)

[Appendix 9.04 – AVR Datasheet](#)

2.2.3 Cooling System

The generating set is supplied with a set mounted two-circuit type radiator assembly complete with expansion tank & cap and mechanically driven cooling fan.

Specifications:

- | | |
|----------------------------|-----------------------|
| • Cooling ambient design: | 40°C |
| • Cooling altitude design: | <100m |
| • Engine coolant capacity: | 350 litres |
| • Coolant Type: | Glycol-Ethylene 50/50 |
| • Thermostat: | 79-92°C |

2.2.4 Starting System

The generating set starting system comprises:

- 24V 10kW electrical starter motor and redundant starter motor.
- 24V dual set low maintenance lead acid starting batteries (each sized for maximum 3 x genset starting attempts, 6 total crank cycles of 10 seconds with redundant operation).
- Battery charging alternator.
- Dual battery chargers fed from auxiliary supply.

See the following appendices for further details:

2.2.5 Earthing

Earthing points are provided on the generator base frame.

2.2.6 Generator Controller

The generating sets are controlled via Deep Sea 8620 Mk II controllers located within the generator control panel mounted on the bedframe of the generator set. The Deepsea controller provides individual set control and monitoring. The control panel is fed from the 24V DC battery backed generator supply and is operated with an 3-inch ergonomic screen.

The Deep Sea control panel provides:

- Control of the genset in both automatic and manual mode
- Testing of the generating set both on/off load
- Display of genset measurement values (electrical and mechanical)
- Status of generating set (both current and historical)
- Time-stamped event display with log for up to defined amount of events
- Adjustment of genset parameters with appropriate user level (i.e. timer settings)
- Automatic cooldown periods with user defined time settings
- Engine oil pressure
- Engine water temperature
- Engine oil temperature
- Engine speed
- Hours run
- Number of start attempts
- Battery voltage

Event-based history (up to 500 records) with customer-selectable list of stored values; RTC; statistic values.

See the following appendices for further details:

[Appendix 05 – Controller Datasheet](#)



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

3.0 - List of Exceptions & Clarifications

To be discussed separately.

4.0 - Manufacturers Documents

Please see appendices.

5.0 - Certified Drawings

N/A

6.0 - Interfaces and Dependencies Schedule

Auxiliary Supply Required	Detail	Quantity Required	Provided By	Final Connection By
TBC	Maintained Generator Auxiliary Supply	1 per generating set	Others	Others
High Level Interface	Generator alarm monitoring (Modbus)	1 per generating set	Others	Others
Low Level Interface	Generator alarm monitoring (VFC's)	TBC	Others	Others

Note: The above list is based on initial design information and may be subject to change as the project progresses.

7.0 - Builders Work Requirements

N/A



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

8.0 – Schedule of Comments

The following table provides a schedule of all comments required against this document and details the AVK response and status of each comment.

Item	Client Comment	AVK Response	Status

Note: Client to advise status of comment from the following list:

- Accepted (no further action)
- Rejected (refer to comments)



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

9.0 – Appendices

Item	Document Name
9.01	Generator Datasheet
9.02	Engine Datasheet
9.03	Alternator Datasheet
9.04	AVR Datasheet
9.05	Controller Datasheet
9.06	UTI Letter



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

APPENDIX 9.01

Generator Datasheet

WPG3750B7

DIESEL GENERATING SET

50 Hz – Emission EPA Tier II Compliant

GENERATING SET RATINGS 50Hz – 1500rpm @ 0.8p.f

Voltage	DCP		PRP		ESP	
	kVA	kWe	kVA	kWe	kVA	kWe
400/230	3250	2600	3250	2600	3750	3000



Image shown may not reflect actual configuration

PRODUCT STANDARD FEATURES

Engine and Block

- Vermicular graphite cast iron cylinder block and head
- Alloyed cast iron, wet cylinder liners with fire ring on the top
- Separate cylinder head with 4 valves, top-down cooling
- Hydraulic bolt for both the cylinder head and bearing cap
- Hardened steel forged crankshaft with induction hardened journals, crankpins and radius

Cooling System

- Two separate circuits
- High temperature circuit equipped with thermostatically-controlled system with one gear-driven coolant pump
- Low temperature circuit equipped with thermostatically-controlled system with one gear-driven coolant pump

Fuel System

- Super-high pressure common-rail fuel system for more peak fire pressure
- Pre-filter and main filters with electric fuel pump
- Multistage fuel-water separation system

Lubrication System

- Finned oil cooler, spin-on oil filters
- Bypass oil and oil thermostat to keep the oil temperature steady
- Electrical oil pre-lube pump to pre-lubricate the engine and ensure good starting ability

Air Intake and Exhaust System

- 4 single-stage turbochargers
- Exhaust manifold and turbocharger shield for heat isolating

Electrical System

- Standard starting system comes with 2 x 24 Vdc electric starter motors and 1 x battery charging alternator
- Redundant dual starting system available as an option.

Alternator

- High Efficiency Brushless, 4 Pole, IP23 drip-proof revolving field
- design built with Class H insulation/Class F Temperature rise
- Direct-coupled by high-elasticated coupling
- Sustained overcurrent >300% in 10 sec
- Direct drive centrifugal blower fan cooling
- Excitation by PMG

Generating Set Controller

- Baudouin's generating set controller is ideal for a wide range of applications.
- Display status message Provide protection Auto shutdown at fault detection
- The class of protection is IP4X
- See individual spec sheet for detailed specifications

1) All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271. Performance tolerance of $\pm 5\%$.
2) Test conditions: 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.
3) Power output curves are based on the engine operating with a fuel system, water pump, and lubricating oil pump; not included are the battery charging alternator, fan, and optional equipment.

GENERATING SET SPECIFICATIONS		
Governor and regulation class		In accordance with ISO 8528-5 Class G3 performance
Phase number and connection		3 phase, 4 wires, Y-type
Cooling method		Closed looped water-cooled
Starting method		DC 24V Electric starter
Steady-state voltage deviation		≤± 1%
Steady-state frequency band		≤ 0.5%
ENGINE		
Brand / Model		Baudouin / 16M55G6D2/5
Gross Power	kWm	ESP – 3300 / PRP - 2900
Cylinder / Type / Aspiration		16 / Vee Type, Turbocharged and Aftercooled
Bore x Stroke	mm	180 x 215
Displacement	L	87.5
Compression ratio		16.5:1
Brake Mean Effective Pressure	kPa	ESP – 3017
** See engine data sheet for detailed specification.		
ALTERNATOR		
Coupling / No. of Bearing		Coupling / Double
Winding Pitch		2/3
Type of Excitation		PMG
Cooling type		Air
Voltage regulation method		AVR
Winding temperature sensor		PT100
Bearing temperature sensor		PT100
Anti-condensation heater voltage		AC230V
Classes (Insulation / Temperature Rise)		H / F
Protection Grade		IP23
** See alternator data sheet for detailed specification		
COOLING SYSTEM(Optional)		
Type of Coolant		Liquid(water + 50% antifreeze)
Max coolant temperature – shutdown	°C	112
Cooling Fan Airflow	m3/min	3715
** See radiator data sheet for detailed specification		
EXHAUST SYSTEM		
Exhaust Gas temperature after the turbocharger	°C	TBA
Exhaust Gas flow	m3/min	ESP –766.7 / PRP –723.6
Max Exhaust back pressure	mBar	150
Noise level(Open)	dB(A)@1m(75%)	/
Noise level(Open)	dB(A)@7m(75%)	/
FUEL CONSUMPTION (Tolerance ±5%)		
100% ESP	L/hr	787
100% PRP	L/hr	723.7
75% PRP	L/hr	569.9
50% PRP	L/hr	388.8
25% PRP	L/hr	214
GENSET CONTROLLER		
Baudouin's generating set controller is designed for manual/auto parallel systems.		
The controller is an easy to use Synchronising Auto Mains (Utility) Failure Control Module suitable for paralleling single generating set (diesel or gas) with the mains (utility).		
Key Benefits		
• Real-time clock provides accurate event logging		
• Ethernet communication, provides built in advanced remote monitoring.		
• Can be integrated into building management systems (BMS) and programmable logic control (PLC)		
		

Ratings definitions

Emergency standby power (ESP):

ESP is the maximum power available for a varying load for the duration of a main power network failure. The average load factor over 24 hours of operation should not exceed 70% of the engine's ESP power rating.

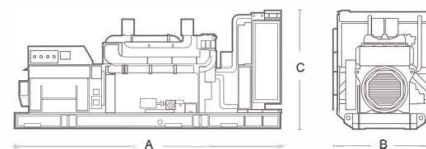
Typical operational hours of the engine are 200 hours per year, with maximum usage of 500 hours per year. This includes an annual maximum of 25 hours per year at the ESP power rating. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

Prime power (PRP):

PRP is the maximum power available for unlimited hours of usage in a variable load application. The average load factor should not exceed 70% of the engine's PRP power rating during any 24-hour period. An overload capability of 10% is available for 1 hour within every 12-hour period.

Data Center power (DCP):

DCP is the maximum power that an engine is capable of delivering while supplying a variable or continuous load and during unlimited run hours. An overload capability of 10% is available for 1 hour within every 12-hour period.



Outline

This outline drawing is to provide representative configuration details for Model series only.
See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Dimension and Weight

Structure	Model	Dim "A" mm	Dim "B" mm	Dim "C" mm	Dry wt. kg
Open	WPG3750B7	8285	3104	4005	30500

* Note: Sizes and weights represent a generating set with standard features and tolerance is $\pm 3\%$. See the outline drawings for the detailed configurations of sizes and weights.

Codes and standards

ISO 9001	This generating set is designed and manufactured in facilities certified to ISO 9001.	ISO 8528	This generating set has been designed to comply with ISO 8528 regulation.
CE	This generating set is designed and manufactured in facilities certified to CE certification.	UKCA	The generating set is designed to meet UKCA certification.

The generating set is designed and manufactured in facilities certified to standards ISO9001:2015 and ISO14001:2015. The generating set is prototype-tested, factory-built and production tested and is in compliance with the relevant standards:

- ISO 8528-13, ISO 3046, DIN627
- EN 60034-1, EN 60204-1
- Machinery Directive 2006/42/EC EMC Directive 2014/30/EU RoHS Directive 2011/65/EC

Data and specifications are subject to change without notice.



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

APPENDIX 9.02

Engine Datasheet

	Model : 16M55G6D2/5	Date : 30/11/22
	PowerKit Engine Datasheet	Page : 1 / 4

Ratings

RPM	Gross Engine Output				Net Engine Output *			
	PRP		ESP		PRP		ESP	
	kWm	BHP	kWm	BHP	kWm	BHP	kWm	BHP
1500	2900 *	3889 *	3300	4425	\ *	\ *	\	\

1 kWm = 1,34102 BHP

* When the engine is used with a cooling system using an electrically driven fan, net engine output data may change and quoted figures should be used for reference only

Basic data

Engine model	16M55G6D2/5
N° of Cylinders / Valves	16 / 64
Cylinders arrangement	At Vee
Bore x Stroke (mm)	180 x 215
Displacement (L)	87.5
Thermodynamic Cycle	Diesel 4 stroke
Firing Order	A1-B1-A3-B3-A2-B2-A5-B5-A8-B8-A6-B6-A7-B7-A4-B4
Mean Piston Speed (m/s)	10.75
BMEP @ ESP (Bar)	30.17
Cooling System	Liquid (water + 50% antifreeze)
Injection System	Direct
Fuel System	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled
Compression ratio	16.5 : 1
Flywheel housing	SAE 00
Flywheel	21"
Rotation Viewed from Flywheel...	Counterclockwise
Allowed static bending moment of the flywheel housing...	/
N° of teeth on flywheel ring gear	202
Inertia of flywheel (kg•m²)	20.78
Inertia of crankshaft (kg•m²)	17.1
Emission standard	EPA Tier2
Overall Dimensions without radiator (Length x Width x Height) (mm)	4161×1953×2468
Engine dry weight without radiator and without radiator pipes (kg)	11500
Engine dry weight with radiator and radiator pipes (kg)	N/A
Engine wet weight with radiator (includes oil, coolant) (kg)	N/A

* The indicated PRP Power is for reference only. This engine is designed for emergency standby power (ESP) applications only.

DPK-TDS-EN-16M55-9002-22-11-30 Moteurs Baudouin reserve the right to modify these specifications, without notice. Document not contractual.

	Model : 16M55G6D2/5	Date : 30/11/22
	PowerKit Engine Datasheet	Page : 2 / 4

Air intake system

Air intake temperature rise (°C)	≤ 5
Air intake restriction clean filter (mBar)	≤ 35
Air intake restriction dirty filter (mBar)	≤ 70
Recommended air flow @ PRP (m³/min)	225.4
Recommended air flow @ ESP (m³/min)	237.0
Min. diameter of intake pipe (mm)	140

Aftercooling system

Aftercooler system type	Air to Water
Max. intake temperature @ 25°C ambient temperature (°C)	55
Max. difference between intake temperature and ambient temperature (°C)	30
Max. intake pressure drop of aftercooler (mBar)	60

Lubrication system

Oil capacity Low / High (L)	405 / 500
Oil pressure in normal condition idle speed (Bar)	≥ 1.8
Oil pressure in normal condition at 1500 Rpm @ PRP (Bar)	4 - 6.5
Lowest oil pressure alarm (shutdown) (Bar)	1.8
High Oil Pressure Warning	6.5
Max. oil temperature (°C)	105
Oil flow at 1500 Rpm (L/min)	1460
Oil fuel consumption ratio based on engine fuel consumption data	≤ 0.2 %
Total system capacity (including filters) (L)	582

Heat balance test data (with ambient temperature 25 °C)

Total heat dissipation @ ESP (kJ/s)	4846
- Heat Rejection to Jacket Water @ ESP (kJ/s)	1219
- Heat Rejection to Low temperature circuit @ ESP (kJ/s)	734
- Radiated Heat to Ambient @ ESP (kJ/s)	357
- Heat Rejected to Exhaust @ ESP (kJ/s)	2536

Exhaust system

Max. exhaust back pressure (mBar)	150
Max. exhaust temperature before turbocharger (°C)	740
Max. exhaust temperature after turbocharger (°C)	550
Exhaust flow @ PRP (m³/min)	723.6
Exhaust flow @ ESP (m³/min)	766.7
Min. diameter of exhaust pipe (mm)	280
Max. bending moment of exhaust gas exit flange (Nm)	10

DPK-TDS-EN-16M55-9002-22-11-30 Moteurs Baudouin reserve the right to modify these specifications, without notice. Document not contractual.

	Model : 16M55G6D2/5	Date : 30/11/22
	PowerKit Engine Datasheet	Page : 3 / 4

Cooling system without radiator

System designed for ambient temperature up to (°C) ¹	\
Radiator type	\
Fan type	\
Min. inside diameter of coolant outlet pipe (mm)	LT 76 / HT 96
Coolant capacity of radiator and pipes (L)	\
Coolant alarm (shutdown) temperature (°C)	112
Thermostat opening temperature / full open temperature (°C)	82 / 92
Max. additional restriction for external cooling circuit (Bar)	HT 0.6 / LT 0.4
Coolant capacity of the engine (L)	350.5
Cooling fan airflow (m³/min)*	\
Fan absorbed power (kW)	\
Additional restriction (for reference) - Duct allowance (Pa)	150

* Air flow figure assumes the presence of the standard radiator provided, taking into consideration the backpressure caused

Fuel system

Governor	ECU
Governor steady state speed stability at constant load (ISO 8528-5 Class G3) ²	≤ +/- 0.5 %
Max. restriction at fuel inlet (Bar)	0.1
Max. pressure at fuel inlet (Bar)	0.5
Max. fuel return restriction (Bar)	0.2
Max. fuel inlet temperature (°C)	70
Fuel supply flow (L/hr)	3400
Min. internal diameter of inlet pipe (mm)	19
Min. internal diameter of return pipe (mm)	19

Electrical system

Electrical system voltage (negative to ground) (Vdc)	24
Starter power (kW)	2 x 10
Battery charger current (A)	55
Battery charger absorbed power (kW)	1.6
Max. electric resistance of starting circuit (Ω)	0.008
Min. sectional area of wire (mm²)	2 x 95
Min. cold start temperature without auxiliary starting device (°C) ³	-10
Min. cold start temperature with auxiliary starting device (°C) ³	TBD

¹ The indicated value is based on the AOT value of 1°C for an engine tested at 100% of the ESP Power, reflecting temperature in an open condition, without an enclosure or container, without any airflow obstruction in the front of the radiator, without air recirculation, with free exhaust gas exit and with the engine thermostatic valve in its full open condition, without a closing plate present. The reference air restriction is equal to 50Pa. For the equivalent ATB (Air-to-Boil) performance in a customer or project basis, please consult Baudouin Application Engineering.

² This refers only to the frequency response of the engine and should not be confused with the performance class of the Generator Set, which is subject to additional contributing factors such as alternator selection and control settings.

³ Engines used in emergency standby application or applications that require immediate start under load, they must be equipped with coolant heaters. Baudouin recommend heaters installation to be executed by providing constant coolant circulation across all the engine components. Two heaters are required for V-type engines, one per each side.

	Model : 16M55G6D2/5	Date : 30/11/22
	PowerKit Engine Datasheet	Page : 4 / 4

Noise

Diesel engine noise (Acoustic power level) (dB(A))	124.2
Noise - upper side (dB(A))	107.2
Noise - right side (view from flywheel) (dB(A))	106.9
Noise - left side (view from flywheel) (dB(A))	106.2
Noise – front (radiator) side (dB(A))	102.6
Noise – rear (flywheel) side (dB(A))	102.3

Notes :

- Noise test made at 100% of the ESP power, at 1 mt. distance, on engine without radiator, without cooling fan and without silencer.
- Noise test refers to ISO 6798 norm : "Reciprocating internal combustion engines. Measurement of emitted airborne noise. Engineering method and survey method".

Fuel consumption

Rating	gr/kWh	L/hr
100% ESP	200.1	788.3
100% PRP	207.4	716.2
75% PRP	214.0	554.1
50% PRP	222.9	384.7
25% PRP	249.2	215.1
Fuel consumption tolerance +/- 5%		

Notes:

This engine is designed for ESP (Emergency Standby) applications only, the values shown above at PRP levels refer to the Referenced Power (2900 kWm).

Ratings definitions

Emergency Standby Power (ESP)

Emergency Standby Power is the maximum power available for a varying load for the duration of a main power network failure. The average load factor over 24 hours of operation should not exceed 70% of the engine's ESP power rating. Typical operational hours of the engine is 200 hours per year, with a maximum usage of 500 hours per year. This includes an annual maximum of 25 hours per year at the ESP power rating. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

Prime Power (PRP)

Prime Power is the maximum power available for unlimited hours of usage in a variable load application. The average load factor should not exceed 70% of the engine's PRP power rating during any 24 hour period. An overload capability of 10% is available, however, this is limited to 1 hour within every 12 hour period.

- All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271. Performance tolerance of $\pm 5\%$.
- Test conditions : 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.
- Power output curves are based on the engine operating with fuel system, water pump and lubricating oil pump; not included are battery charging alternator, fan and optional equipment.



Engine model :

16M55G6D2/5

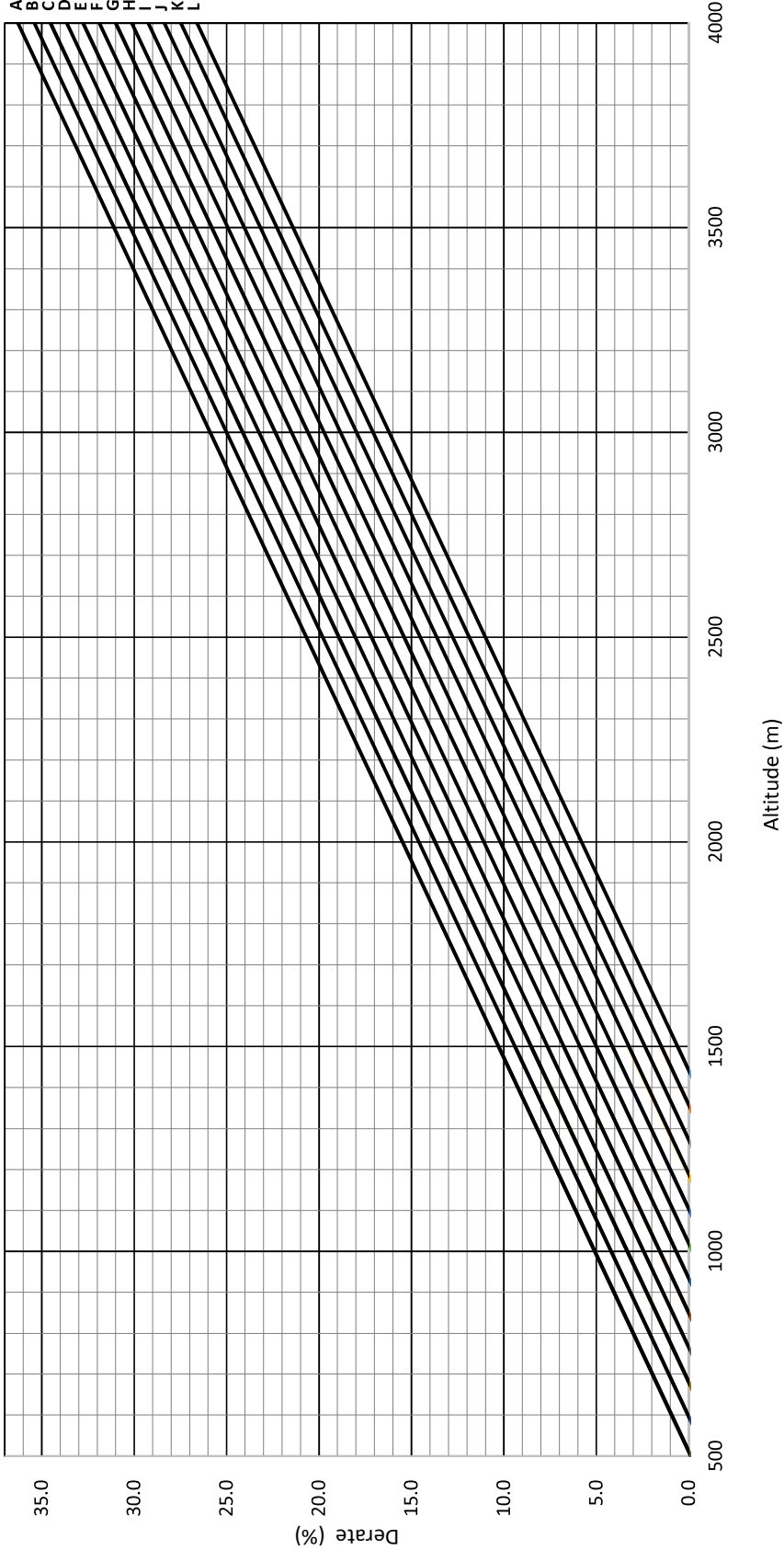
Date : 08/06/24

PowerKit Engine Derate Curves

Page : 1 / 1

Ambient Temperature (°C / °F)

A	B	C	D	E	F	G	H	I	J	K	L
55 / 131	50 / 122	45 / 113	40 / 104	35 / 95	30 / 86	25 / 77	20 / 68	15 / 59	10 / 50	5 / 41	0 / 32



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APPENDIX 9.03

Alternator Datasheet

ALTERNATOR TECHNICAL DESCRIPTION

WHA 54.2 ZL17 / 4p

Date: 06-17-2024

197 A,Fushou East Street,High-Tech Development Zone, Weifang,China

Main data				C
Generator type:	WHA 54.2 ZL17 / 4p			
Power:	3 750	kVA	3 000 kWe	3 099 kWm
Voltage:	400	V	Star serial	
Rated voltage range:	+5/-5%			
Power factor - Lagging:	0,8			
Frequency:	50	Hz		
Speed:	1 500	rpm		
Nominal current:	5 413	A		
Winding type:	p2/3			
Classes (Insulation / Temperature Rise):	H / F			
Ambient temperature:	45	°C		
Altitude:	1 000	m		
Installation		IEC	Quantity	1
Prime mover:	Reciprocating engine			
Manufacturer:	-			
Type:	-			
Duty:	Base Rating			
Mechanical construction				IM1101
Type of construction:	Two bearing			
Mounting arrangement:	Horizontal Axis			
Direction of rotation:	Clockwise (seen when facing the drive end - DE)			
Bearing type:	Anti-friction			
Bearing Lubrication:	Regreasable			
Bearing insulation:	Not insulated			
Shaft end type:	Cylindrical with keyway			
Balancing - Class (ISO 21940-11):	Half key - G2,5 (std)			
Flange:	None / without			
Shaft height:	500	mm		
Width:	1 150	mm		
Additional specificities				
Stabilized Runaway speed:	1 800	rpm - 2 min.		
Cooling Method				IC01
Degree of protection:	IP23			
Coolant:	Air / Temperature: 45 °C			
Air quality:	Clean			
Ventilation (internal):	Self-ventilated			
Filters:	Without			
Ducting for air inlet:	No			
Ducting for air outlet:	No			

ALTERNATOR TECHNICAL DESCRIPTION

WHA 54.2 ZL17 / 4p

Date: 06-17-2024

Connection, Excitation & Regulation

Parallel operation:	Island mode (0F) - no droop CT	1
Excitation:	Self-excited - Brushless - Type: PMG	1
Sustained 3-phase Isc:	> 3 x FLC for 10s.	1
AVR type:	D550 - Digital	1
AVR location:	In terminal box	1
Alternator Voltage sensing:	In terminal box	1

Terminal box

Power connection:	4 connectors (brought out neutral)	1
Main terminal box location:	1 terminal box on the top	1
Line side outlet:	Left hand side (seen when facing the drive end - D)	1
Gland plate:	Non magnetic, Undrilled	1
Auxiliaries	In main terminal box	1

Protection and measurement accessories

Temperature detection

Stator windings:	6 x PT100 (3 wires)	1
Combined guide and thrust bearing - DE:	1 x PT100 per bearing (3 wires)	1
Guide bearing - NDE:	1 x PT100 per bearing (3 wires)	1

Anti-condensation heating

Voltage: 230 V - 1Ph / Power: 500 W

Various items

Paint:	PE - Primary - RAL 7032	1
Documentation:	PDF manual	1
Documentation Language:	English	1
Nameplate	Sticker	1

Controls

Standards:	IEC	1
QUAL/INES/006 001 => 101	Measurement of winding resistance	1
QUAL/INES/006 021 => 128	Insulation check on sensors (when fitted)	1
QUAL/INES/006 002 => 102&103	Voltage balance and phase order check	1
QUAL/INES/006 007 => 109	Overspeed test (according to test bench limitation)	1
QUAL/INES/006 009 => 111	High potential test	1
QUAL/INES/006 010 => 112	Insulation resistance measurement	1

ALTERNATOR ELECTRICAL DATA

WHA 54.2 ZL17 / 4P

Date: 06-17-2024

Main data:						C
Power:	3 750	kVA	3 000	kWe	3 099	kWm
Voltage:	400	V	Frequency:	50	Hz	
Rated voltage range:	+5% / -5%		Speed:	1500	rpm	
Power factor - Lagging:	0,8					
Nominal current:	5 413	A	Phases	3		
Insulation / Temperature rise:	H / F		Connexion	Star serial		
Cooling:	IC01		Winding type:	p2/3		
			Winding:	- 6 Wires		
Ambient temperature:	45	°C				
Altitude:	1000	m	Overspeed (rpm)	1800		
Duty: Base Rating			Total Harmonic Distortion (THD)	< 3.5%		

Efficiency (Base 3000 kWe)						IEC
	25%	50%	75%	100%	110%	
Power factor - Lagging: 0,8	92,33	95,55	96,46	96,79	96,85	1
Power factor - Lagging: 1	92,69	96,00	97,00	97,42	97,51	1

Reactances (%) - (Base 3750 kVA)						
Unitary impedance (1 per unit) = 0,042667 ohms						
		Unsaturated		Saturated		
	Direct axis			Quadrature axis		
Synchronous reactance	Xd	174	113	Xq	89	57
Transient reactance	X'd	19,2	16,3	X'q	89	57
Subtransient reactance	X''d	10,4	8,9	X''q	10,9	9,3
Negative sequence reactance	X2	10,7	9,1			
X0	2,3	Zero sequence reactance				
Xl	5,2	Stator leakage reactance				
Xr	15,2	Rotor leakage reactance				
Kc	0,89	Short-circuit ratio				

Time constants (s)					
		Direct axis		Quadrature axis	
Open circuit transient time constant	T'do	4,22		T'qo	NA
Short-circuit transient time constant	T'd	0,466		T'q	NA
Open circuit subtransient time constant	T''do	0,061		T''qo	0,240
Subtransient time constant	T''d	0,033		T''q	0,030
Ta	0,057	Armature winding short circuit time constant			

Resistances (%)					
Ra	0,6	Armature resistance	R0	0,8	Zero sequence resistance
X/R	14.8	X/R ratio (without unit)	R2	2,1	Negative sequence resistance

Voltage accuracy: 0,25%

Maximum inrush current for a voltage dip of 15%: 3833 kVA

when starting an AC motor having a starting power factor between 0 and 0.4

Rating is provided for the specified temperature rise, by resistance measurement according to IEC60034-1

According to: I.E.C. 60034.1 - 60034.2 - NEMA MG 1-32

Products and materials shown in this catalogue may, at any time, be modified in order to follow the latest technological developments,

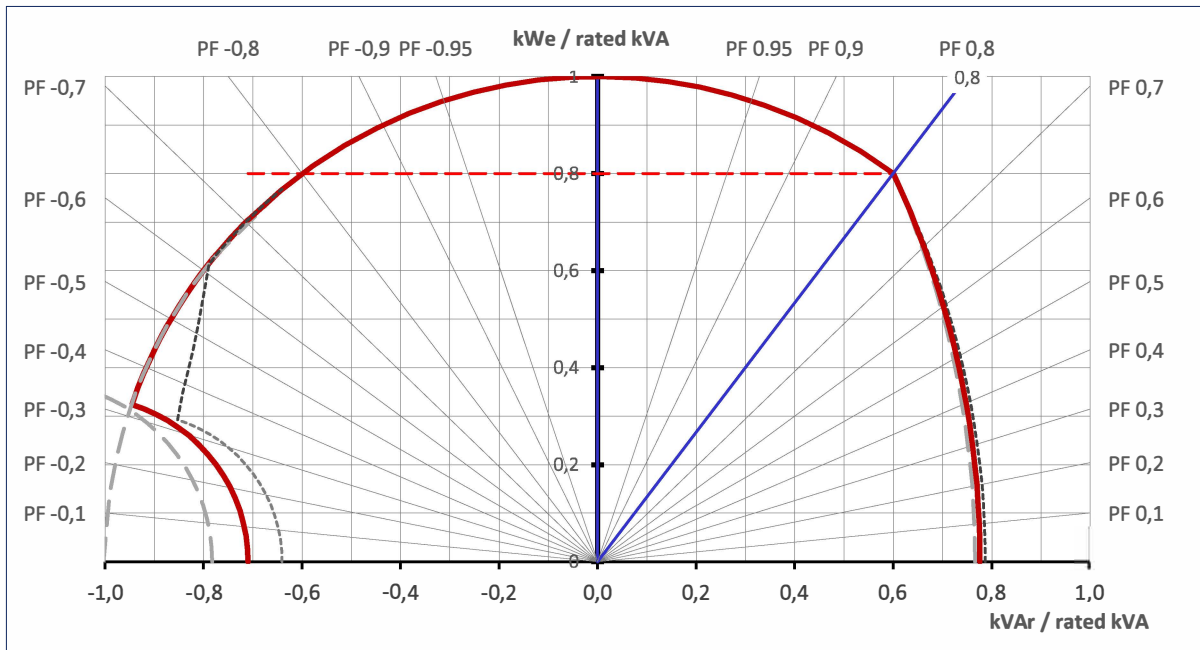
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

3750kVA - 400V - 50 Hz

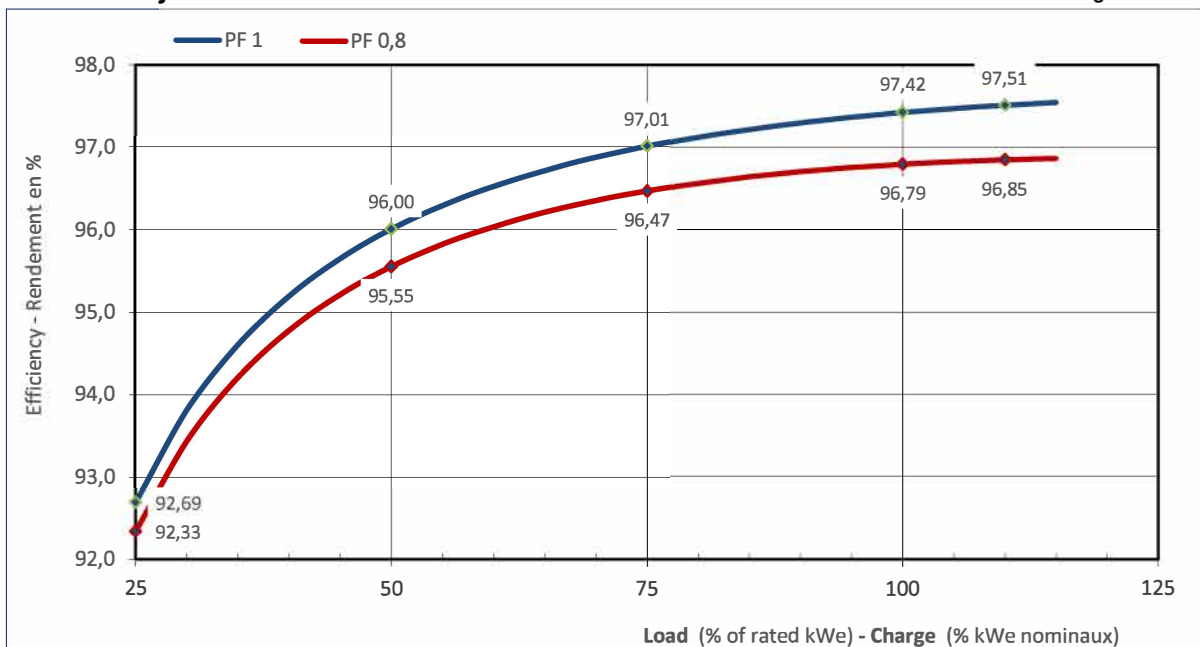
Capability Curve

---	Umax	+ 5%	420	V
—	Un		400	V
---	Umin	- 5%	380	V



Efficiency Curves

According to: IEC



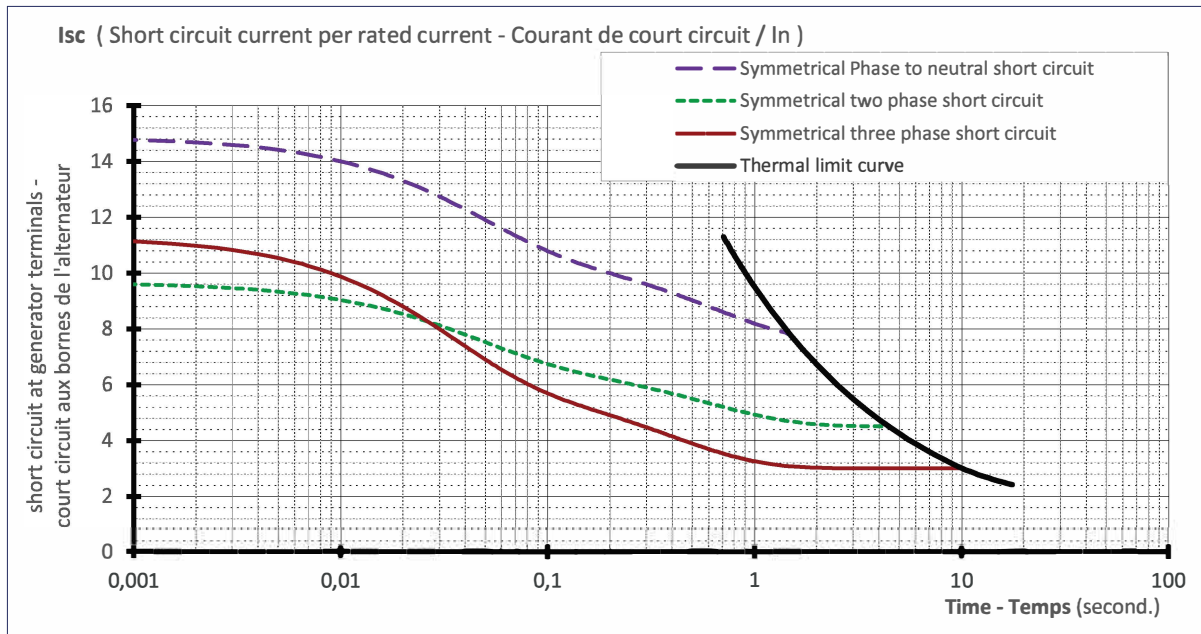
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

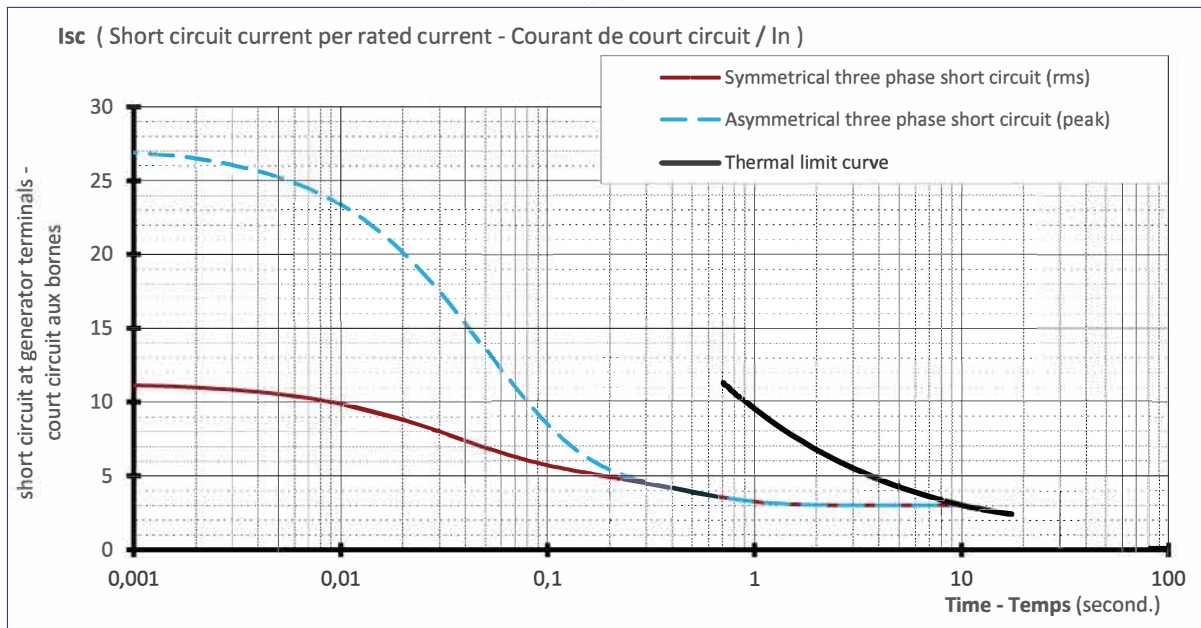
3750kVA - 400V - 50 Hz

Stator Current decrement curves

Symmetrical phase to neutral short-circ	initial	79 932	A	14,8 x I_n	$I_n = 5413$ A
Symmetrical two phase short-circuit	max	51 916	A	9,6 x I_n	
Symmetrical three phase short-circuit	value	60 258	A	11,1 x I_n	
Thermal Limit					



Asymmetrical three phase short-circuit IP 144 356 A 26,7 x I_n



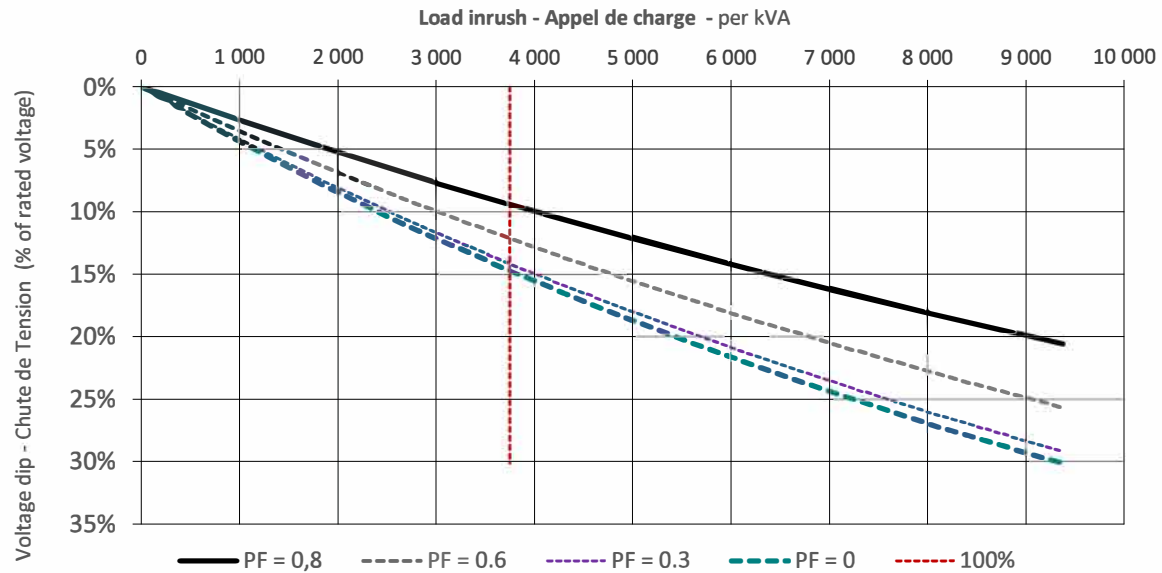
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

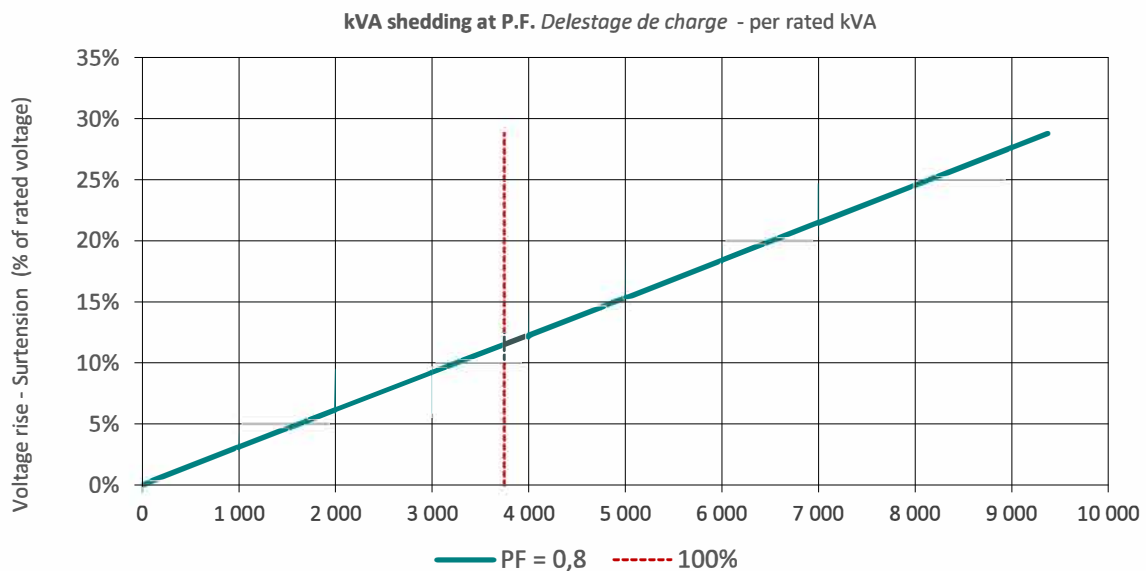
3750kVA - 400V - 50 Hz

Transient Voltage Variation

Transient voltage dip curve versus load impact



Transient voltage rise curve versus load rejection





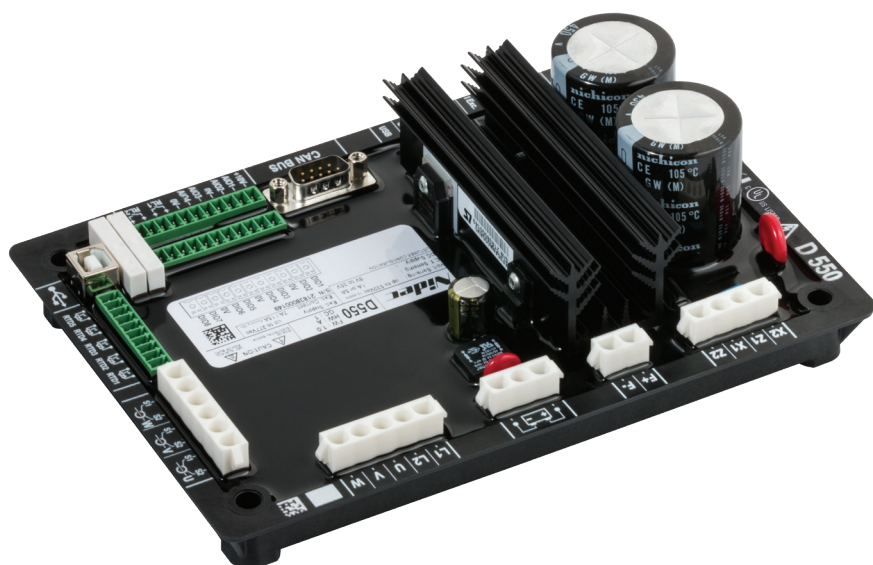
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APPENDIX 9.04

AVR Datasheet

D550 DIGITAL AVR

FOR ALTERNATORS WITH SHUNT, AREP OR PMG EXCITATION



The D550 is a digital automatic voltage regulator (AVR) for alternators with rated field current up to 8 A at 55°C.

It offers a vast array of regulation modes suitable for all power generation applications, including grid-connected configurations.

The D550 also integrates a visual interface through the EasyReg Advanced software, which allows the user to read the configuration values and parameters. It can also be configured directly via USB without external power supply.

The D550 also includes several protections and functions to keep the alternator running in full safe operation, in particular settings to comply with public network connection instructions (grid code).

The communication port is CANJ1939 compatible.

DATASHEET

KEY FEATURES

- **Regulation modes:**
 - Voltage regulation accuracy: $\pm 0.25\%$
 - Field current (manual mode)
 - Generator power factor
 - Grid power factor
 - Generator kVAR
- **Regulation features:**
 - Voltage equalization
 - Droop management
 - Cross current compensation
 - Soft start
 - Load Acceptance Module (L.A.M.) function to assist during heavy load application events
 - Negative field forcing
- **kW, kVAR, kVA and PF calculation**
- **Protections & Limitations:**
 - Under and over field current limitation
 - Loss of field sensing
 - Generator under/over voltage
 - Loss of sensing
 - V/Hz regulation mode
 - Diode fault monitor
- **Data logger** (option)
- **Synchronization monitoring**
- **Events log**

ELECTRICAL FEATURES

- **Generator voltage measurement:**
 - 3-phase, 2-phase
 - Range: 0-230-530 VAC
 - Consumption: < 2 VA
- **Grid voltage measurement:**
 - 2-phase
 - Range: 0-230-530 VAC
 - Consumption: < 2 VA
- **Generator current measurement:**
 - 1 or 3-phase
 - Secondary range: 1 or 5 A
 - Consumption: < 2 VA
- **AC supply input:**
 - PMG, AREP, SHUNT
 - Range: 50-277 VAC
- **Excitation:**
 - Rated field current (continuous):
 - 7 A at 70°C
 - 8 A at 55°C
 - Field forcing current (10s max):
 - 15 A at 70°C
 - Recommended field resistance:
 - > 4 ohms
- **Auxiliary supply: 8-35 VDC**
 - Consumption: < 1 A
- **Frequency range: 30-400 Hz**
- **Storage temperature range:**
 - 55°C +85°C
- **Operating temperature range:**
 - 40°C +70°C

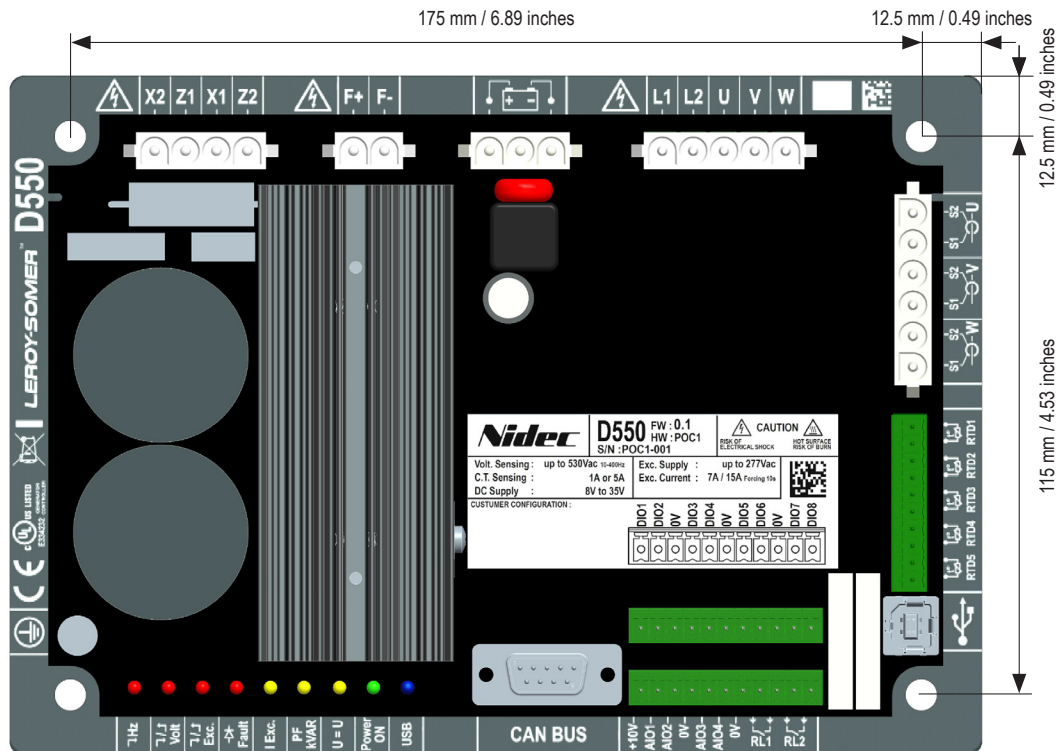
INPUTS / OUTPUTS

- **8 programmable digital inputs & outputs:**
 - Output specification: 150 mA - 30 VDC
- **4 programmable analog inputs & outputs:**
 - 4-20 mA / ± 10 V / 0-10 V / potentiometer (1 k Ω)
- **2 relay outputs:**
 - Specifications: 125 VAC - 5 A
- **5 temperature sensings:**
 - Type: Pt100/CTP
 - Programmable threshold

COMMUNICATION AND SETTINGS

- Software configuration (PC tool)
- USB port (self powered)
- CAN J1939 and Proprietary (Nidec Leroy-Somer protocol)

DIMENSIONS





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APPENDIX 9.05

Controller Datasheet

DSE8620 MKII

SYNCHRONISING AUTO MAINS (UTILITY) FAILURE LOAD SHARE CONTROL MODULE



Module can be configured to function as a DSE8610 MKII Synchronising and Load Sharing Control Module

Refer to DSE8610 MKII Data Sheet for product features.

KEY FEATURES

- Comprehensive synchronising & loadsharing capabilities
- Built in governor and AVR control
- Base load (kW export) control
- Positive & negative kVAr export control
- Mains (Utility) decoupling protection
- Mains (Utility) failure detection
- Mains (Utility) power (kW, kV Ar, kV A & pf) monitoring
- Mains (Utility) de-coupling protection
- Mains (Utility) kW export protection
- Peak lopping & shaving functionality
- 4-Line back-lit LCD text display
- Multiple Display Languages
- Five key menu navigation
- LCD alarm indication
- Heated display option available
- Customisable power-up text and images
- DSENet® expansion compatibility
- Data logging & trending facility
- Internal PLC editor
- Protections disable feature
- Fully configurable via PC using USB, RS232, RS485 & Ethernet communication
- Front panel configuration with PIN protection
- Power save mode
- 3 phase generator sensing and protection
- Generator current and power monitoring (kW, kvar, kVA, pf)
- kW and kvar overload alarms
- Reverse power alarms
- Over current protection
- Unbalanced load protection
- Independent earth fault protection
- Breaker control via fascia buttons
- Fuel and start outputs configurable when using CAN
- 8 configurable DC outputs
- 2 configurable volt-free relay outputs
- 4 configurable analogue/digital inputs
- Built in sensors to support 0 V to 10 V & 4 mA to 20 mA
- 12 configurable digital inputs
- Configurable 5 stage dummy load and load shedding outputs
- CAN, MPU and alternator frequency speed sensing in one variant
- Real time clock
- Manual and automatic fuel pump control
- Engine run-time scheduler
- Fuel usage monitor and low fuel level alarms
- Simultaneous use of all communication ports
- Remote SCADA monitoring via various DSE software applications
- MODBUS RTU & TCP support with configurable MODBUS pages for integration into building management systems (BMS)
- 3 configurable maintenance alarms
- Compatible with a wide range of CAN engines, including tier 4 engine support
- Uses DSE Configuration Suite PC Software for simplified configuration

KEY BENEFITS

- Can be configured for use as a DSE8610 MKII
- 132 x 64 pixel ratio display for clarity
- Real-time clock provides accurate event logging
- Ethernet communication, provides built in advanced remote monitoring.
- Can be integrated into building management systems (BMS) and programmable logic control (PLC)
- Increased input and output expansion capability via DSENet®
- Licence-free PC software
- IP65 rating (with supplied gasket) offers increased resistance to water ingress
- Extended internal PLC editor allows user configurable functions to meet specific application requirements.

EXPANSION DEVICES

- DSE124 CAN/MSC Extender
- DSE2130 Input Expansion Module
- DSE2131 Ratio-metric Input Expansion Module
- DSE2133 RTD & Thermo-couple Expansion Module
- DSE2152 Ratio-metric Output Expansion Module
- DSE2157 Output Expansion Module
- DSE2548 LED Expansion

SPECIFICATIONS

DC SUPPLY

CONTINUOUS VOLTAGE RATING
5 V to 35 V Continuous

CRANKING DROPOUTS

Able to survive 0 V for 100 mS, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries. LEDs and backlight will not be maintained during cranking.

MAXIMUM OPERATING CURRENT

530 mA at 12 V, 280 mA at 24 V

MAXIMUM STANDBY CURRENT

320 mA at 12 V, 160 mA at 24 V

CHARGE FAIL/EXCITATION RANGE

0 V to 35 V

GENERATOR & MAINS (UTILITY)

VOLTAGE RANGE

15 V to 415 V AC (Ph to N)
26 V to 719 V AC (Ph to Ph)

FREQUENCY RANGE

3.5 Hz to 75 Hz

MAGNETIC PICKUP

VOLTAGE RANGE

+/- 0.5 V to 70 V

FREQUENCY RANGE

10,000 Hz (max)

INPUTS

DIGITAL INPUTS A TO L

Negative switching

ANALOGUE INPUTS A TO D

Configurable as:
Negative switching digital input
0 V to 10 V sensor
4 mA to 20 mA sensor
0 Ω to 480 Ω sensor

OUTPUTS

OUTPUT A & B (FUEL & START)

15 A DC at supply voltage

OUTPUTS C & D

8 A AC at 250 V AC (Volt-free)

AUXILIARY OUTPUTS E TO L

2 A DC at supply voltage

BUILT IN AVR GOVERNOR CONTROL

MINIMUM LOAD IMPEDANCE

500 Ω
Fully isolated

GAIN VOLTAGE

0 V to 10 V DC
Fully isolated

OFFSET VOLTAGE

0 V to 10 V DC
Fully isolated

DIMENSIONS

OVERALL

245 mm x 184 mm x 51 mm
9.6" x 7.2" x 2.0"

PANEL CUT-OUT

220 mm x 160 mm
8.7" x 6.3"

MAXIMUM PANEL THICKNESS

8 mm
0.3"

STORAGE TEMPERATURE RANGE

-40 °C to +85 °C
-40 °F to +185 °F

OPERATING TEMPERATURE RANGE

-30 °C to +70 °C
-40 °F to +185 °F

HEATED DISPLAY VARIANT

-40 °C to +70 °C
-40 °F to +158 °F

RELATED MATERIALS

TITLE

DSE8620 MKII Installation Instructions

DSE8620 MKII Operator Manual

DSE8620 MKII PC Configuration Suite Manual

DSE8610 MKII Data Sheet

PART NO.

053-183

057-254

057-238

055-204

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DSE8620 MKII

SYNCHRONISING AUTO MAINS (UTILITY) FAILURE LOAD SHARE CONTROL MODULE

The DSE8620 MKII is an easy to use Synchronising Auto Mains (Utility) Failure Control Module suitable for paralleling single gensets (diesel or gas) with the mains (utility) supply. The controller can be configured for use as a DSE8610 MKII Auto Start Control Module. When converted for use as a DSE8610 MKII the unit provides generator to generator load share.

Designed to synchronise a single genset with a single mains (utility) supply the DSE8620 MKII will automatically control the change over from mains (utility) to generator supply or run the generator in synchronisation with the mains (utility) to provide no break, peak lopping and peak shaving power solutions.

System alarms are annunciated on the LCD screen (multiple language options available), illuminated LED and audible sounder.

Comprehensive communications are also available via RS232, RS485 and Ethernet for remote PC control and monitoring and integration into building management systems

The event log will record 250 events to facilitate easy maintenance, and an extensive number of fixed and flexible monitoring, metering and protection features are included.

Designed to offer increased built in support for active sensors for 0 V to 10 V & 4 mA to 20 mA. Comprehensive communication and system expansion options are available.

Using the DSE PC Configuration Suite Software allows easy alteration of the operational sequences, timers and alarms. With all communication ports capable of being active at the same time, the DSE8620 MKII is ideal for a

wide variety of demanding load share applications.

KEY LOAD SHARE FEATURES:

- Peak lopping/sharing (with appropriate DSE mains (utility) controller
- Manual voltage/frequency adjustment
- R.O.C.O.F. and vector shift protection
- Mains (Utility) decoupling
- Mains (Utility) decoupling test mode
- Direct governor and AVR control
- Volts and frequency matching
- kW and kvar load sharing

ENVIRONMENTAL TESTING STANDARDS

ELECTRO MAGNETIC COMPATIBILITY

BS EN 61000-6-2
EMC Generic Immunity Standard for the Industrial Environment
BS EN 61000-6-4
EMC Generic Emission Standard for the Industrial Environment

ELECTRICAL SAFETY

BS EN 60950
Safety of Information Technology Equipment, including Electrical Business Equipment

TEMPERATURE

BS EN 60068-2-1
Ab/Ae Cold Test -30 °C
BS EN 60068-2-2
Bb/Be Dry Heat +70 °C

VIBRATION

BS EN 60068-2-6
Ten sweeps in each of three major axes
5 Hz to 8 Hz at +/-7.5 mm, 8 Hz to 500 Hz at 2 gn

HUMIDITY

BS EN 60068-2-30
Db Damp Heat Cyclic 20/55 °C at 95% RH
48 Hours
BS EN 60068-2-78
Cab Damp Heat Static 40 °C at 93% RH
48 Hours

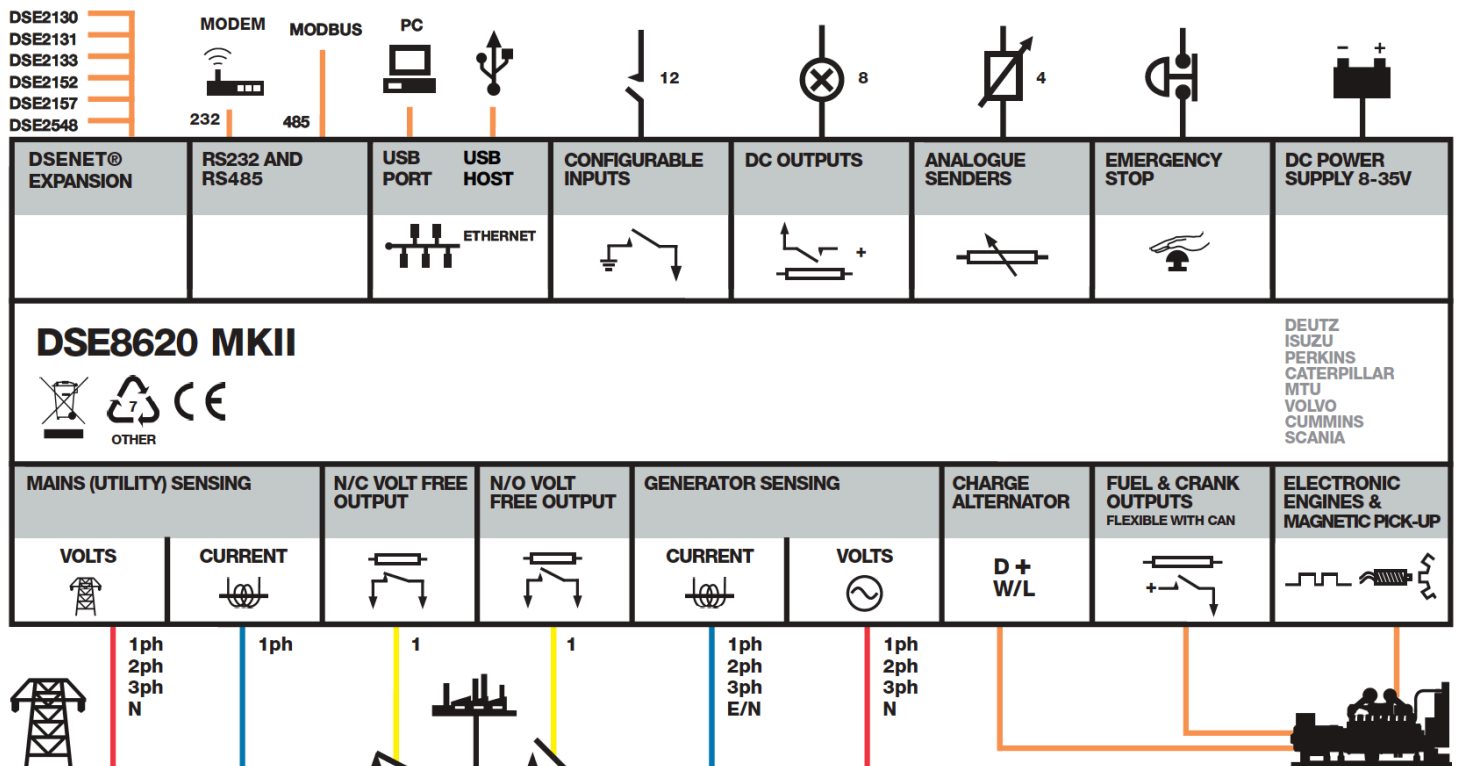
SHOCK

BS EN 60068-2-27
Three shocks in each of three major axes
15 gn in 11 ms

DEGREES OF PROTECTION PROVIDED BY ENCLOSURES

BS EN 60529
IP65 - Front of module when installed into the control panel with the supplied sealing gasket.

COMPREHENSIVE FEATURE LIST TO SUIT A WIDE VARIETY OF LOAD SHARE APPLICATIONS





AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

APPENDIX 9.06

UTI Letter

15 November 2023

Paul Randall
Powergen Business Advisor
Weichai Singapore Pte. Ltd.
237 Pandan Loop, #05-11 Westech Building
Singapore 128424
Singapore

Dear Paul Randall,

The *Tier Standard: Topology* requires that Tier III and Tier IV engine generator systems are capable of supporting the design load for unlimited hours.

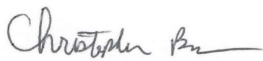
2.5.2 Engine generators for Tier III and Tier IV sites shall not have a limitation on consecutive hours of operation when loaded to 'N' demand. Engine generators that have a limit on consecutive hours of operation at 'N' demand are appropriate for Tier I or Tier II.

Since this clarification to the Tier Standard, engine generator manufacturers have been providing letters attesting to the continuous capacity of select engine-generator models.

Weichai Singapore Pte. Ltd. has introduced their Data Center Rated (DCR) engine-generator rating, defined as the maximum power that the generator is capable of delivering continuously to a constant or varying electrical load for unlimited hours in a data center application.

Considering this definition and the review of documentation provided by Weichai, I am pleased to inform you that Uptime Institute considers the Weichai Singapore Pte. Ltd. rating as acceptable for a Tier III or Tier IV objective for the units shown in Table 1 and Table 2 at the baseline conditions of 45°C and an elevation of 800 meters (m) above sea level when certain project conditions exist. Specifically, Weichai will provide project-specific letters confirming the constant load unlimited runtime of the unit with a preapproved letter template and preapproved signers, as identified by Weichai Singapore Pte. Ltd. Additionally, as part of a Tier Certification of Constructed Facility review, the unit installed must contain a nameplate with the DCR rating; if not, an additional letter would be required to verify the constant load unlimited runtime capacity of the unit with reference to the serial numbers of the units installed on site. In addition, ambient temperatures and other site factors also need to be accounted for on an individual basis.

If there are questions on this matter, please bring them to my attention.



Christopher Brown
Chief Technical Officer

Enclosure: Table 1. WPG B Series DCR Non-Environmental Protection Agency (EPA) 2 Engine-Generator Models and Table 2. WPG B Series DCR EPA 2 Engine-Generator Models

Weichai Singapore Pte. Ltd. Data Center Rated							
Model Number		DC Rating (kilowatts [kW])	Voltage (V)	Engine		Alternator	
				Manufacturer	Model	Manufacturer	Model
Non-EPA 2 Engine-Generator Models	WPG2500B7	2,000	415/240	Baudouin	20M33G2500 /5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2500B7	2,000	400/230	Baudouin	20M33G2500 /5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2750B7	2,200	415/240	Baudouin	12M55G2750 /5	Weichai or Baudouin	WHA 54 M90
	WPG2750B7	2,200	400/230	Baudouin	12M55G2750 /5	Weichai or Baudouin	WHA 53.2 L14
	WPG3000B7	2,400	415/240	Baudouin	12M55G3000 /5	Weichai or Baudouin	WHA 54 M90
	WPG3000B7	2,400	400/230	Baudouin	12M55G3000 /5	Weichai or Baudouin	WHA 54.2 ZL17
	WPG3750B7	3,000	415/240	Baudouin	16M55G3750 /5	Weichai or Baudouin	WHA 54.2 ZL18
	WPG3750B7	3,000	400/230	Baudouin	16M55G3750 /5	Weichai or Baudouin	WHA 54.2 ZL17

Table 1. WPG B Series Data Center Rated Non-EPA 2 Engine-Generator Models

Weichai Singapore Pte. Ltd. Data Center Rated							
Model Number		DC Rating (kilowatts [kW])	Voltage (V)	Engine		Alternator	
				Manufacturer	Model	Manufacturer	Model
EPA 2 Engine-Generator Models	WPG2500B7	2,000	415/240	Baudouin	20M33G4D2/5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2500B7	2,000	400/230	Baudouin	20M33G4D2/5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2750B7	2,200	415/240	Baudouin	12M55G8D2/5	Weichai or Baudouin	WHA 54 M90
	WPG2750B7	2,200	400/230	Baudouin	12M55G8D2/5	Weichai or Baudouin	WHA 53.2 L14
	WPG3000B7	2,400	415/240	Baudouin	12M55G10D2/5	Weichai or Baudouin	WHA 54 M90
	WPG3000B7	2,400	400/230	Baudouin	12M55G10D2/5	Weichai or Baudouin	WHA 54.2 ZL17
	WPG3750B7	3,000	415/240	Baudouin	16M55G6D2/5	Weichai or Baudouin	WHA 54.2 ZL18
	WPG3750B7	3,000	400/230	Baudouin	16M55G6D2/5	Weichai or Baudouin	WHA 54.2 ZL17

Table 2. WPG B Series Data Center Rated EPA 2 Engine-Generator Models

Generator technical submittal TS-01

Project number: E2025-1034 LON16.1

Rev 0



1.0 Technical submission front page

Trade contractor:	AVK-SEG (UK) Ltd	From:	Noelia Medina
Trade contractor sub No:	TS01	Date:	16/02/2026
Revision:	0		
Reason for revision:	First issues		

Approval for the following equipment is required:

Equipment:	Diesel Generating Set	Make:	AVK
Equipment reference:	WPG3000B7 Generating Set	Areas used:	
Description:	Supply and installation of 8 no. Baudouin WPG3000B7 Standby with UTI Rated Diesel Generating Set Comprising of: – 16M55G0D3/5 Optimised Diesel Engine – Leroy Somer WHA 54.2 ZL17 / 4p Brushless Synchronous Alternator – Mechanical driven Cooling Package – ComAp IntelliGen 1000 Generator Controller		
Planned on site date:			

Attached detail documents:

(Tick if included and insert references within boxes identifying supporting documentation included within this submission)

Section	Description	Tick	Section	Description	Tick
1.0	Technical Submission Front Page	✓	6.0	Interfaces and Dependencies Schedule	✓
2.0	Equipment Description	✓	7.0	Builders Work Requirements	X
3.0	List of Exceptions & Clarifications	✓	8.0	Schedule of Comments	✓
4.0	Manufacturers Documents	✓	9.0	Appendices	✓
5.0	Certified Drawings	X			

Signed by	Noelia Medina
Date	16/02/2026

Approval

Company	Name	Date	Status	Comments

Note: If client sign off and/or comments have not been received within 2 weeks of the date stated on this Compliance Statement then the products and/or services detailed in the Technical Statement are deemed to be accepted.

2.0 Equipment Description

2.1 Requirements

We are required to provide 8 no. 3000kVA/2400kW net, standby rated with UTI letter, LV diesel generating set. Complete with electric mechanical driven cooling package and generator mounted controller.

2.2 Generator

Baudouin WPG3000B7 diesel generating set with 16M55G0D3/5 optimised turbocharged diesel engine and Leroy Somer WHA 54.2 ZL17 / 4p brushless synchronous alternator.

Generating set sized to support a standby rated load of 3000VA/2400kW net, at 400V, 3-phase, 50Hz, 1500 rev/min, for an unlimited number of operating hours per year with varying load conditions (average load factor <100%), as stated in the UTI letter, in accordance with ISO 8528-1 and ISO 3046-1. No overload capability for this rating.

Generating set designed to performance class G3.

Generating set supplied with:

- Integrated digital automatic voltage regulator (AVR)
- Dual 24V electrical starter motor with battery charging alternator (redundant operation)
- Dual 24V low maintenance lead acid starting batteries.
- 24V battery chargers
- Air, fuel, and lube oil filters
- Electronic engine management
- Common rail electronic injection system
- Low lube oil pressure protection switch
- High water temperature protection switch
- Low coolant level alarm
- Common skid frame with rubber type anti-vibration pads between engine/alternator and skid.
- Thermostatically controlled water jacket heater and circulating pump.
- Flanged exhaust bellows
- CE label

See the following appendices for further details:

Appendix 9.01 – Generator datasheet

Appendix 9.02 – Engine datasheet

Appendix 9.03 – Alternator datasheet

2.2.1 Engine

In-line, liquid-cooled, four-stroke 16M55G0D3/5 turbocharged diesel engine. Electronically controlled common rail fuel injection system with low and high-pressure fuel pumps, fuel pressure accumulator, high pressure fuel lines, duplex fuel filter and fuel priming pump for initial system filling and venting.

Forced-feed lubrication system with piston cooling, lube oil circulation pump with safety valve, automatic lube oil make-up system, lube oil multi-stage filter, lube oil heat exchanger, oil filler neck and oil dipstick for measurement on non-running engine and closed crankcase venting system. Hand pump included for manual lube oil extraction.

Thermostatically controlled water jacket heater with coolant circulation pump and coolant thermostat for charge air cooling circuit.

The power output is based on the below, site conditions:

- Ambient temperature – 40 °C
- Altitude above sea level – 150m
- Exhaust Back Pressure - 150mbar
- Intake Air Depression – 75mbar

Engine warranted to operate using the fluids and lubricants specified in Appendix 04 – Operation and Maintenance Manual

See the following appendices for further details:

Appendix 9.02 – Engine datasheet

Appendix 9.04 – Operation and Maintenance Manual

2.2.2 Alternator

Leroy Somer WHA 54.2 ZL17 / 4p brushless self-excited PMG, self-regulating, double bearing, p2/3 winding type, IP23 drip proof, insulation class H, temperature rise class F alternator sized to support a Standby rated load of 3000kVA/2400kW net, at 400V, 3-phase, 50Hz, 1500 rev/min, for an unlimited number of operating hours per year with varying load conditions (average load factor < 100%), as stated in UTI letter, in accordance with ISO 8528-1 and ISO 3046-1. No overload capability available for this application group

Integrated digital type automatic voltage regulator (AVR) included to maintain alternator output voltage of 400V $\pm$ 5% from no load to full load, unity to 0.8 lagging power factor, 3-phase, 50 Hz, 400V, 1500 rev/min and a total harmonic distortion (THD) of < 3.5%.

See the following appendices for further details:

Appendix 9.03 – Alternator datasheet

Appendix 9.05 – AVR datasheet

2.2.3 Cooling system

The generating set is supplied with a remote radiator assembly complete with expansion tank.

Specifications:	
Cooling ambient design:	40oC
Cooling altitude design:	150m
Air flow:	42 m3/s
Duct resistance	250 Pa
Coolant capacity of the engine:	261.3 litres
Coolant Type:	50 Ethylene Glycol
Thermostat:	82-92OC

2.2.4 Starting system

The generating set starting system comprises:

- 2 x 24V electrical starter motor and redundant starter motor.
- 24V dual set low maintenance lead acid starting batteries.
- Battery charging alternator.
- Dual battery chargers fed from auxiliary supply.

See the following appendices for further details:

Appendix 9.07 – Battery Datasheet

2.2.5 Earthing

Earthing points are provided on the generator base frame.

2.2.6 Generator controller

The generating sets are controlled via ComAp IntelliGen1000 controllers located within the generator control panel mounted on the bedframe of the generator set. The ComAp controller provides individual set control and monitoring. The control panel is fed from the 24V DC battery backed generator supply and is operated with an 5.2-inch ergonomic touch screen.

The ComAp control panel provides:

- Control of the genset in both automatic and manual mode
- Testing of the generating set both on/off load
- Display of genset measurement values (electrical and mechanical)
- Status of generating set (both current and historical)
- Time-stamped event display with log for up to defined amount of events
- Adjustment of genset parameters with appropriate user level (i.e. timer settings)
- Automatic cooldown periods with user defined time settings
- Engine oil pressure
- Engine water temperature
- Engine oil temperature
- Engine speed
- Hours run
- Number of start attempts
- Battery voltage

Event-based history (up to 1000 records) with customer-selectable list of stored values; RTC; statistic values.

See the following appendices for further details:

Appendix 07 – ComAp Datasheet

Appendix 08 – ComAp HMI Datasheet

3.0 List of exceptions & clarifications

Please see CDE document.

4.0 Manufacturers documents

Please see appendices.

5.0 Certified drawings

N/A

6.0 Interfaces and dependencies schedule

Auxiliary supply required	Detail	Quantity required	Provided by	Final connection by
TBC	Maintained Generator Auxiliary Supply	1 per generating set	Others	Others
High Level Interface	Generator alarm monitoring (Modbus)	1 per generating set	Others	Others
Low Level Interface	Generator alarm monitoring (VFC's)	TBC	Others	Others

Note: The above list is based on initial design information and may be subject to change as the project progresses.

7.0 Builders work requirements

N/A

8.0 Schedule of comments

The following table provides a schedule of all comments required against this document and details the AVK response and status of each comment.

Item	Client comment	AVK response	Status

Note: Client to advise status of comment from the following list:

- Accepted (no further action)
- Rejected (refer to comments)

9.0 Appendices

Item	Document name
9.01	Generator datasheet
9.02	Engine datasheet
9.03	Alternator datasheet
9.04	Operation and Maintenance Manual
9.05	Emission datasheet
9.06	AVR datasheet
9.07	Battery datasheet
9.08	ComAp datasheet
9.09	ComAp HMI datasheet
9.10	UTI letter

Appendix 9.01

Generator datasheet

16M55 SERIES

DIESEL GENERATOR SET

RATINGS (50Hz – 1500rpm @ 0.8p.f)

Model	DCR		DCP	
	kVA	kW	kVA	kW
WPG3000B7	3000	2400	2750	2200

China Non-road III



Image shown may not reflect actual configuration

PRODUCT STANDARD FEATURES

Engine and Block

- Vermicular graphite cast iron cylinder block and head
- Alloyed cast iron, wet cylinder liners with fire ring on the top
- Separate cylinder head with 4 valves, top-down cooling
- Hydraulic bolt for both the cylinder head and bearing cap
- Hardened steel forged crankshaft with induction hardened journals, crankpins and radius

Cooling System

- Two separate circuits
- High temperature circuit equipped with thermostatically-controlled system with one gear-driven coolant pump
- Low temperature circuit equipped with thermostatically-controlled system with one gear-driven coolant pump

Fuel System

- Super-high pressure common-rail fuel system for more fuel pressure
- Multi-stage fuel filtration system
- Independent electric fuel transfer pump

Lubrication System

- Finned oil cooler, spin-on oil filters
- Bypass oil and oil thermostat to keep the oil temperature steady
- Electrical oil pre-lube pump pre-lubricates the engine to ensure good starting capacity

Electrical System

- Reliable starting system equipped with 2pcs*24 Vdc electric starter motors and 1* battery charging alternator
- Redundant starter motors (2pcs*2) is available as an option

Air Intake and Exhaust System

- Multiple single-stage turbochargers
- Silencer is available as an option
- Exhaust manifold and turbocharger shield for heat isolating

Alternator

- High efficiency brushless, 4 pole, IP23 protection system
- Design built with Class H insulation
- Low reactance with 2/3 pitch windings on the stator
- Coupled by high-elasticated coupling
- Sustained overcurrent >300% in 10 sec
- Direct drive centrifugal blower fan cooling
- Excitation by PMG

Generator Set Controller

- Baudouin's generator set controller is ideal for a wide range of applications
- Display status message
- Provide protection auto shutdown at fault detection

1) All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271.

2) Test conditions: 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.

Data and specifications are subject to change without notice.

Technoparc du Brégadan, 13260, Cassis, France

GENERATOR SET SPECIFICATIONS		
Model		WPG3000B7
Governor and regulation class		In accordance with ISO 8528-5 Class G3 performance
Phase number and connection		3 phase, 4 wires, Y-type
Cooling method		Closed looped water-cooled
Starting method		DC 24V Electric starter
Steady-state voltage deviation		± 1%
Steady-state frequency band		± 0.5%
ENGINE SPECIFICATIONS		
Brand		Baudouin
Model		16M55G0D3/5
Gross Power	kWm	PRP - 2500 /ESP – 2750
Brake Mean Effective Pressure	kPa	2514@ESP
Cylinder / Type / Aspiration		16 / Vee Type / Turbocharged and Aftercooled
Bore × Stroke	mm	180 x 215
Displacement	L	87.5
Compression ratio		16.5:1
* See engine data sheet for detailed specification		
ALTERNATOR SPECIFICATIONS		
Coupling / No. of Bearing		Coupling / Double
Type of Excitation		PMG
Cooling type		Air cooled as per IEC60034-6
Voltage regulation method		AVR-D550
Winding temperature sensor		PT100 *6
Bearing temperature sensor		PT100 *2
Anti-condensation heater voltage		AC230V
Insulation Class		H
Protection Grade		IP23
* See alternator data sheet for detailed specification.		
FUEL CONSUMPTION (Tolerance ±5%)		
100% DCR	L/hr	623.0
100% DCP	L/hr	563.7
75% DCR	L/hr	466.3
50% DCR	L/hr	324.8
25% DCR	L/hr	183.1
GENERATOR SET CONTROLLER		
Baudouin's generator set controller WHC8620 MKII is designed for manual/auto parallel systems.		
The WHC8620 MKII is an easy to use Synchronising Auto Mains (Utility) Failure Control Module suitable for paralleling single genset with the mains (utility) supply.		
Key Benefits • Real-time clock provides accurate event logging • Ethernet communication, provides built in advanced remote monitoring • Can be integrated into building management systems (BMS) and programmable logic control (PLC) • 12 configurable digital inputs • 8 configurable DC outputs • 4 configurable analogue inputs • 2 configurable vol-free relay outputs		

Optional

Engine

- ☐ Set mounted / Remote radiator(40°C&50°C)
- ☐ Redundant Battery float charger
- ☐ Alternator 45°top cable entry
- ☐ Lead-acid battery
- ☐ Exhaust Y-connection pipe
- ☐ Silencer (-15dB(A)) , (-25dB(A))
- ☐ Spring vibration isolator
- ☐ Lube oil automatic replenishment system

Alternator

- ☐ 380V/400V/415V, Multiple voltages are available
- ☐ Class H , F temperature rise
- ☐ Infrared view port
- ☐ Winding protections for harsh environments and relative humidity greater than 95%

Rating definitions

Data Center rate (DCR):

DCR is the maximum power that genset is capable of delivering while supplying a variable load. Average power output is 85% of the rated power, no over load.

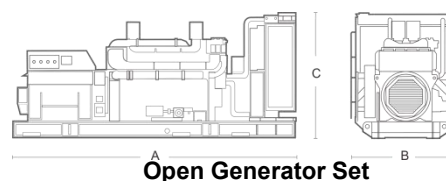
Typical peak demand up to 100% of rated kW for up to 5% of the operating time. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year.

DCR rated generators for UPTIME INSTITUTE TIER III & TIER IV Data Center shall be evaluated by a site-specific survey.

Data Center power (DCP):

DCP is the maximum power that genset is capable of delivering while supplying a variable or continuous load and during unlimited run hours.

An overload capability of 10% is available for 1 hour within every 12-hour period.



Please note

The generator set will be supplied with the Uptime Institute Ratings Certificate and will be capable of providing power for an outage of unlimited duration, according to the conditions stated on the UTI letter

This outline drawing is to provide representative configuration details for Model series only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design.

Dimension and Weight

Model	Voltage V	Dim "A" mm	Dim "B" mm	Dim "C" mm	Dry wt. Kg	Remark
WPG3000B7	400	8285	3215	3360	29950	Alternator based on DCR

* Note: Sizes and weights represent a set with standard features and are for reference only . See the outline drawings for the detailed configurations of sizes and weights.

Certifications and standards

ISO 9001	This generator set is designed and manufactured in facilities certified to ISO 9001.	ISO 8528	This generator set has been designed to comply with ISO 8528 regulation.
CE	The CE marking is only valid when equipment is used in a fixed installation application. Material compliance declaration is available upon request.	NFPA 110	The generator set can comply to a single step in accordance with NFPA 110

The generator set is designed and manufactured in facilities certified to standards ISO9001:2015 and ISO14001:2015. The generator set is prototype-tested, factory-built and production tested and is in compliance with the relevant standards:

- ISO 8528-13, ISO 3046, DIN6271
- EN 60034-1, EN 60204-1
- Machinery Directive 2006/42/EC
- Electromagnetic compatibility Directive: 2014/30/EU

Note:Certifications may not be available in all model configurations.

Appendix 9.02

Engine datasheet

	Model :	Date :	01/01/26
		Revision :	Rev.26.01
	PowerKit Technical Datasheet		Page : 1 / 5

Ratings^{1,2}

RPM	Gross Engine Output				Net Engine Output			
	PRP		ESP		PRP		ESP	
	kWm	BHP	kWm	BHP	kWm	BHP	kWm	BHP
1500	2500	3353	2750	3688	2498.5	3351	2748.5	3686

¹ When the engine is used with a cooling system using an electrically driven fan and any optional auxiliary components, net engine output data may change and quoted figures should be used for reference only.

² 1 kWm = 1,34102 BHP

Basic data

Engine model	16M55G0D3/5
No. of cylinders / Valves	12/48
Cylinders arrangement	At Vee
Bore x Stroke (mm)	180x215
Displacement (L)	87.5
Thermodynamic cycle	Diesel 4 stroke
Firing order	A1-B1-A3-B3-A2-B2-A5-B5-A8-B8-A6-B6-A7-B7-A4-B4
Number of turbochargers	4
Mean Piston Speed (m/s)	10.75
BMEP @ ESP (Bar)	25.14
Cooling system	Liquid (water + 50% antifreeze)
Injection system	Direct
Fuel system	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled
Compression ratio	16.5 : 1
Flywheel housing	SAE 00
Flywheel	21"
Rotation viewed from flywheel	Counter Clockwise
Allowed static bending moment of the flywheel housing (Nm)	TBD
No. of teeth on flywheel ring gear	202
Inertia of flywheel (kg•m ²)	20.78
Inertia of crankshaft (kg•m ²)	17.1
Emission standard	Unregulated
Overall dimensions without radiator (Length x Width x Height) (mm)	4158 × 1816 × 2467
Engine dry weight without radiator and without radiator pipes (kg)	11963
Engine dry weight with radiator and radiator pipes (kg)	N/A
Engine wet weight with radiator (includes oil, coolant) (kg)	N/A

	Model : 16M55G0D3/5	Date : 01/01/26
		Revision : Rev.26.01
	PowerKit Technical Datasheet	Page : 2 / 5

Air intake system

Air intake restriction clean filter (mBar)	≤ 35
Air intake restriction dirty filter (mBar)	≤ 75
Combustion air flow @ PRP (m³/min)	172.3
Combustion air flow @ ESP (m³/min)	179
Min. diameter of intake pipe (mm)	140

Aftercooling system

Aftercooler system type	Air to Water
Max. intake manifold temperature (°C)	80
Max. difference between intake manifold temperature and ambient temperature (°C)	30
Max. intake pressure drop of aftercooler (mBar)	60

Lubrication system

Oil capacity Low / High (L).....	405 / 500
Oil pressure in normal condition at idle speed (Bar)	≥ 1.8
Oil pressure in normal condition at rated speed (Bar)	4 - 6.5
Lowest oil pressure alarm (shutdown) (Bar)	1.8
High Oil Pressure Warning (Bar).....	6.5
Max. oil temperature (°C).....	105
Oil flow at 1500 rpm (L/min).....	1460
Oil consumption ratio based on engine fuel consumption data (%)	≤ 0.2
Total system capacity (L)	530

Exhaust system

Max. exhaust back pressure (mBar)	150
Max. exhaust gas temperature before turbocharger (°C)	780
Max. exhaust gas temperature after turbocharger (°C)	N/A
Exhaust flow @ PRP (m³/min).....	553
Exhaust flow @ ESP (m³/min).....	595.9
Min. diameter at exhaust pipe (mm)	280
Max. bending moment of exhaust gas exit flange (Nm)	10

Noise

Diesel engine noise (Acoustic power level) (dB(A))	123.8
Noise - upper side (dB(A))	106.8
Noise - right side (view from flywheel) (dB(A))	106.5
Noise - left side (view from flywheel) (dB(A))	105.8
Noise - front (radiator) side (dB(A))	102.2
Noise - rear (flywheel) side (dB(A))	101.9

Notes :

- Noise test made at 100% of the ESP power, at 1 mt. distance, on engine without radiator, without cooling fan and without silencer.
- Noise test refers to ISO 6798 norm : "Reciprocating internal combustion engines. Measurement of emitted airborne noise. Engineering method and survey method".

	Model : 16M55G0D3/5	Date : 01/01/26
		Revision : Rev.26.01
	PowerKit Technical Datasheet	Page : 3 / 5

Cooling system (NonRad)

System designed for ambient temperature up to (°C) ¹	N/A
Radiator type	N/A
Fan type	N/A
Min. inside diameter of coolant outlet pipe (mm)	LT 76 / HT 96
Coolant capacity of engine HT (L)	261.3
Coolant capacity of engine LT (L)	89.2
Coolant capacity of radiator and pipes HT (L)	N/A
Coolant capacity of radiator and pipes LT (L)	N/A
Coolant alarm (shutdown) temperature (°C)	112
Thermostat opening temperature / full open temperature (°C)	82 / 92
Max. additional restriction for external cooling circuit HT/LT (Bar)	0.6/0.4
Cooling fan air flow assumes the presence of the standard radiator provided (m³/min)	N/A
Fan absorbed power (kW)	N/A

Fuel system

Governor	ECU
Steady state speed stability at constant load (%) ²	±0.25%
Max. restriction at fuel inlet (Bar)	0.1
Max. pressure at fuel inlet (Bar)	0.5
Max. fuel return restriction (Bar)	0.2
Max. fuel inlet temperature (°C)	70
Fuel supply flow of engine inlet (L/hr)	1117.0
Min. internal diameter of inlet pipe (mm)	19
Min. internal diameter of return pipe (mm)	19

Electrical system

Electrical system voltage (negative to ground) (Vdc)	24
Starter motor quantity × power(kW)	2 × 10
Minimum recommended battery capacity CCA @-18°C(A)	750-900
Battery charging alternator output (A) / (Vdc)	55/28
Battery charging alternator output power (kW)	1.5
Max. electric resistance of starting circuit (Ω)	0.008
Min. cross-sectional area of wire (mm²)	95
Min. cold start temperature without auxiliary starting device (°C) ³	-10
Min. cold start temperature with auxiliary starting device (°C) ³	N/A

¹ The indicated value is based on the AOT value of N/A°C for an engine tested at 100% of the ESP Power, reflecting temperature in an open condition, without an enclosure or container, without any airflow obstruction in the front of the radiator, without air recirculation, with free exhaust gas exit and with the engine thermostatic valve in its full open condition, without a closing plate present. The reference air restriction is equal to 50Pa. For the equivalent ATB (Air-to-Boil) performance on a customer or project basis, please consult Baudouin Application Engineering.

² This refers only to the frequency response of the engine.

³ Engines used in emergency standby application or applications that require immediate start, they must be equipped with coolant heaters and pre-lubricated system, details guidance reference the <Operation and Maintenance Manual for Diesel Engine> which documents attached to engine. Baudouin recommend heaters installation to be executed by providing constant coolant circulation across all the related components. For V-type engines, it is necessary to ensure that both sides are heated simultaneously.

	Model : 16M55G0D3/5	Date : 01/01/26
		Revision : Rev.26.01
	PowerKit Technical Datasheet	Page : 4 / 5

Heat balance test data (with ambient temperature 30 °C)

Designation	PRP		ESP	
	HT	LT	HT	LT
Coolant inlet / output pressure (kPa)	3.0/28.2	12.9/25.5	2.7/33.5	12.9/25.3
Coolant inlet / output temperature (°C)	90.6/95.5	46.8/57.1	90.4/95.8	45.3/56.9
Coolant flow (m³/h)	113.0	50.0	109.6	50.6
Intercooler inlet / output temperature (°C)	L:159.0/52.3 R:153.6/52.8		L:176.7/51.6 R:167.9/52.2	
Intercooler inlet / output pressure (kPa)	L:208.4/203.2 R:206.1/204.3		L:231.4/227.8 R:230.9/229.6	
Engine total dissipation heat (kJ/s)	3119		3476	
The heat taken by the HT circuit (kJ/s)	589		669	
The heat taken by the LT circuit (kJ/s)	555		625	
The heat taken by the exhaust (kJ/s)	1837		2029	
Radiation heat of the engine surface (kJ/s)	138		153	
Exhaust gas temperature after turbo. (°C)	515		542	

Note: HT: Jacket Water Circuit; LT: Low Temperature Circuit

- 1) Tolerance: Temperature: $\pm 8\%$; Flow: $\pm 5\%$; Pressure: $\pm 10\%$;
- 2) The heat distribution is $\pm 5\%$ of the total heat. Heat rejection values based on using Liquid (water+50% antifreeze).

	Model : 16M55G0D3/5	Date : 01/01/26
		Revision : Rev.26.01
	PowerKit Technical Datasheet	Page : 5 / 5

Fuel consumption gross

Rating	PRP		ESP	
	gr/kWh	L/hr	gr/kWh	L/hr
100%	189.4	563.7	190.3	623
75%	191.1	426.6	189.9	466.3
50%	200.9	299	198.4	324.8
25%	227.4	169.2	223.7	183.1

Note: The reference testing diesel density is 0.84 kg/L.

Ratings definitions

Prime Power (PRP)

Prime Power (PRP) is the maximum power that can be delivered while supplying a variable electrical load. A PRP-rated engine may operate for an unlimited number of hours per year, but the permissible average power output over 24 hours of operation shall not exceed 70% of the PRP. A 10% overload capability is permitted for 1 hour within 12 hours of operation.

Emergency Standby Power (ESP)

Emergency Standby Power (ESP) is the maximum power that can be delivered in the event of a utility power outage while supplying a variable electrical load. An ESP-rated engine may operate for up to 200 hours per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

- 1) All ratings are determined in accordance with operating conditions specified in ISO 8528-1, ISO 3046, and DIN 6271 standards.
- 2) This PowerKit Technical Datasheet contains information applicable to standard engine configurations and is intended for reference only. For performance specifications beyond the parameters indicated, please submit technical inquiries to the Applications Engineering Department.

DPK-TDS-EN-16M55-6000-01-01-26 Moteurs Baudouin reserve the right to modify these specifications, without notice. Document not contractual.

Appendix 9.03

Alternator datasheet

ALTERNATOR TECHNICAL DESCRIPTION

WHA 54.2 ZL17 / 4p

Date: 06-17-2024

197 A,Fushou East Street,High-Tech Development Zone, Weifang,China

Main data				C
Generator type:	WHA 54.2 ZL17 / 4p			
Power:	3 000	kVA	2 400 kWe	2 486 kWm
Voltage:	400	V	Star serial	
Rated voltage range:	+5/-5%			
Power factor - Lagging:	0,8			
Frequency:	50	Hz		
Speed:	1 500	rpm		
Nominal current:	4 330	A		
Winding type:	p2/3			
Classes (Insulation / Temperature Rise):	H / F			
Ambient temperature:	45	°C		
Altitude:	1 000	m		
Installation				Quantity
Prime mover:	Reciprocating engine			1
Manufacturer:	-			
Type:	-			
Duty:	Base Rating			
Mechanical construction				IM1101
Type of construction:	Two bearing			
Mounting arrangement:	Horizontal Axis			
Direction of rotation:	Clockwise (seen when facing the drive end - DE)			
Bearing type:	Anti-friction			
Bearing Lubrication:	Regreasable			
Bearing insulation:	Not insulated			
Shaft end type:	Cylindrical with keyway			
Balancing - Class (ISO 21940-11):	Half key - G2,5 (std)			
Flange:	None / without			
Shaft height:	500	mm		
Width:	1 150	mm		
Additional specificities				
Stabilized Runaway speed:	1 800	rpm - 2 min.		
Cooling Method				IC01
Degree of protection:	IP23			
Coolant:	Air / Temperature: 45 °C			
Air quality:	Clean			
Ventilation (internal):	Self-ventilated			
Filters:	Without			
Ducting for air inlet:	No			
Ducting for air outlet:	No			

ALTERNATOR TECHNICAL DESCRIPTION

WHA 54.2 ZL17 / 4p

Date: 06-17-2024

Connection, Excitation & Regulation

Parallel operation:	Island mode (0F) - no droop CT	1
Excitation:	Self-excited - Brushless - Type: PMG	1
Sustained 3-phase Isc:	> 3 x FLC for 10s.	1
AVR type:	Leroy Somer - D550 - Digital	1
AVR location:	In terminal box	1
Alternator Voltage sensing:	In terminal box	1

Terminal box

Power connection:	4 connectors (brought out neutral)	1
Main terminal box location:	1 terminal box on the top	1
Line side outlet:	Left hand side (seen when facing the drive end - D)	1
Gland plate:	Non magnetic, Undrilled	1
Auxiliaries	In main terminal box	1

Protection and measurement accessories

Temperature detection

Stator windings:	6 x PT100 (3 wires)	1
Combined guide and thrust bearing - DE:	1 x PT100 per bearing (3 wires)	1
Guide bearing - NDE:	1 x PT100 per bearing (3 wires)	1

Anti-condensation heating

Voltage: 230 V - 1Ph / Power: 500 W	1
-------------------------------------	---

Various items

Paint:	PE - Primary - RAL 7032	1
Documentation:	PDF manual	1
Documentation Language:	English	1
Nameplate	Sticker	1

Controls

Standards:	IEC	1
QUAL/INES/006 001 => 101	Measurement of winding resistance	1
QUAL/INES/006 021 => 128	Insulation check on sensors (when fitted)	1
QUAL/INES/006 002 => 102&103	Voltage balance and phase order check	1
QUAL/INES/006 007 => 109	Overspeed test (according to test bench limitation)	1
QUAL/INES/006 009 => 111	High potential test	1
QUAL/INES/006 010 => 112	Insulation resistance measurement	1

ALTERNATOR ELECTRICAL DATA

WHA 54.2 ZL17 / 4P

Date: 06-17-2024

Main data:

C

Power:	3 000	kVA	2 400	kWe	2 486	kWm	1
Voltage:	400	V	Frequency:	50	Hz		1
Rated voltage range:	+5% / -5%		Speed:	1500	rpm		1
Power factor - Lagging:	0,8						1
Nominal current:	4 330	A	Phases	3			
Insulation / Temperature rise:	H / F		Connexion	Star	serial		1
Cooling:	IC01		Winding type:	p2/3			1
			Winding:	- 6 Wires			1
Ambient temperature:	45	°C					1
Altitude:	1000	m	Overspeed (rpm)	1800			1
Duty: Base Rating			Total Harmonic Distortion (THD)	< 3,5%			1

Efficiency (Base 2400 kWe)

IEC

	25%	50%	75%	100%	110%	
Power factor - Lagging: 0,8	90,66	94,78	96,03	96,56	96,67	1
Power factor - Lagging: 1	90,99	95,20	96,52	97,12	97,26	1

Reactances (%) - (Base 3000 kVA)

Unitary impedance (1 per unit) = 0,053333 ohms

		Unsaturated	Saturated		Unsaturated	Saturated	
	Direct axis				Quadrature axis		
Synchronous reactance	Xd	139	90	Xq	71	46	1
Transient reactance	X'd	15,3	13,0	X'q	71	46	1
Subtransient reactance	X''d	8,3	7,1	X''q	8,8	7,4	1
Negative sequence reactance	X2	8,5	7,3				
X0	1,8			Zero sequence reactance			1
Xl	4,2			Stator leakage reactance			
Xr	12,2			Rotor leakage reactance			
Kc	1,11			Short-circuit ratio			1

Time constants (s)

		Direct axis	Quadrature axis	
Open circuit transient time constant	T'do	4,22	T'qo	NA
Short-circuit transient time constant	T'd	0,466	T'q	NA
Open circuit subtransient time constant	T''do	0,061	T''qo	0,240
Subtransient time constant	T''d	0,033	T''q	0,030
Ta	0,057	Armature winding short circuit time constant		

Resistances (%)

Ra	0,5	Armature resistance	R0	0,6	Zero sequence resistance	1
X/R	14,8	X/R ratio (without unit)	R2	1,7	Negative sequence resistance	

Voltage accuracy: 0,25%

Maximum inrush current for a voltage dip of 15%: 3833 kVA

when starting an AC motor having a starting power factor between 0 and 0.4

Rating is provided for the specified temperature rise, by resistance measurement according to IEC60034-1

According to: I.E.C. 60034.1 - 60034.2 - NEMA MG 1-32

Products and materials shown in this catalogue may, at any time, be modified in order to follow the latest technological developments.

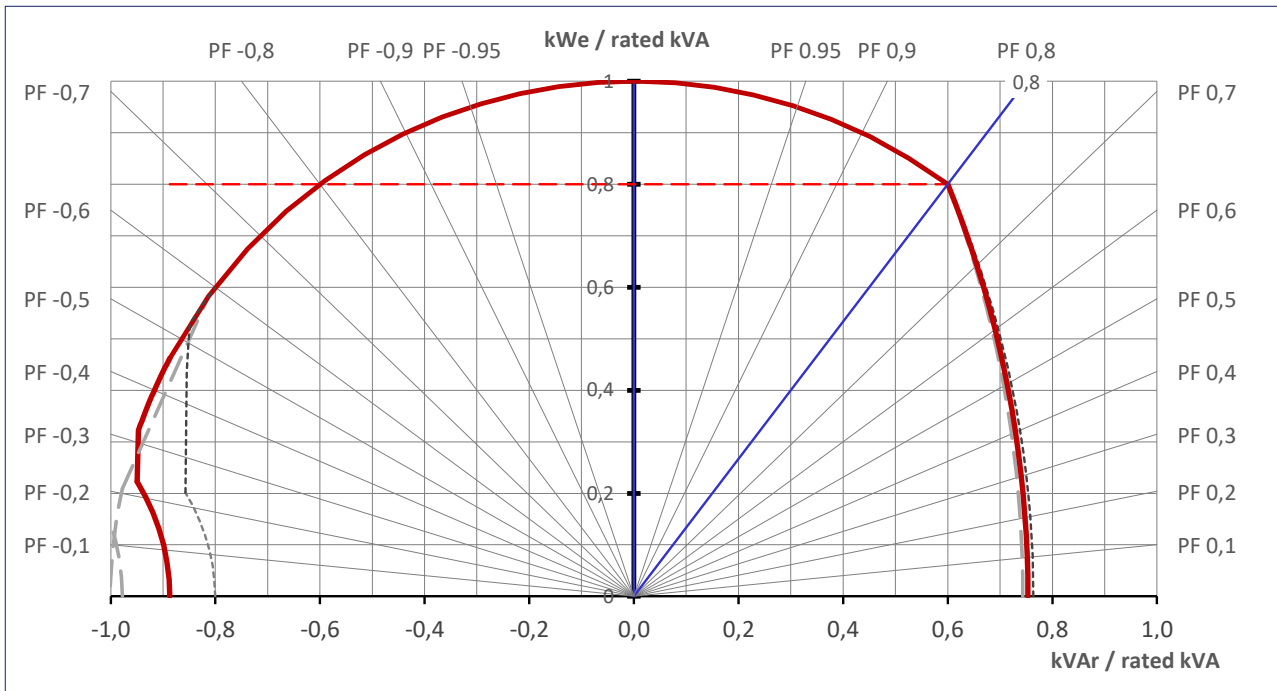
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

3000kVA - 400V - 50 Hz

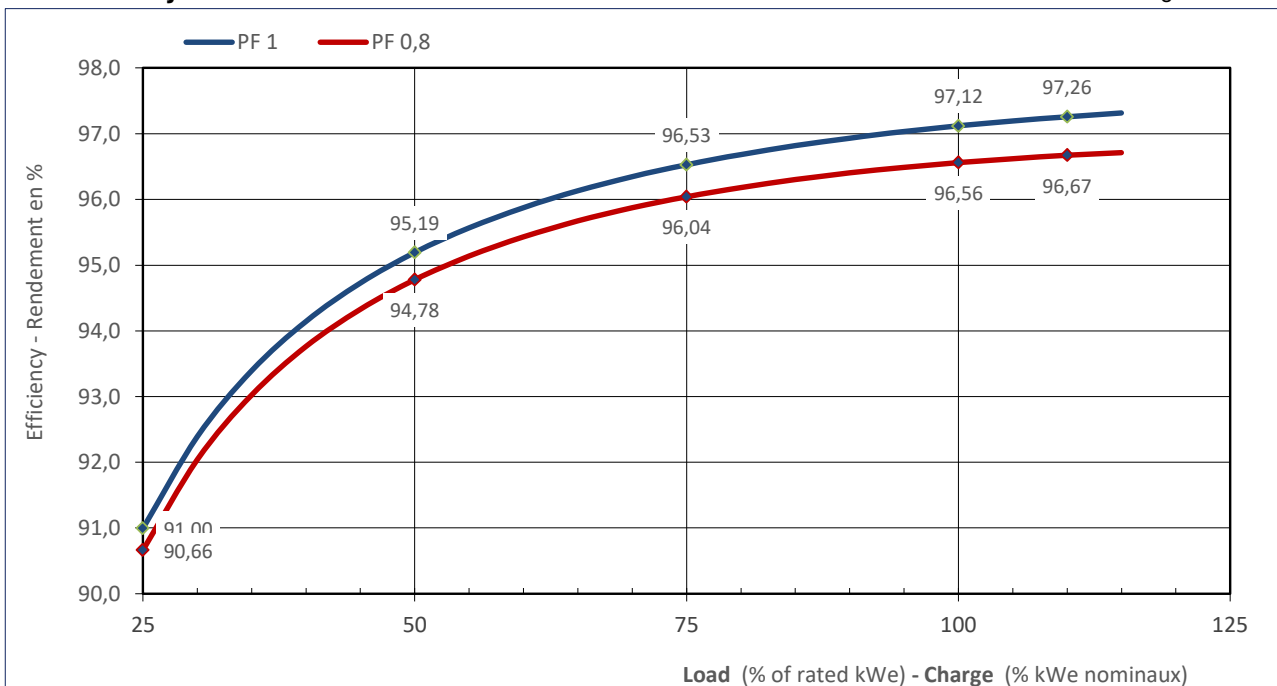
Capability Curve

---	Umax	+ 5%	420	V
—	Un		400	V
- - - -	Umin	- 5%	380	V



Efficiency Curves

According to: IEC



ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

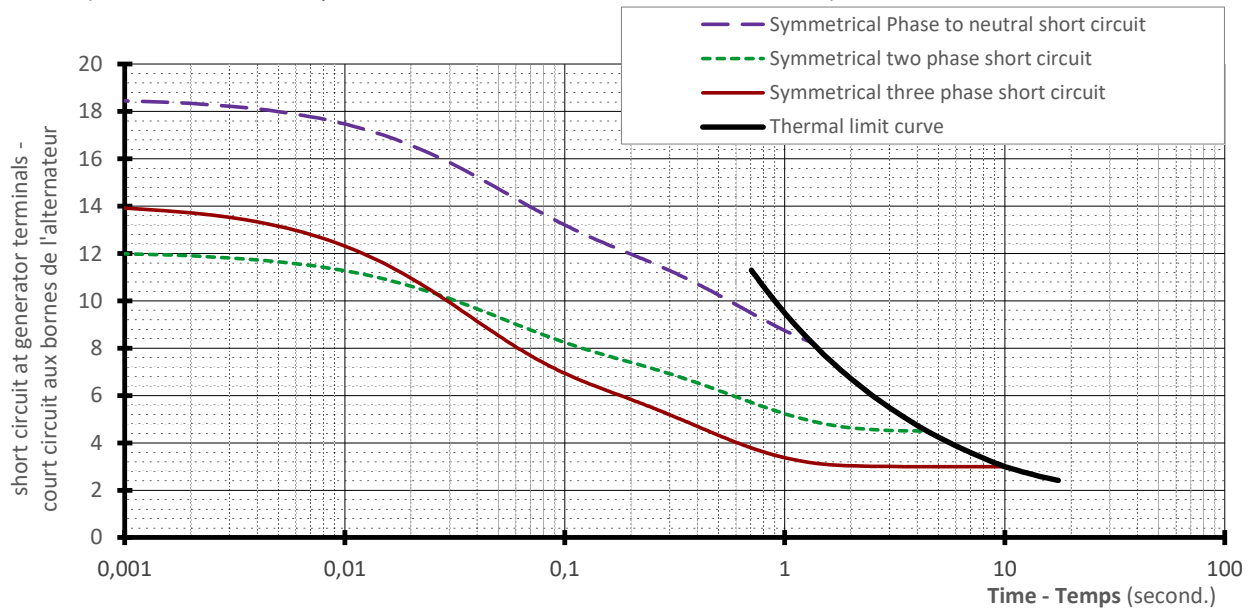
Date: 06-17-2024

3000kVA - 400V - 50 Hz

Stator Current decrement curves

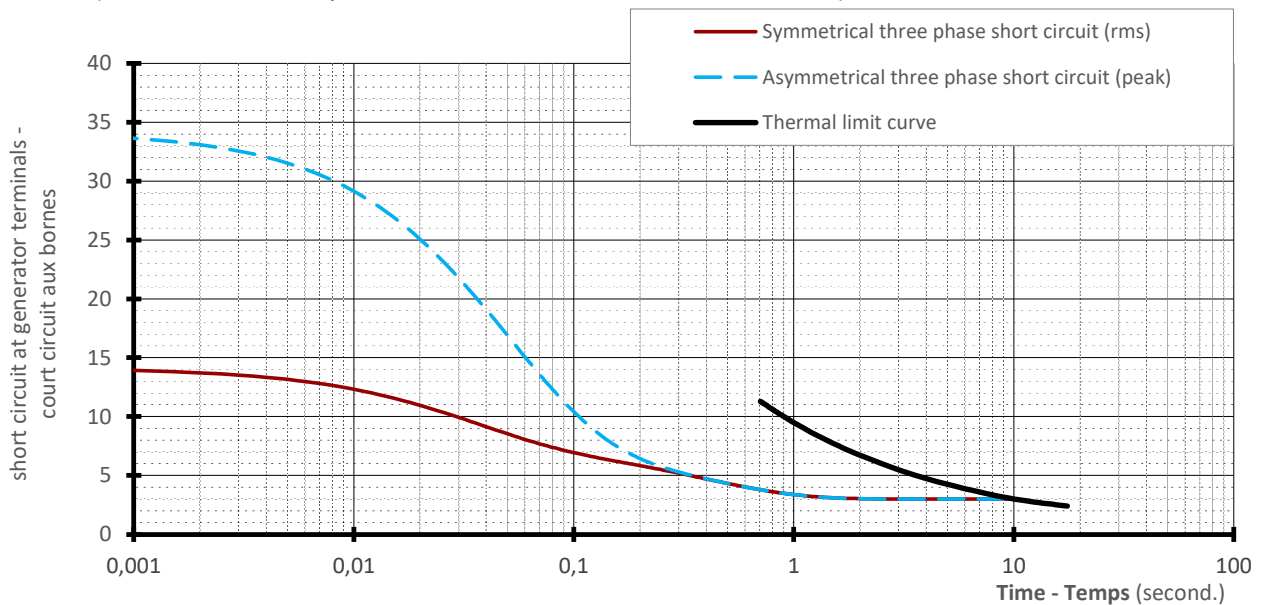
Symmetrical phase to neutral short-circuit	initial	79 912	A	18,5 x I_n	
Symmetrical two phase short-circuit	max	51 903	A	12 x I_n	$I_n = 4330$ A
Symmetrical three phase short-circuit	value	60 245	A	13,9 x I_n	
Thermal Limit					

I_{sc} (Short circuit current per rated current - Courant de court circuit / I_n)



Asymmetrical three phase short-circuit I_P 144 343 A 33,3 x I_n

I_{sc} (Short circuit current per rated current - Courant de court circuit / I_n)



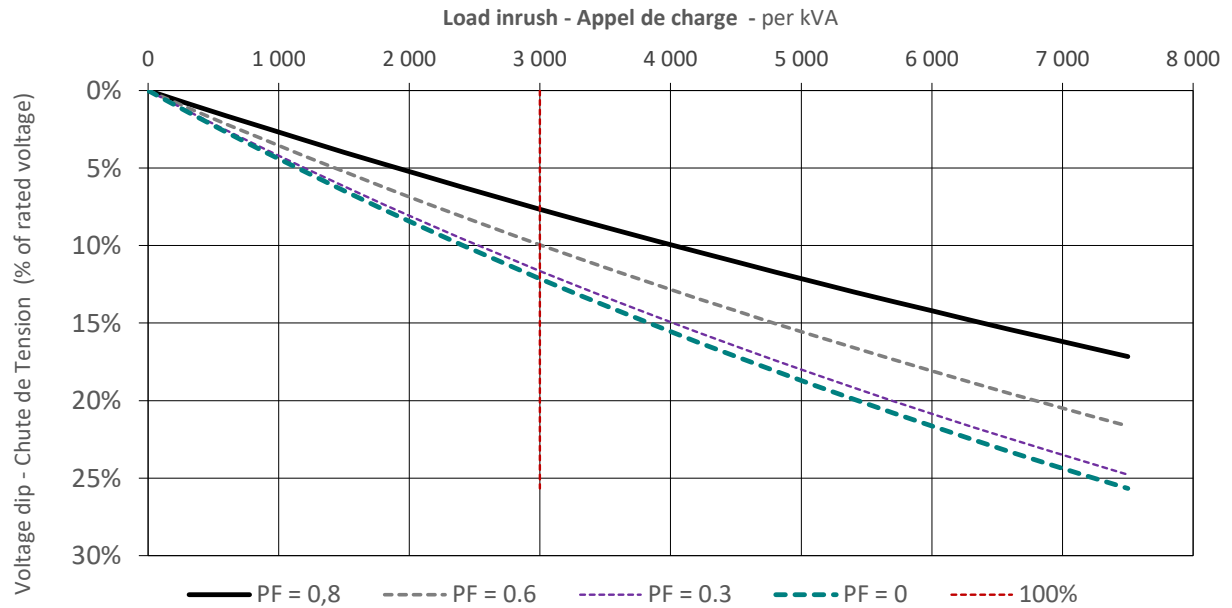
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Date: 06-17-2024

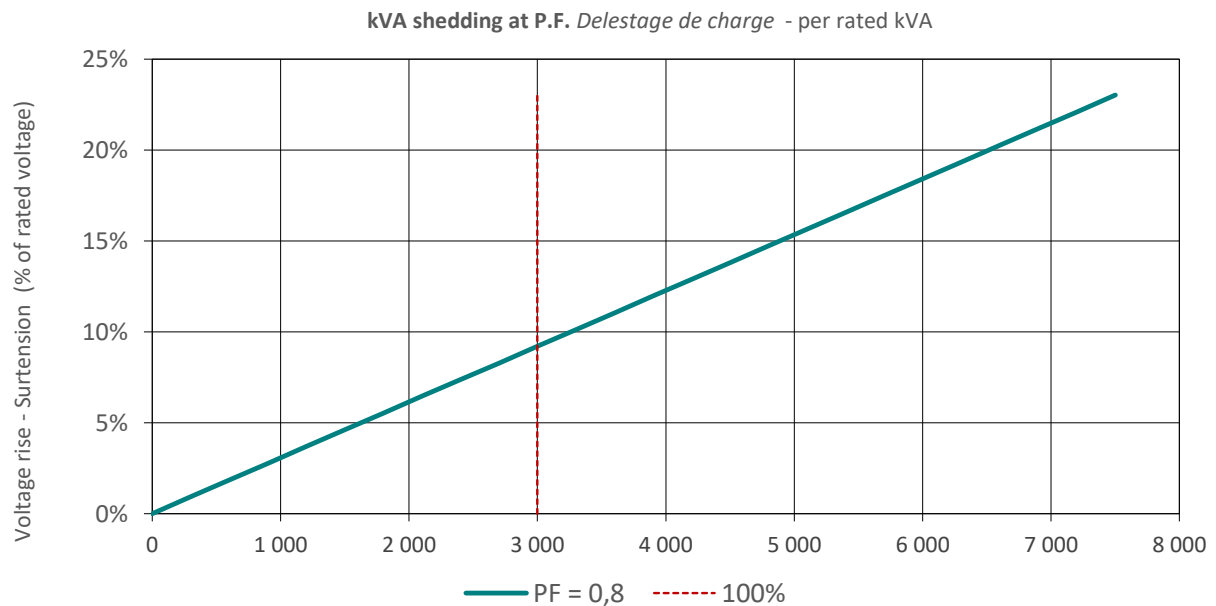
3000kVA - 400V - 50 Hz

Transient Voltage Variation

Transient voltage dip curve versus load impact



Transient voltage rise curve versus load rejection

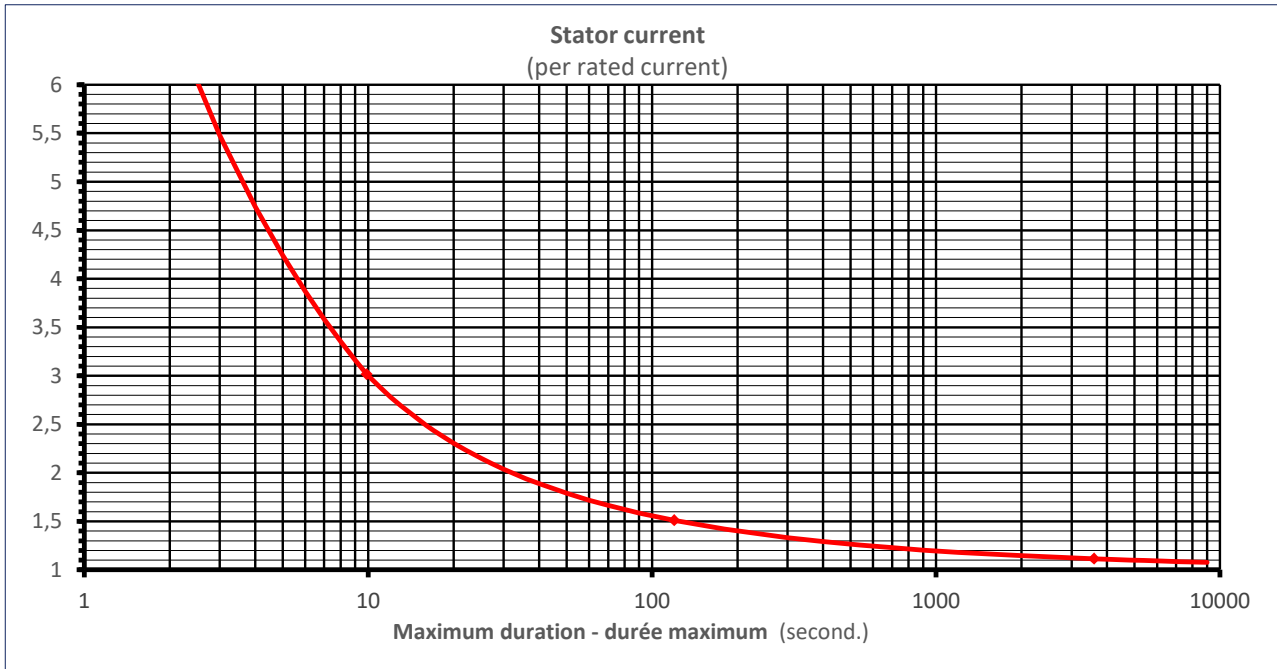


ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

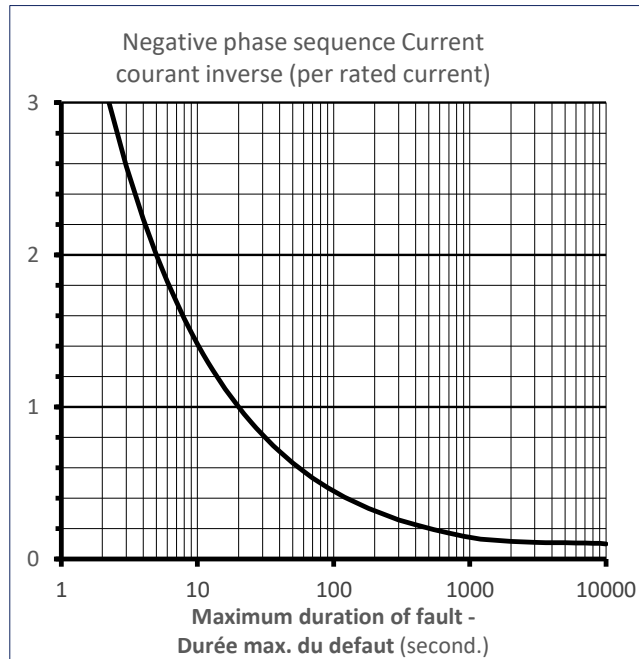
Date: 06-17-2024

3000kVA - 400V - 50 Hz

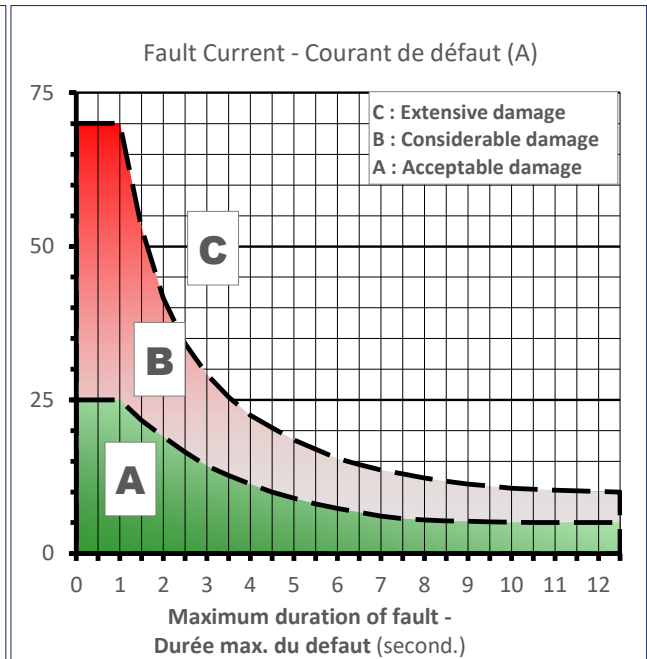
Thermal Damage Curve



Unbalance Load Curve



Stator Earth Fault Current



Appendix 9.04

Operation and Maintenance Manual

OPERATION AND MAINTENANCE MANUAL

16M55 Diesel Engine for Powerkit

Foreword

Please be advised, do not operate or perform any operation, maintenance, or repair on this engine until you have read and understood the information in this Manual in its entirety. This manual must be read in full before operating your engine in order to gain the maximum operational performance of the engine and to safely operate and maintain the engine. The operation and maintenance instructions are given as a guide for engines operating at the rating as sold.

Documentation

We use English as the primary business language for all publications. Other languages may be available, please consult with your local representative.

The photos and illustrations in this manual are for reference only. Some illustrations may have been modified to ensure clarity (for example guards and covers may be removed), and some equipment shown in this manual may be different to your engine. For the latest information, please contact your local representative.

The information contained in this Manual is correct at the time of publication. We reserve the right to modify these specifications without notice.

Safety

The Safety section of this manual covers basic safety precautions and shows warnings and potentially hazardous situations. This Manual must be read in full before operating your engine in order to operate and maintain the engine safely.

Maintenance & Spare Parts

Maintenance should be carried out at the appropriate intervals as shown in the Maintenance Table. The inspection and maintenance intervals are given as a guide, for engines operating under normal conditions. Consult with your representative for operation under severe conditions.

We recommend that a copy of the Maintenance Schedule be displayed near the engine and that a service record be kept and stored with the engine.

The use of Genuine Spare Parts is imperative to the optimal operation, performance and longevity of your engine. The use of alternatives or counterfeit parts can lead to voiding engine warranty, damage, failures, and personal injury or death.

Overhaul

This Manual does not include detailed instructions for overhaul of your engine. Contact your local representative who can help you to proceed with an overhaul program for your engine. All major repairs should be carried out by an authorized partner.

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Chapter I Safety

1.1 Safety Information

Failure to comply with the preventive measures and safety instructions included in this manual and with warnings indicated on the engine may lead to injury or death. This Operation and Maintenance Manual must be kept on or near the engine and must be easily accessible and ready to be consulted at any time. Furthermore, this manual must stay with the engine at all times.

Most accidents can be prevented by following basic safety precautions, recognizing hazardous situations and acting accordingly, but these safety instructions alone are not sufficient to avoid every hazard. Baudouin cannot anticipate or identify every possible hazard in your operating environment. Persons operating or maintaining the engine must be able to recognize hazardous situations, and they must have the necessary skills, training and tools to perform operation and maintenance activities properly.

1.2 Symbols Used

Please take note of the warnings and precautions indicated throughout this Manual in order to avoid unsafe practices and conditions. In this Manual, the following symbols are used to highlight specific information.

HAZARD WARNING

This warning symbol is recognized across the world. In this Manual this symbol is used to highlight the importance of the information that follows. Make sure that you understand the consequences of a dangerous situation and the ways in which to avoid danger.

Failure to comply with warnings can result in material damage, serious injury or even death.

**WARNING**

This type of warning indicates a potentially dangerous situation, which if not avoided, may result in serious injury, death, or considerable material damage.

**CAUTION**

This type of warning indicates a potentially dangerous situation, which if not avoided, may result in minor injury or material damage. It can also warn against dangerous practices.



The warnings in this guide cannot cover every situation imaginable. Please only use procedures, methods, tools, and parts specially recommended by the engine manufacturer.

Safety symbols

Symbol	Definition
	Wear hand protection
	Wear ear protection
	Wear eye protection

Symbol	Definition
	Wear head protection
	Wear foot protection
	Wear a protective mask
	Wear overalls
	Avoid naked flames
	Do not smoke
	Do not use a mobile phone
	Keep an extinguisher close by
	Danger: battery acid
	Danger: live cables, electrical risks
	Highly flammable products
	Keep away from hanging loads
	Risk of thermal burns
	Risk of mechanical drive / rotating parts

Symbol	Definition
	Lifting is forbidden
	Risk of steam burns
	Water drain valve

Universal Warning

The location of the Universal Warning label is illustrated below.

■ 16M55 Series

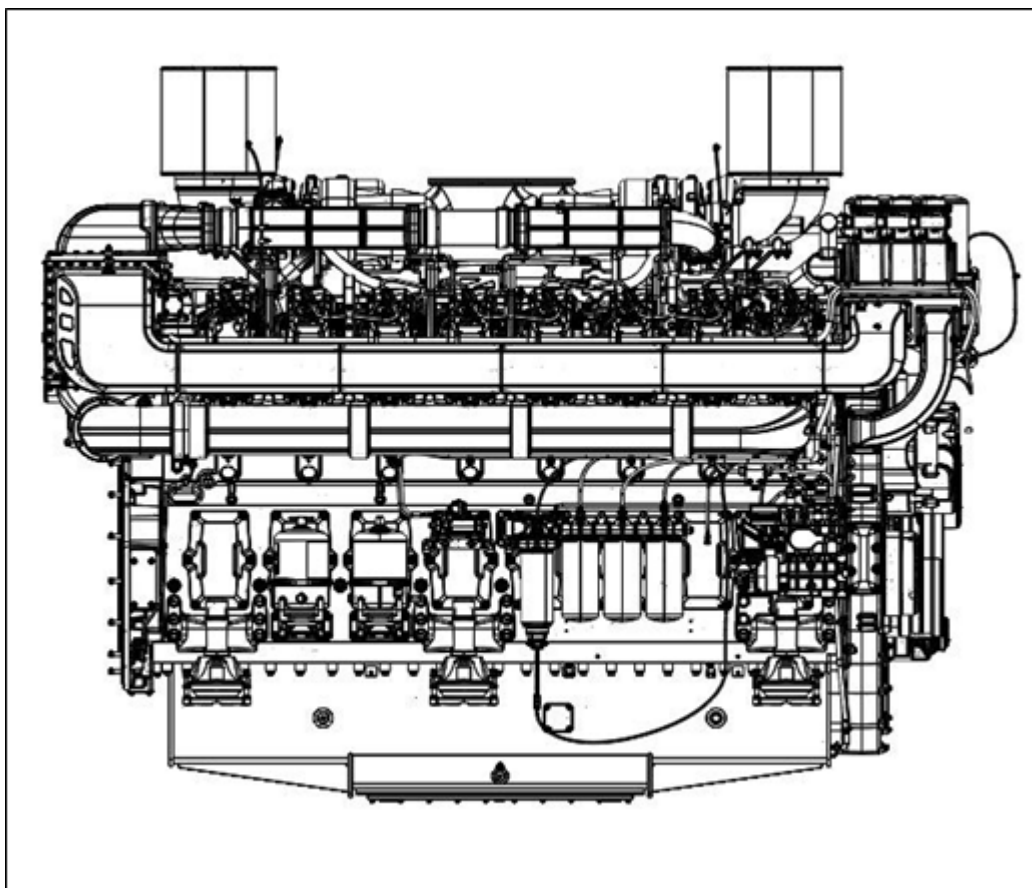
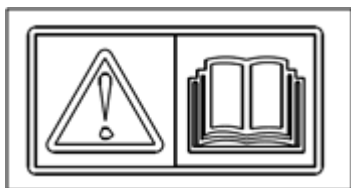


Figure 1-1 16M55 Illustration



Do not operate or perform maintenance on this engine unless you have read and understand the instructions and warnings in this Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in serious injury or death.

1.3 Personal Safety

These Personal Safety precautions are designed to reduce the risk of contamination, serious injury or death.

- Wear personal protective equipment (PPE) as required.

- Avoid prolonged and repeated contact with oil and diesel fuel.
- Do not put oily rags in pockets.
- Avoid contaminating clothing with oil.
- Wash overalls regularly. Throw away unwashable clothing and shoes impregnated with oil.
- Emergency treatment must be immediately sought in the event of any injury.
- Always wear protective mechanic's gloves before working in order to avoid prolonged and repeated contact with oil and diesel fuel.
- Wash with soap and hot water or, alternatively, use hand detergent and a nailbrush to make sure that all oil is removed. Products containing lanolin can help replace the skin's natural oils that may have been removed.
- DO NOT use petrol, kerosene, fuel, thinners or solvents to clean the skin.
- If skin problems occur, immediately consult a doctor.
- If possible, degrease components before handling them.
- When there are risks for the eyes, use safety glasses or a face shield. An eye-rinsing solution must be kept close at hand.
- Do not spill oil or other fluids on the ground when repairing the engine. In the event of an accidental spillage of hydrocarbon or other fluid, take all the necessary measures to section off the area, clean up and protect people and the environment.
- The handling, storage and recycling of hydrocarbons, ethylene, glycol and oil must comply with the safety and environmental standards applicable in the country where these operations take place.
- Ensure that all guards and covers are secured in place on the engine.
- Make sure adequate, non-expired extinguishers are available and that personnel are adequately trained in extinguisher operation.

1.4 Environmental Safety

- There are laws regarding environmental protection and the disposal of waste of hydrocarbons. To ensure compliance with environmental protection laws, consult your local authorities who will advise you. Obey all local regulations for the handling and disposal of liquids.
- The products and spare parts supplied by Baudouin do not contain asbestos.

1.5 Fluid Safety

- All oil, fuel, and some coolant liquids are flammable. If these liquids are leaking onto hot surfaces they can cause a fire which can cause injury and/or damage.
- Do not check for leaks using any body part. Use a cardboard section or other appropriate tool to check for a leak.
- Store all fuels and lubricants in closed, clearly labelled containers in a safe place.
- When draining liquids from the engine, ensure that the correct tools are used and that liquids are collected in a suitable container and disposed of following all local regulations.
- Oily rags and other flammable materials must not be stored in close proximity to engine or system.
- Do not smoke near the fuel tank or while in the filling area. Ensure there are no open flames or sparks. Always stop the engine before refuelling.
- Mobile phones (in particular their batteries) may give off sparks that could cause an explosion in certain high-risk areas. Switch off all mobile phones when filling the fuel tank or while in the filling area.



1.6 Batteries

- Wear personal protective equipment (PPE) as required.
- Do not smoke in areas where batteries are charged or near fuel circuits.
- The batteries release flammable fumes that can explode. Ensure there are no open flames or sparks near the battery.
- If the batteries are in a closed area, make sure there is sufficient ventilation.
- The battery cables must be fitted with a battery switch and fuse or circuit breaker to isolate the circuit.
- Sulphuric acid contained in batteries is toxic and corrosive; it can burn clothes and skin or even cause blindness in case of contact with the eyes.
- Disconnect the batteries before any operation involving the electrical system.
- Never disconnect any battery cable while the engine is operating.
- Never check battery charge by short circuiting it.
- Do not charge a frozen battery; heat it up 16°C (61°F) beforehand.
- In the event of corrosive material contact with a body part:
 - ◆ Rinse the affected part with plenty of water.



- ◆ Apply bicarbonate of soda or lime to neutralise the acid.
- ◆ Rinse your eyes for 10 to 15 minutes.
- ◆ See a doctor immediately.
- In the event of ingestion see a doctor immediately.
- Make sure the batteries are clean and fitted with the recommended covers, cables and connections.
- Electric wiring must be kept in good condition, properly positioned and attached.

1.7 Welding

- Do not weld or flame cut pipes, hoses or tanks that contain flammable fluids. Components containing flammable fluids must be drained and cleaned appropriately with a non-flammable solvent before conducting any welding or flame cutting.
- Disconnect the engine wiring harness before welding (control cabinets, electrical cabinets etc.).
- Comply with all legal provisions in force before conducting welding work.
- Do not use open fires.
- Make sure that the work will not affect the on-board electrical and electronic equipment.
- Make sure that the automatic fire suppression system is deactivated before any welding or grinding work.
- Make sure that there is sufficient ventilation in the premises where welding is to be carried out.



1.8 Electrical Risks

- Electrical checks must be carried out regularly.
- Electric wiring must be kept in good condition, properly positioned and soundly attached.
- All wires should be of the recommended size.
- Wires and cables must be protected by a fuse or calibrated circuit breaker.
- Do not short-circuit fuses and/or circuit breakers.
- The electrical circuit of the engine must be isolated from the engine and generator.
- Ensure that the engine is grounded correctly to prevent uncontrolled electrical circuit paths which can cause damage.
- Insulation problems can cause short-circuits or stray current. Stray current can damage electrical and electronic components, bushing or crankshaft seating and may also cause radio-frequency disturbance.
- The engine earth must be properly connected to the chassis, as well as all the flexible hoses.
 - ◆ Flexible connections for cooling
 - ◆ Flexible circuit connections for fuel
 - ◆ Electrical control systems and electronic fuel injection



- Earth faults can cause corrosion in the pipes and engine unit components.

1.9 Lines, Tubes and Hoses

- Ensure that all high pressure lines are not bent, worn or damaged. High pressure lines must be positioned, supported and firmly fastened. Do not attach any other components to the high pressure lines. Tighten all connections to the recommended torque.
- Do not check for leaks using your hand. Use a cardboard to check for a leak.
- Tighten all connections and filter housings to the recommended torque.
- Release the lubrication, fuel and pressure cooling circuits before disconnecting or removing hoses or associated parts.



1.10 Coolant Safety

- At operating temperature, the coolant is hot and pressurized. When pressure is released sharply, this hot liquid may be transformed into fumes. Any contact with this hot liquid or these fumes may cause serious burns.
- The cooling system also contains alkali which can cause injury. Do not allow alkali to contact your skin, eyes or mouth.
- Let the components of the coolant circuit cool down before draining the circuit.
- Only check the coolant level when the engine has stopped.
- Slowly unscrew the coolant filler plug to release pressure.



1.11 Cleaning the Engine

- Use personal protective equipment when cleaning an engine.
- Regularly clean the engine surface to remove any greasy deposits that may be flammable.
- Do not wash an engine in operation or which has just stopped.
- Use the safety equipment required by your local codes and standards.
- Make sure high-pressure water cannot damage the equipment being washed. Do not get electrical equipment or seals wet.
- Take necessary precautions when using a high-pressure cleaner. Comply with the safety instructions indicated for the cleaning equipment used as well as local codes and standards.
- High pressure cleaning can blow out high-speed debris from the engine which can cause injury.



1.12 General Precautions for Operation

1.12.1 Before any Operation or Maintenance on any Baudouin Product

- Wear personal protective equipment (PPE) where required.
- For maintenance, place a “Do Not Use” or similar sign on the starter switches.
- Access to the equipment is only for authorized and qualified personnel.
- Ensure that all guards and covers are secured in place on the engine.
- Make sure that the repair premises and surrounding area are suitable for safe working.
- Inspect the engine for potential hazards. Ensure there are no personnel on, under or around the engine.
- Ensure that the pipes and hoses are not worn or damaged. Pipes must be positioned, supported and firmly fastened.

- Ensure that the electrical wiring is not worn or damaged. Wiring must be positioned, supported and firmly fastened.
- Remove all wiring that is obstructive to repair/maintenance or unattached.
- Use the proper tools for the operation being performed.
- Report all necessary repairs promptly.
- Remove any rings, chains and watches before starting work. Wear suitable and properly-fitting work clothes.
- Remove and isolate the control panel key.
- Do not perform any operation or maintenance operations which are not fully understood.
- Clear the engine of any flammable materials such as fuel, oil or debris.
- Do not smoke near the engine or where flammable materials are stored.
- Exhaust shields (if equipped) must be fitted correctly.
- Do not expose the engine or components to flames.
- Do not touch hot parts of an engine in operation or which has just been stopped.
- Ensure the starter battery insulation switch is in open position.
- Switch off the circuit breaker located in engine connection box (if equipped).
- Switch off engine room lock switch or emergency stop (if equipped).
- For maintenance, for engines fitted with a pneumatic starter system, isolate the tanks and evacuate the pipe linking the tanks to the starter.
- For engines installed on automatic start equipment select the lock position on the selection mode of the control panel, to avoid the engine start.
- Use caution when cover plates or other components are removed. Gradually loosen and remove bolts/nuts but do not remove the last two bolts which are located on opposite ends of the plate. Before removing the last two bolts, pry open the plate and gradually release the pressure.
- Do not remove any hydraulic components or parts until the pressure in the system has been relieved. Contact Baudouin for procedures required to remove hydraulic components.
- Injector gasket must be replaced when replacing or check the injector / injector nozzle.

1.12.2 Starting the Engine

- For initial start-up of a new engine, or the first start after a service, make provisions to be able to stop the engine if a fault occurs. This can be done by shutting off the fuel or air supply to the engine.
- Never use any engine starting agents (for example, ether) to facilitate start-up due to a risk of explosion or injury.

- Never start an engine without checking that this operation can be carried out without danger to people or equipment. If there is a warning tag attached to the control panel or start switch do not start the engine or touch the controls.
- Start the engine from the control panel or operator' s booth.
- Ensure that the jacket water heater and/or lube oil heater (if equipped) are working properly by checking the temperature gauges during the heating operation.
- Never short across the starting motor terminals or the batteries as this could damage the electrical system.
- Never bypass or disable the automatic shutoff circuit - these are provided to help prevent injury and engine damage.
- Engine exhaust could be harmful to your health, therefore always start and operate the engine in a well-ventilated area. If in an enclosed area, ensure the engine exhaust is vented properly to the outside.

1.12.3 Stopping the Engine

- Stop the engine from the control panel or operator' s booth.
- Use the Emergency Stop Button (if equipped) only in the event of an emergency. Do not use the Emergency Stop Button for normal engine stopping. Do not start the engine after using the Emergency Stop Button until the problem that caused the emergency stop has been corrected.
- Let the engine cool down before carrying out any maintenance operation.
- Do not perform any operations on the engine for at least 15 minutes after an emergency shut-down.

1.13 Recommendations for Engines Equipped with Common Rail System

- Wear personal protective equipment (PPE) where required.
- High-pressure fuel spray can cause irreversible body damage. Wear required protection when conducting operations on the entire circuit.
- Make sure that the lines are depressurized before any dismantling operations.
- Release the high pressure before handling the feed and injection circuit of a common rail engine.
- When checking the injectors, make sure that the high-pressure jet does not touch the skin.
- All investigations of leaking fuel, oil or other high pressure liquids must be conducted using a screen and never with bare hands.
- Use a spray fumes extracting device.
- If fuel comes into contact with the skin, it can cause injury. Consult a doctor immediately.
- Fuel, oil and coolant contain harmful chemicals. Avoid any contact with skin and hands.

Chapter II Product

2.1 Rating Definitions

Rating definitions	Running conditions
COP Continuous power	■ Annual running time is unlimited ■ Continuous 100% rated power is allowed. ■ No overload ability.
PRP Unlimited Prime Rated Power	■ Annual running time is unlimited. ■ The average load rate is no more than 70% during a range of 24 hours. ■ Maximum time range with overload 10% within 12h is 1 hour.
ESP Emergency Standby Power	■ The annual running time shall not exceed 200h. ■ The average load rate shall not exceed 70% in 24h cycle ■ No overload. ■ The acceleration requirement is in accordance with Q/WCG136.13. Acceleration from starting to rated power should be within 10s without engine warm stage. ■ For natural aspirate diesel engine, when the environment temperature is below 5 degrees Celsius, it is need to use preheat facilities to warm coolant temperature higher than 30 degrees Celsius. When environment temperature is higher than 5degrees Celsius, no preheating facilities are required. ■ For diesel engine with turbocharger, when the environment temperature is below 10 degrees Celsius, it is need to use preheat facilities to warm engine coolant temperature higher than 30 degree Celsius. When environment temperature is higher than 10 degree Celsius, no preheating facilities are required.
LTP Limited-time Running Power	■ No overload ability. ■ The annual operating time shall not exceed 500h under constant rated load.

Rating definitions	Running conditions
DCP Data Center Power	■ 10% overload is allowed. ■ Annual running time is unlimited. ■ Working under variable or constant load of less than 100%.
PSP Prime Standby Power	■ The annual running time shall not exceed 500h. ■ The average load rate is no more than 70% during a range of 24 hours. ■ Maximum time range with overload 10% within 12h is 1 hour.

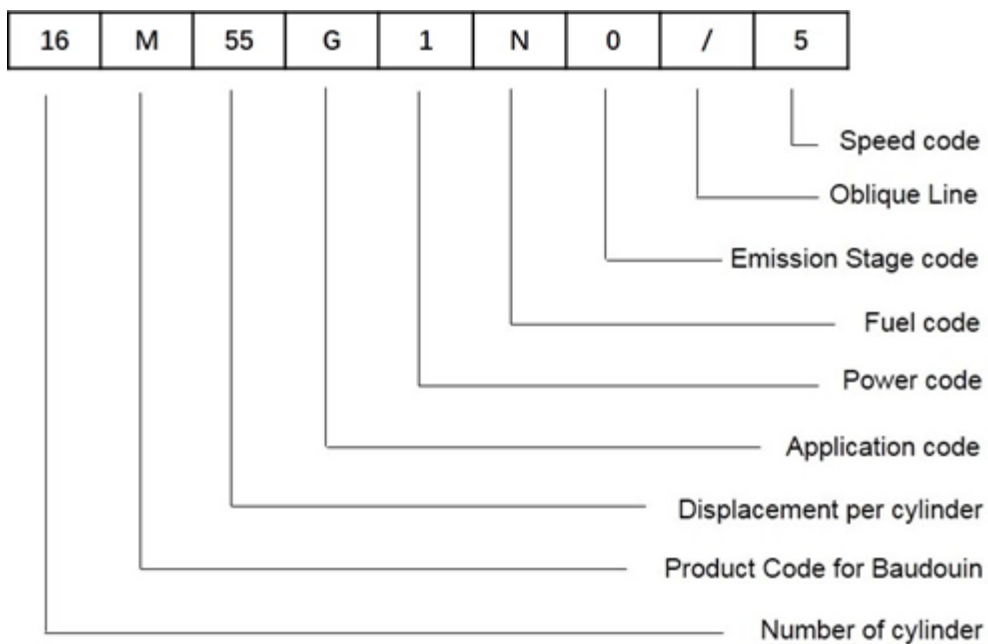
2.2 Engine Model

2.2.1 Abbreviations

16M55: Baudouin engine series with 16 cylinders arranged as V type, and displacement per cylinder is 5.5 liters.

2.2.2 Model Definition

2.2.2.1 Product Model of Baudouin Industrial Engine



2.2.2.2 Product Series Code

Product series Code is comprised by Cylinder Number、Product Code for Baudouin (M) and Displacement per Cylinder.

2.2.2.3 Application Code

Code	Application
G	Land Power Generation
GT	Land Power Generation for Tele com
V	Variable speed models (Pump, Air pressure...)

2.2.2.4 Power Code

■ Common rules

Use number 0,2, 4, 6..... as the different power lever for the models, choose 0 as the lowest power and increase the power with the order of the number, 1, 3, 5, 7..... as the alternate power code and will be used according to market demands.

■ For the single speed engines that without emission (can only be used for PRP or ESP)

Power code for 50Hz correspond Standby Power (kVA) of generating set.

Power code for 60Hz correspond Standby Power (kW) of generating set.

Contents of emission phase code and fuel code will not be used.

2.2.2.5 Speed Code

RPM	1500	1800	1500 & 1800	3000
Code	5	6	S	3
Engine speed is only used for gen-set application using, and is shown as table, the speed code for other application will not be used.				

2.2.2.6 Emission Stage Codes

Emission Stage Code	Non-road
0	No emission certification
1	U.S. EPA 40 CFR 60 JJJJ U.S. EPA Tier 1 India CPCB I

2	U.S. EPA Tier 2 India CPCB II
3	U.S. EPA Tier 3 EU Stage IIIA/B China stage III
4	U.S. EPA Tier 4 India CPCB IV EU Stage IV China stage IV
5	EU stage V
6	EU stage VI
Note1: New product model should be compiled on the basis of the most stringent Emission legislation; Note2: Current model name can still be used when applying for another emission certification with existing product.	

2.2.2.7 Fuel Code

The fuel code of diesel oil is indicated by “D” , natural gas is indicated by “N” , and LPG is indicated by “L” .

2.2.2.8 Engine Plate

■ 16M55 Series Diesel engine

The 16M55 engine is fitted with an Engine Identification Plate.

The plate can be found in a visible location and will supply the information below.

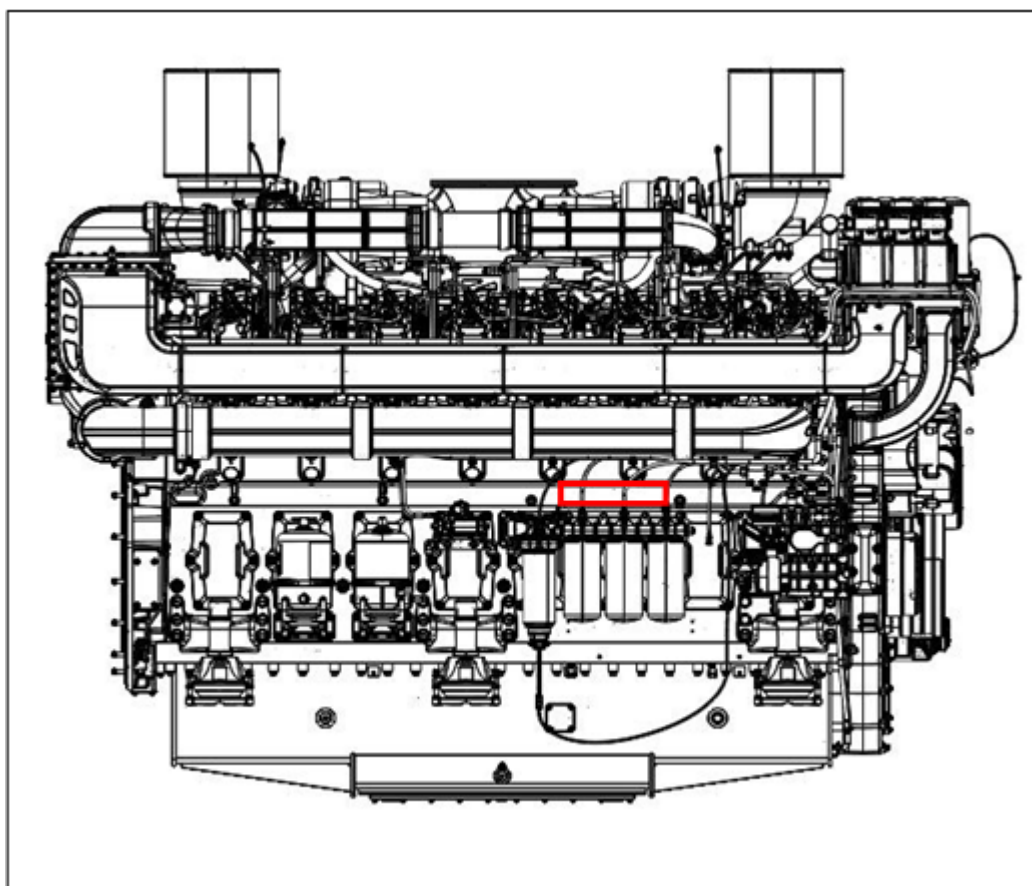
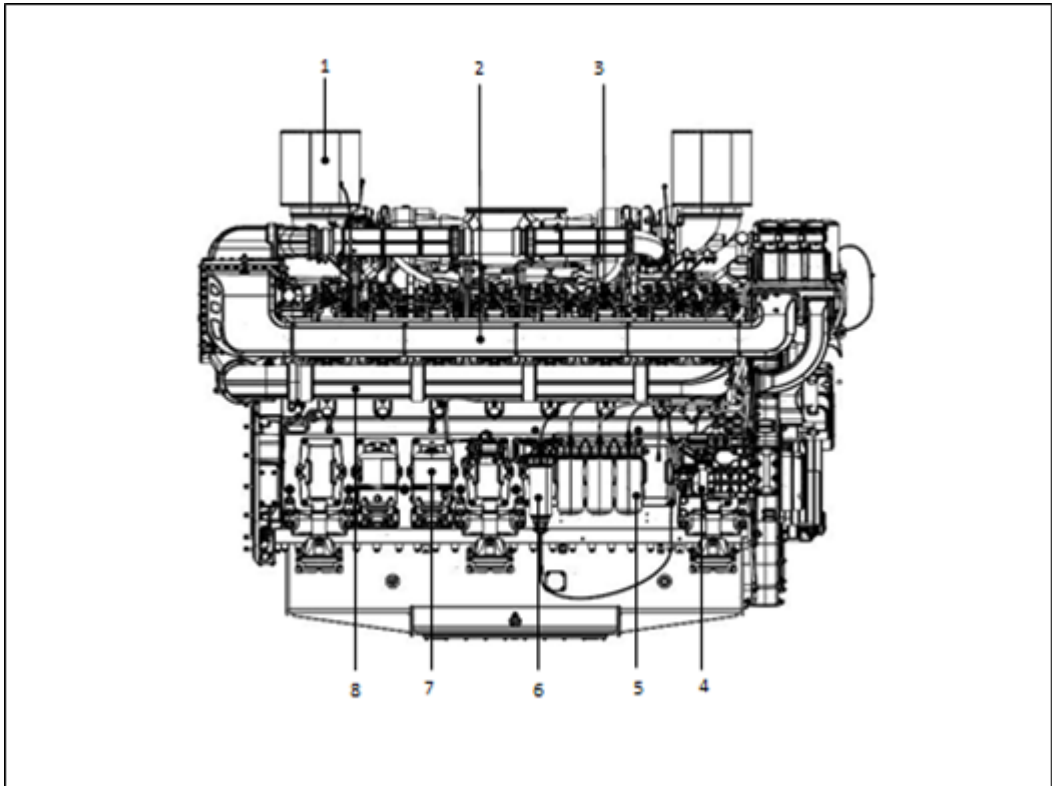
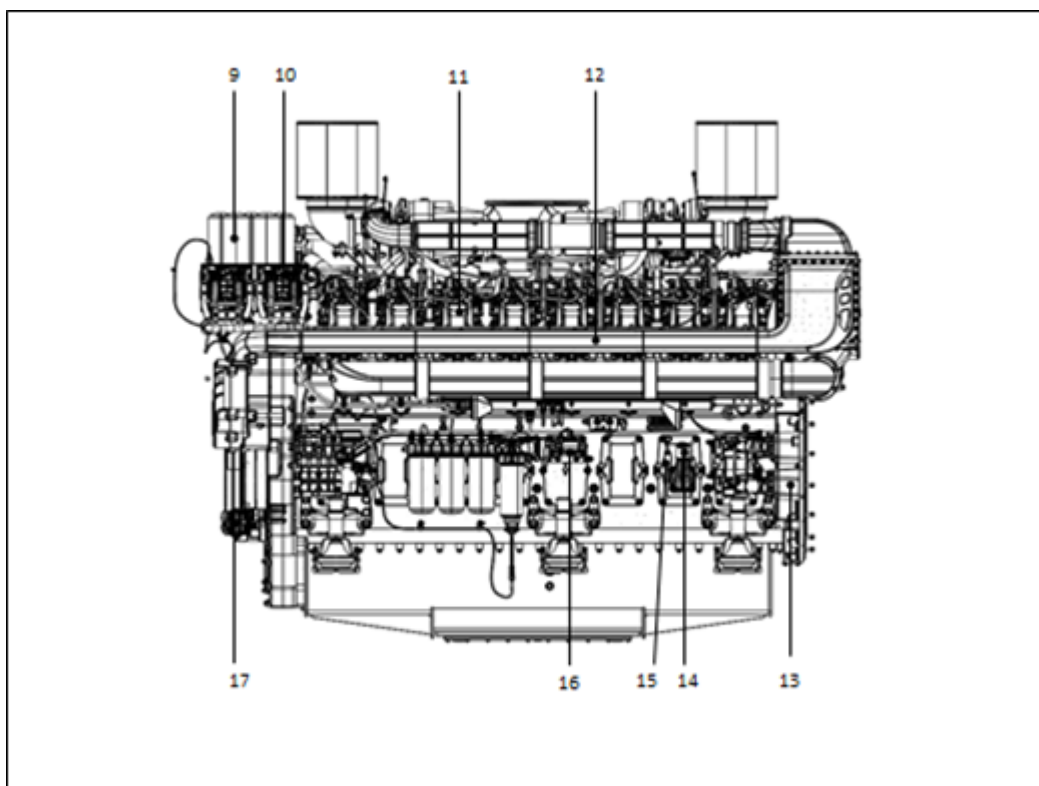


Figure 2-1 Engine Plate

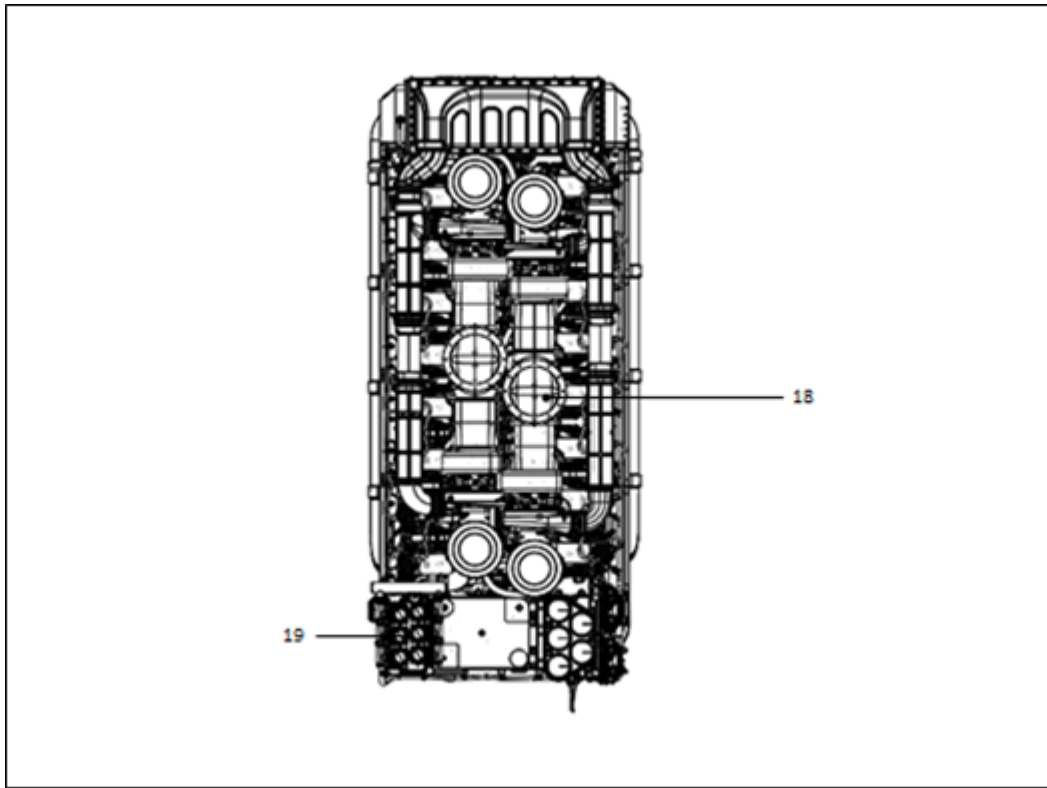
2.3 Engine Overview



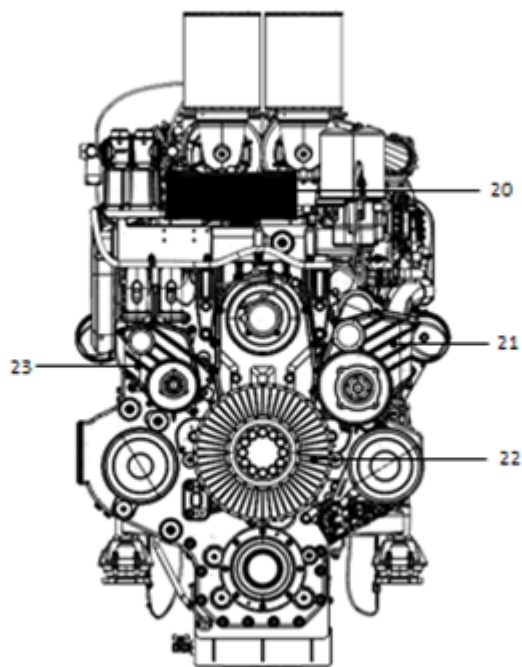
No.	Part Name
1	Air filter
2	Low temperature cooling circle pipe
3	Fuel injector
4	High pressure fuel pump
5	Fuel filter
6	Fuel pre-filter
7	Centrifugal oil filter
8	Air intake manifold



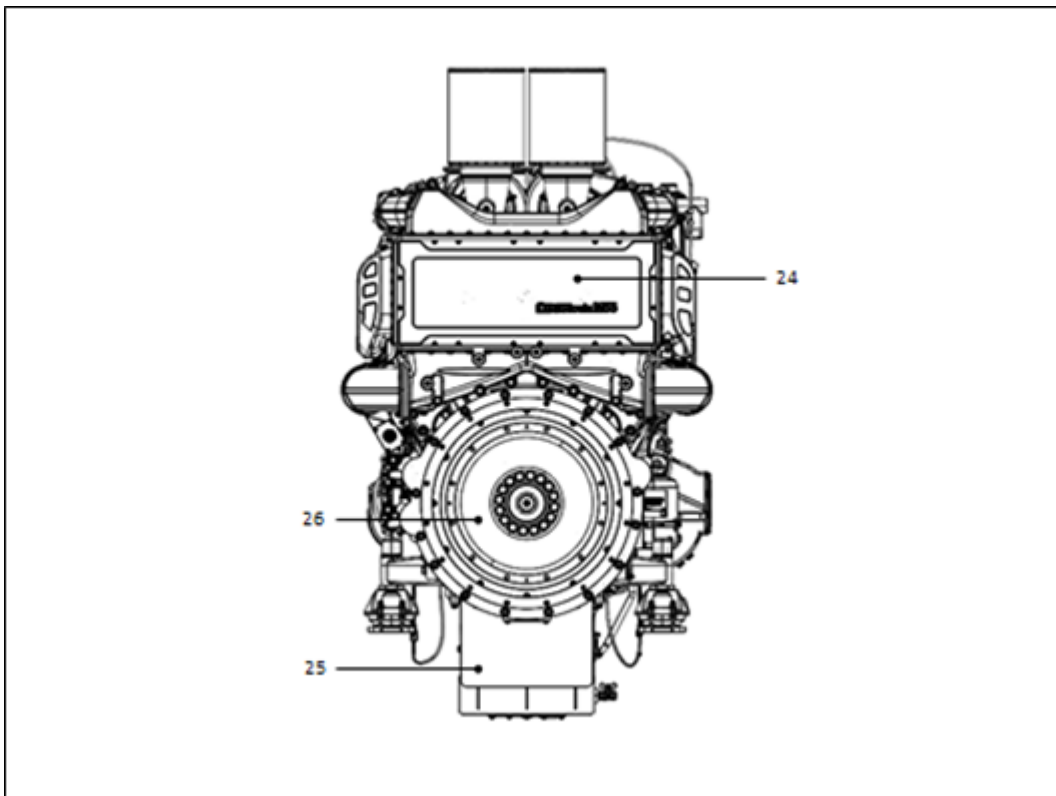
No.	Part Name
9	Oil filter
10	ECU
11	Rocker arm cover
12	High temperature cooling circle pipe
13	Flywheel housing
14	Oil filler cap
15	Oil dipstick
16	Fuel pre-supply pump
17	Alternator



No.	Part Name
18	Air exhaust port
19	Oil-Gas separator



No.	Part Name
20	Oil cooler
21	High temperature coolant pump
22	Crankshaft damper
23	Low temperature coolant pump



No.	Part Name
24	Inter cooler
25	Oil sump
26	Flywheel

2.4 Cooling Circuits

16M55 diesel engine is equipped with 2 cooling circuits.

■ a)High temperature cooling circuit to cool:

- Cylinder block and cylinder head
- Up part of air intercooler

The internal circuit is designed for self-degassing.

To provide effective protection of the engine against freezing, chemical and galvanic corrosion, cavitation and depositing, it is IMPERATIVE to use the correct coolant.

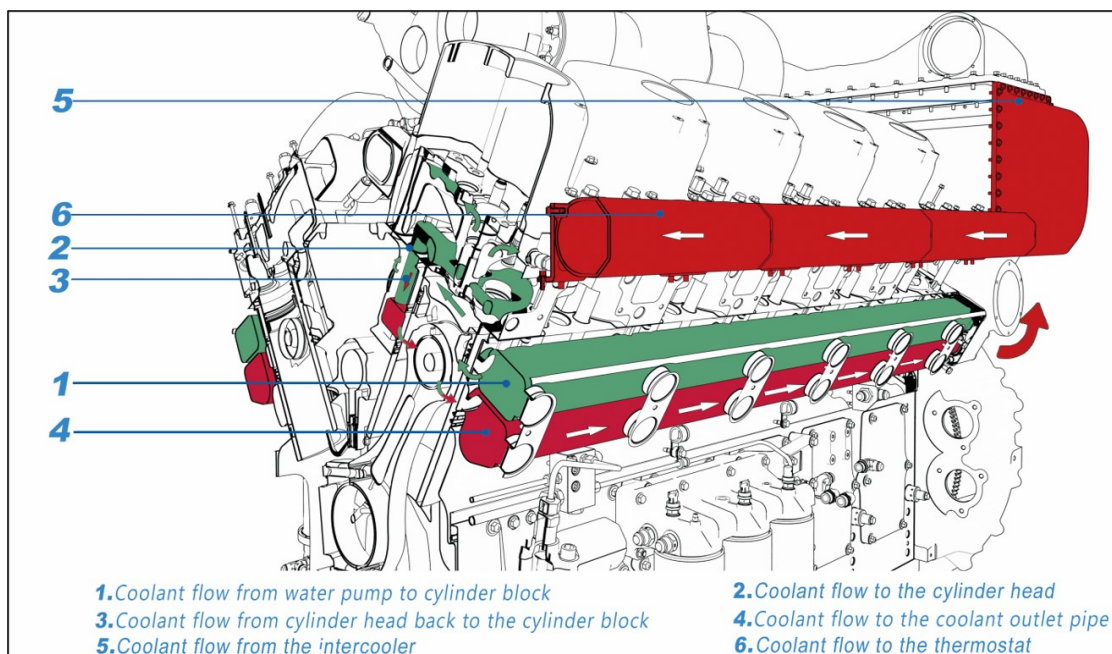


Figure 2-2 Overall Layout of high temperature cooling circuit

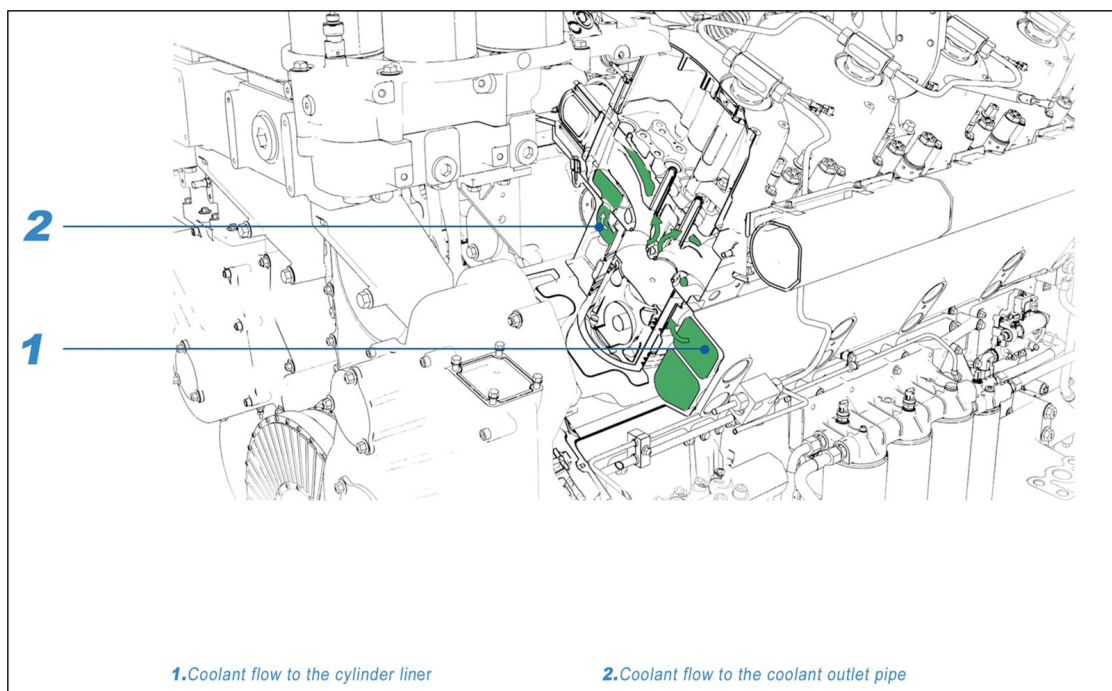


Figure 2-3 Overall Layout of cylinder liner

■ b) Low temperature cooling circuit to cool:

-Low part of air intercooler

-Oil cooler

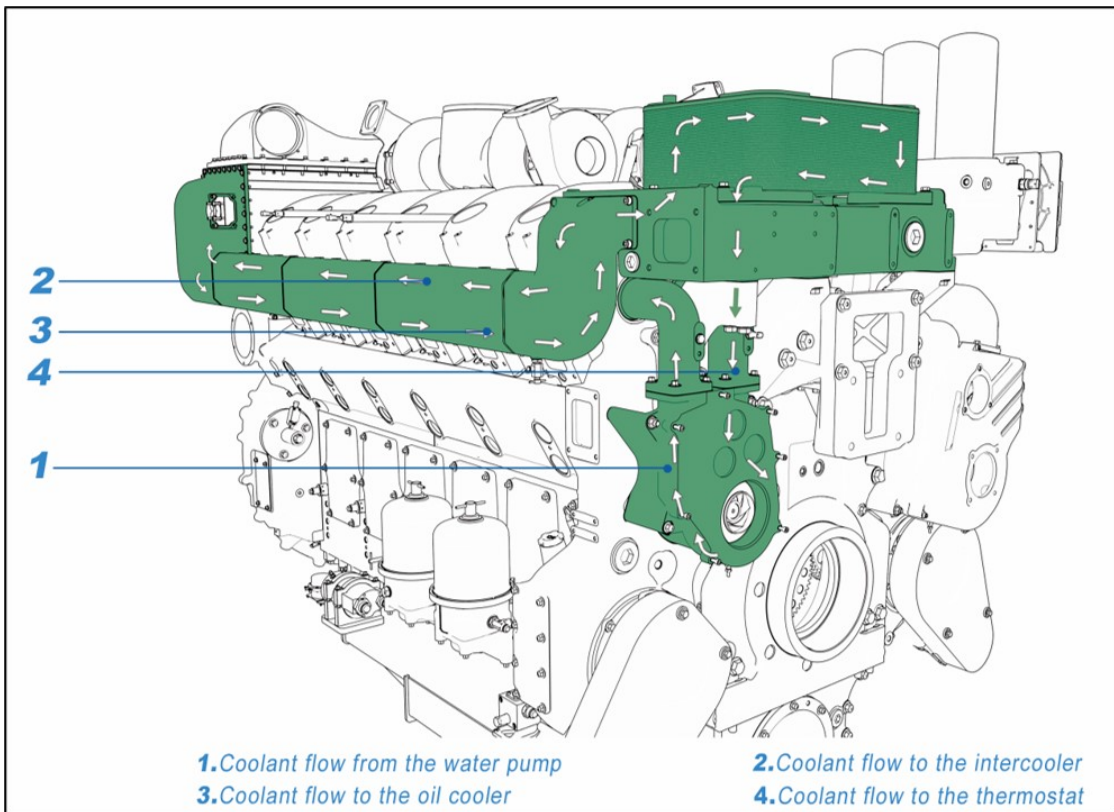


Figure 2-4 Overall Layout of low temperature cooling circuit

2.5 Lubrication System

The 16M55 engine is equipped with a pressurized lubrication system. The system diagram is as figure below. The gear driving oil pump is located at engine's front low end. The oil pump is driven by gear of the crankshaft. Whole engine related parts are lubricated by oil from gear driving pump through special passage or injector.

Pistons are cooled by the oil injected from the special port.

■ Oil filters

16M55 engines range is equipped with a lubricating system including 5 full flow oil filters and two centrifugal oil filter.

The full flow oil filters are arranged on the top of the engine near the oil cooler.

■ Oil cooler

16M55 series engines are equipped with a lubrication system including one oil cooler. This oil cooler is cooled by the coolant of the low temperature cooling circuit.

■ Oil capacity

16M55 oil capacity in stopping status is approx. 445L~500L.

For the specific requirement of lubrication oil, see the appendix.

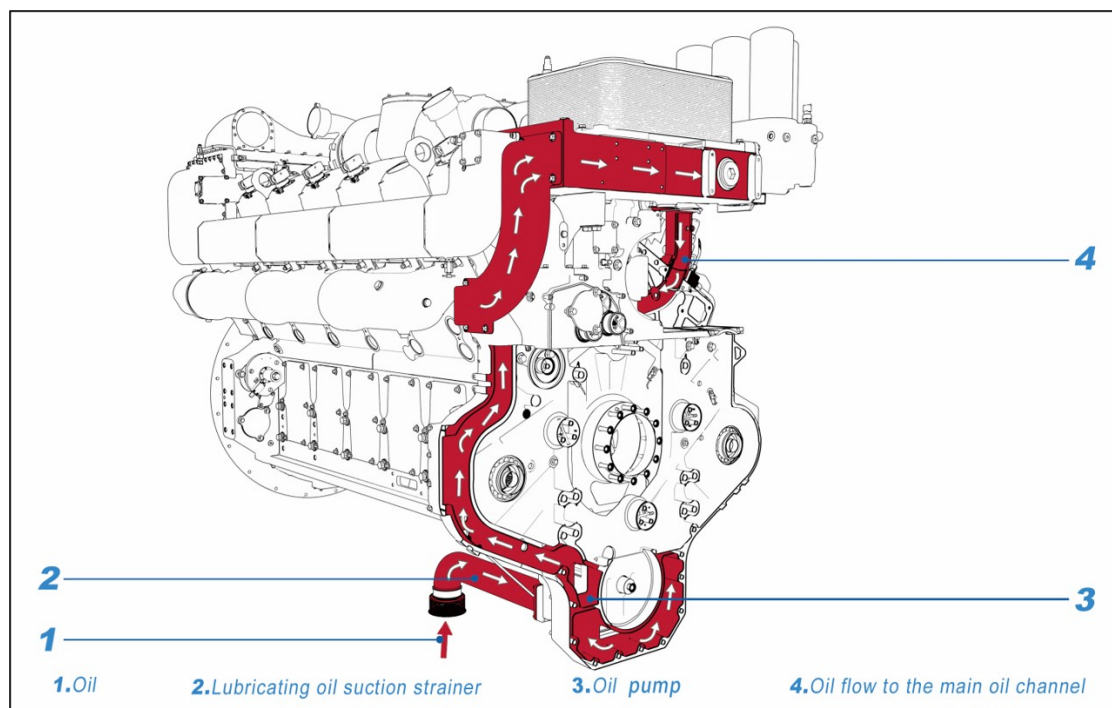


Figure 2-5 Overall Layout of oil circuits

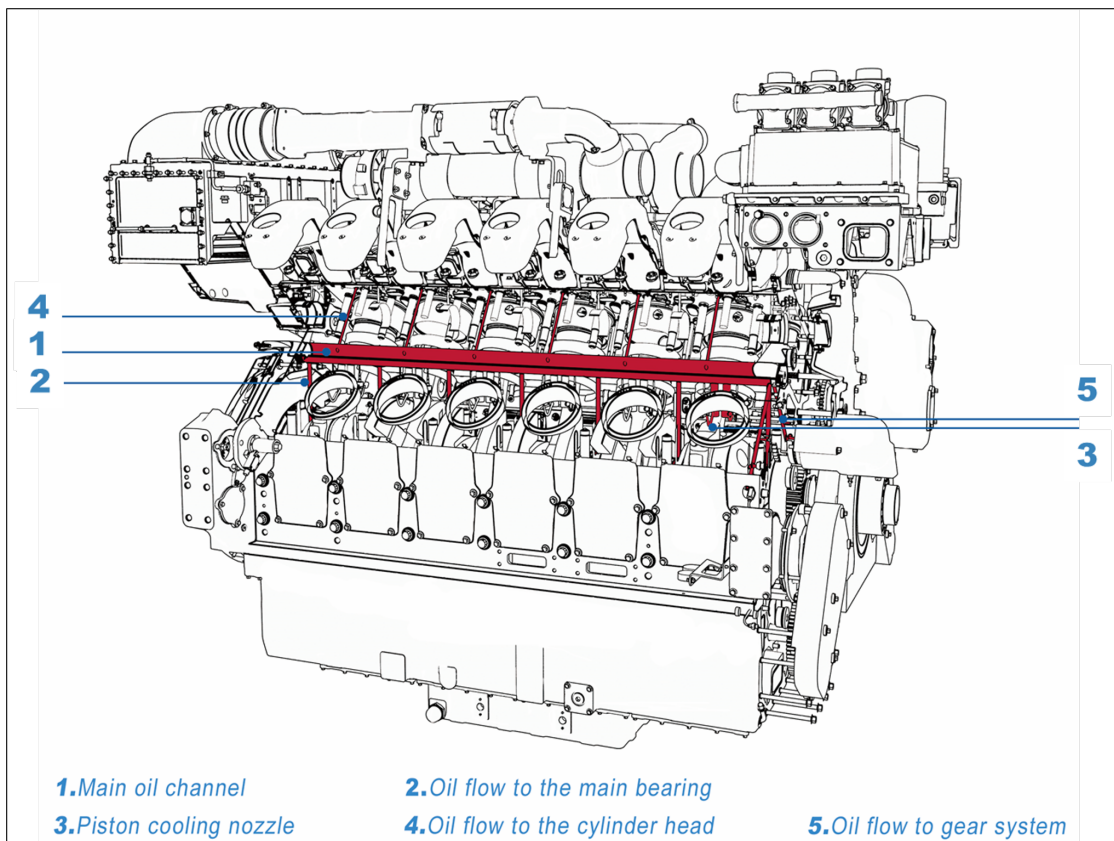


Figure 2-6 Overall Layout of oil circuits

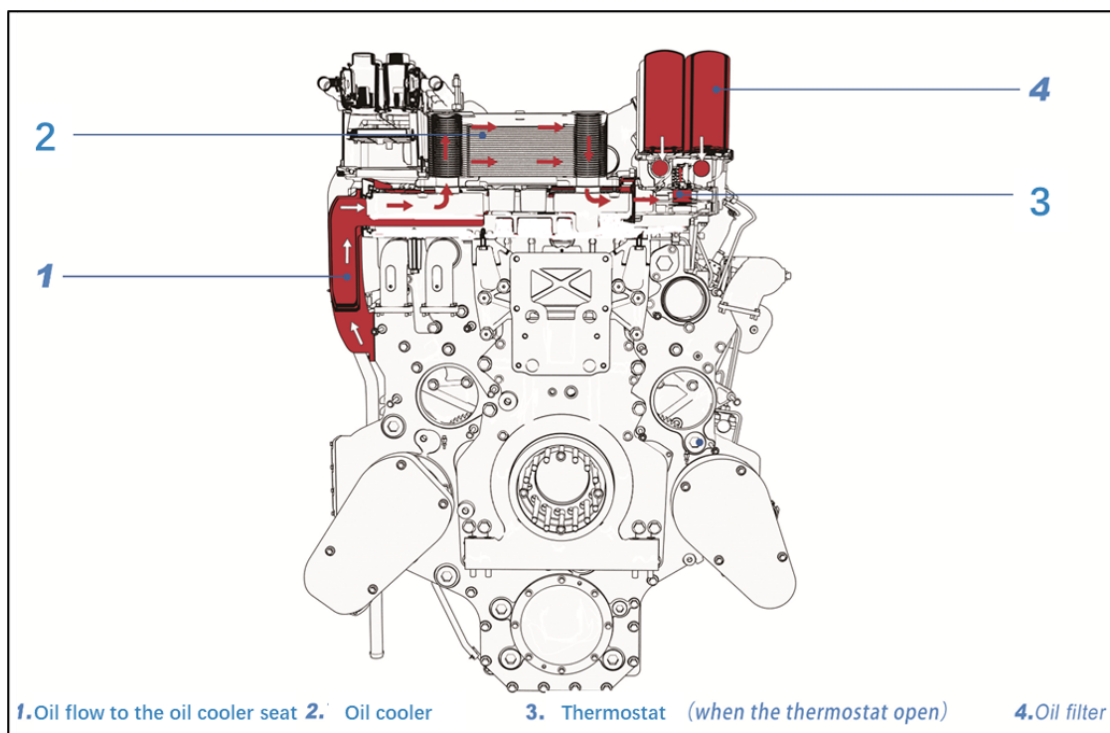


Figure 2-7 Overall Layout of oil circuits

2.6 Fuel System

There are two independently working fuel systems at the two sides of the V-type cylinder. One fuel pump supplies fuel to eight fuel injectors.

The feed pump draws the fuel from the fuel tank through water-separator and then through three full-flows fine filters to the high pressure fuel pump. High pressure fuel pump delivers high pressure (**HP**) fuel to the injectors.

Excess fuel not sprayed is returned to the return port. The excess fuel from high pressure pump flows to return port.

The high pressure fuel line has a pressure regulator valve to release the pressure peak.

■ Electronic fuel pre feed pump

There is one fuel pre feed pump at the each side of the cylinder. It enables the fuel flow automatically after the ECU T15 switch is on to release the air in the fuel system to make the engine start easier.

■ High pressure fuel pump

The two injection pumps are fitted on the front of the engine. They are driven by the gear and lubricated by the pressurized lubrication circuit.

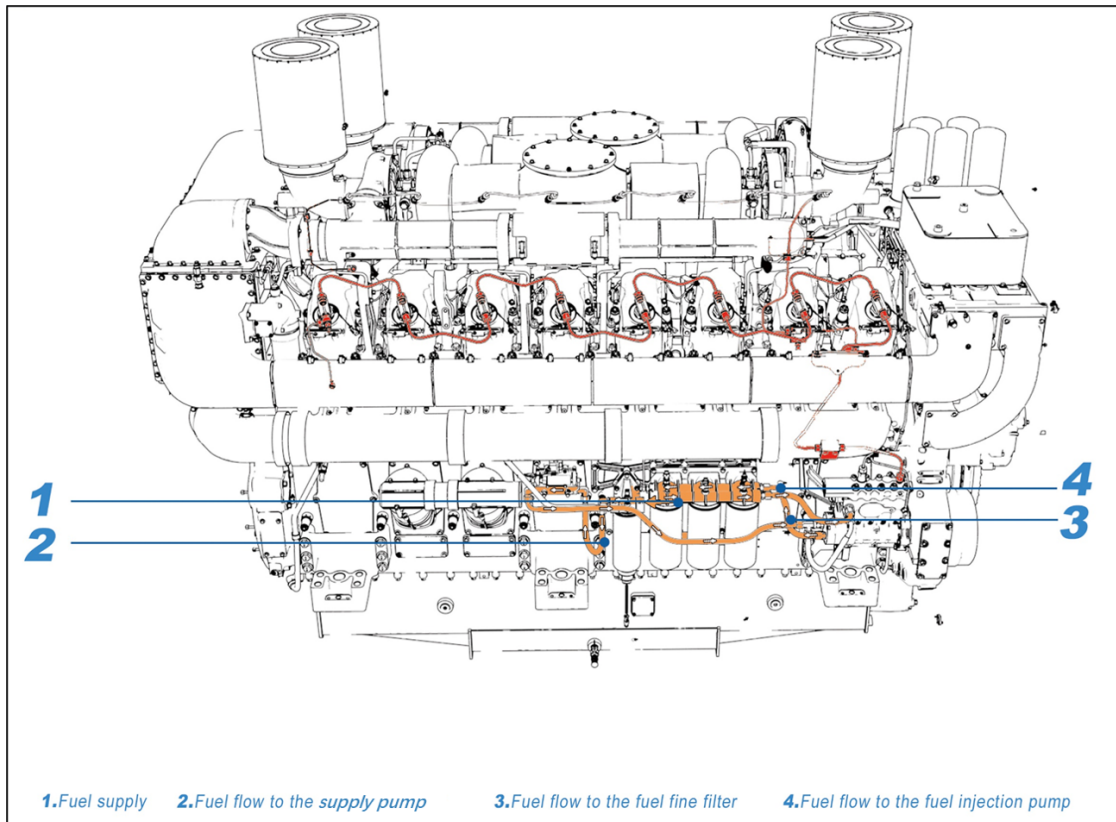


Figure 2-8 Overall Layout of fuel system

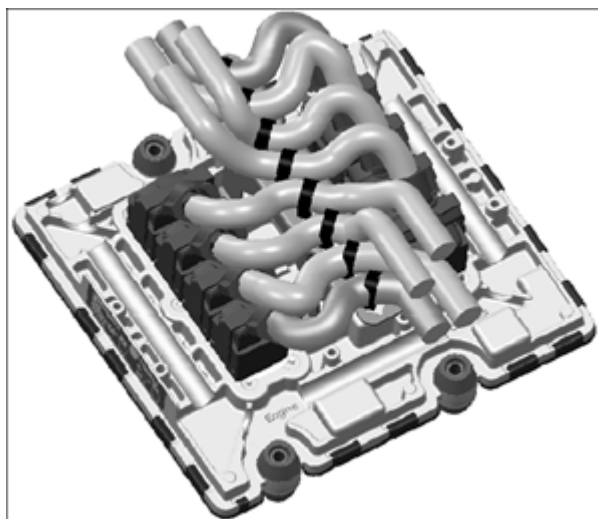
2.7 Electronic Control Unit (ECU)

2.7.1 WISEC10B

WISEC10B supports 6-cylinder or 8-cylinder diesel engine, which can control the emission of diesel engine to fulfill the requirement of specific standard. For more than 8-cylinder diesel engine, 2 pieces of WISEC10B unit are used with master-slave arrangement.

Pin 2.28 of master ECU is connected with the battery” +” , and pin 2.28 of slave ECU is connected with battery” - “.

The WISEC10B ECU has 8 wire socket slots. In factory the 8 wire socket slots are inserted, and 31pins & 9pins connector are reserved. In order to facilitate the connection, OEM needs to assemble the switches and relays according to pin description.



2.7.2 Terminal Diagram

The pin number is as the following:

1	4	7	10	13	16
2	5	8	11	14	17
3	6	9	12	15	18
19	22	25	28	31	34
20	23	26	29	32	35
21	24	27	30	33	36

1	9	17	25	33	41
2	10	18	26	34	42
3	11	19	27	35	43
4	12	20	28	36	44
5	13	21	29	37	45
6	14	22	30	38	46
7	15	23	31	39	47
8	16	24	32	40	48

1	4	7	10	13	16
2	5	8	11	14	17
3	6	9	12	15	18
19	22	25	28	31	34
20	23	26	29	32	35
21	24	27	30	33	36

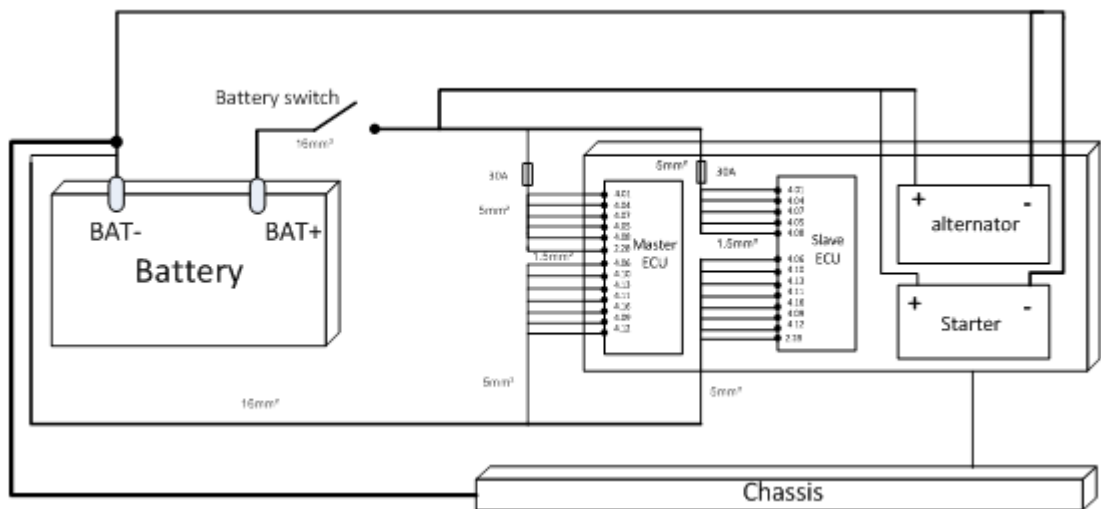
1	9	17	25	33	41
2	10	18	26	34	42
3	11	19	27	35	43
4	12	20	28	36	44
5	13	21	29	37	45
6	14	22	30	38	46
7	15	23	31	39	47
8	16	24	32	40	48

To prevent any damage to ECU, it is forbidden to carry out plugging operation on the ECU harness when the power supply is ongoing.

2.7.3 Function

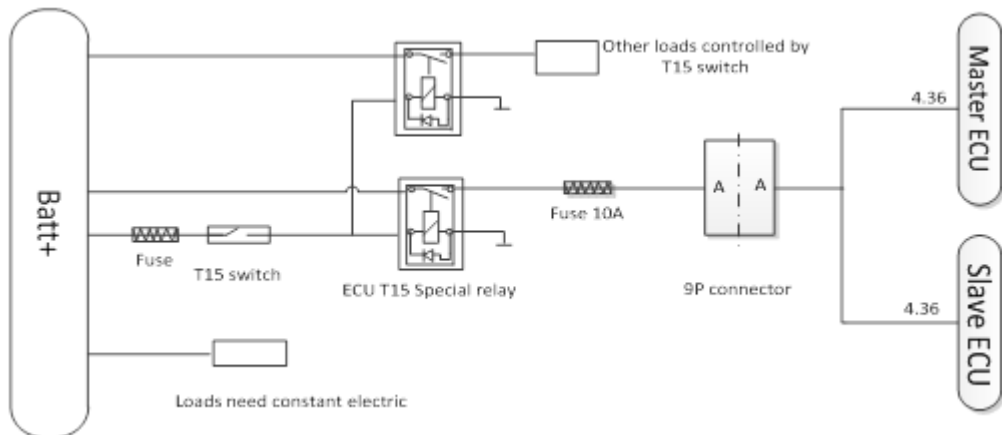
ECU power supply

- Function description: ECU Master power(24VDC)
- Pin No.: 4.01/4.04/4.05/4.07/4.08 (Double ECU power supply)
4.06/4.09/4.10/4.11/4.12/4.13/4.16 (Double ECU grounding)
- Operating voltage range: 9-32V



T15 switch

- Functional description: Power supply switch of two ECU. When this switch is on, the two ECU work. When the switch is off, the engine stop.
- Pin No.: 4.36 (Two ECU) , A (9P connector)
- After the T15 switch is off, the total switch of the battery should be kept for no less than 3 minutes, the driving relevant data (fuel consumption, mileage, etc.) need time to be written into the ECU.



CAN communication

- Function description: It is used for information exchange between ECU and other CAN nodes of the generator set.
- Pin No.: PIN3/PIN4 of 31p connector connected with CAN_H, CAN_L of master ECU, PIN23/PIN24 of 31p connector connected with CAN_H, CAN_L of slave ECU.

CAN flashing

- Functional description: It is used for data calibration and flashing between external equipment.
- Pin No.: PIN1/PIN2 of 31p connector connected with CAN_H, CAN_L of master ECU, PIN21/PIN22 of 31p connector connected with CAN_H, CAN_L of slave ECU.

Engine start controlled by ECU (Input)

- Functional description: ECU controls the starter relay directly, the relay control the starter electrical circuit. When the operator connects the T50 switch, the ECU will turn on the starter relay to start the engine.
- Pin No.: 2.46/2.33 (Starter rely, master ECU), D(9pin connector) connected with the 4.31(Master ECU T50)

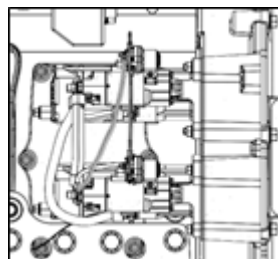


Figure 2-9 Starter

Engine speed output

- Functional description: The display unit can receive engine speed from EEC1 message sent by ECU.
- Pin No.: None

Name	ID	Cycle time	Type	Byte	Bit	Parameter	CAN Resolution
EEC1	0x0CF00400	10ms	Tx	Byte 4-5	8-1	Engine speed	Scale: 0.125rpm/bit Offset: 0

Oil pressure output

- Functional description: The display unit can receive engine oil pressure from EFLP1 message sent by ECU.
- Pin No.: None

Name	ID	Cycle time	Type	Byte	Bit	Parameter	CAN Resolution
EFLP1	0x18FEEF00	500ms	Tx	Byte 4	8-1	Relative engine oil pressure	Scale: 4kPa/bit Offset: 0

Electronic fan control (Output)

- Functional description: ECU controls the electrical clutch of the fan, which can get the good fuel-efficiency, low noise.
- Pin No.:5.09/5.12(Master ECU)

Electrical fan check switch (Input)

- Functional description: When the switch is ON, the fan clutch engaged completely.
- Pin No.:3.47/3.20(Master ECU), 13/14(31P Connector)

Engine speed controlled by TSC1

- Functional description: ECU receives TSC1 message from CAN Bus and controls engine speed.
- Pin No.: None

Name	ID	Cycle time	Type	Byte	Bit	Parameter	CAN Resolution
TSC1VE	0x0C000021	10ms	Rx	Byte 1	8-7	Not defined	
					6-5	Override control mode priority/override	00: Highest Priority 01: High priority 10: Medium priority 11: Low priority
					4-3	Requested speed control conditions	00: Transient Optimized for driveline disengaged and non-lockup conditions 01: Stability Optimized for driveline disengaged and non-lockup conditions 10: Stability Optimized for driveline engaged and/or in lockup condition 1 11: Stability Optimized for driveline engaged and/or in lockup condition 2
					2-1	override control modes/override	00: Override disabled 01: Speed control 10: Torque control 11: Speed/torque limit control
				Byte 2-3		Requested speed/speed limit	Scale: 0.125rpm/bit Offset: 0
				Byte 4	8-1	Requested torque/torque limit	Scale: 1%bit Offset: -125%
				Byte 5	8-1	Not defined	

Engine constant speed control (Input)

- Functional description: When the auxiliary brake pedal is pressed, the engine speed is running at a constant speed of 1300rpm, used to control the engine speed and meet the heat dissipation and hydraulic pump speed requirements of the vehicle's electrical cooling grid. When the pedal is pressed, the accelerator pedal is unavailable.
- Pin No.: 3.32/3.36 (Master ECU) , 11/12(31PConnector).

Engine speed controlled by accelerator

- Functional description: ECU receives the speed demand from the accelerator pedal and then controls the engine speed.
- Pin No.:

No.	Function	ECU PinsNo.	31PConnector
1	Power1	3.17	5
2	Signal1	3.09	6
3	Ground1	3.01	7
4	Power 2	3.18	8
5	Signal2	3.10	9
6	Ground2	3.02	10

Diagnostic indicator function

- uFunctional description:
 - a) When the Green light is on, the engine works normally.
 - b) When the Yellow light is on, the power is not limited. After the work is finished, it needs to be repaired.
 - c) When Red light is on; power is reduced by 30%. If conditions permit, stop and maintenance your engine immediately.
- Pin No.: None

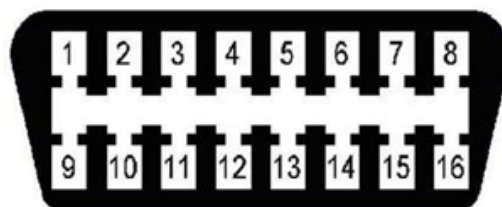


Figure 2-10 standard OBD interface

Name	ID	Cycle time	Type	Byte	Bit	Parameter	CAN Resolution
DM1	0x18FEC-A00	1000ms	TX	1	2-1	MIL Status	00: Lamp off

					3-4	Red Stop Lamp Status	01: Lamp on
					6-5	Amber Warning Lamp Status	
					8-7	Protect Lamp Status/ SVS lamp	

Water in fuel alarm function

- Functional description: When the water level beyond the limit, the water level sensor signal (switch) inputs signal to ECU, the light is on. The driver should draw off water and maintenance as soon as possible.
- Pin No.: Water in fuel sensor: 2.16/ 2.42/2.04

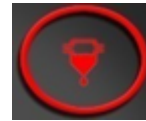


Figure 2-11 water draining indicator

Ambient temperature sensor (Input)

- Functional description: ECU receives message from CAN bus and then adjusts engine performance.
- Pin No.: None

Engine running state relay (Output)

- Functional description: When the engine is RUNNING, the relay is absorbed (low side drive) and output 200mA low edge control signal to control external relay.
- Pin No.: 3.24/3.45 (Master ECU) , 15/16(31P Connector)

Electrical fuel feed pump

- Functional description: Used for draining air in the low-pressure fuel circuit before engine start. When operator turns on T15 switch, the fuel feed pump starts to work for 3minutes.
- Pin No.: Pin "A/C" of the 9P connector.
"A "is voltage "+", "C" is voltage "-"

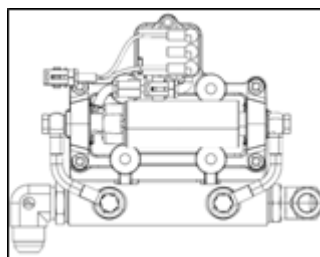


Figure 2-12 fuel pre-feed pump

Chapter III Installation

3.1 Safety instructions

Users should carefully read and fully understand the safety instructions before installing and operating the engine.

The purpose of these installation instructions is to:

- provide insight and advice in installing your engine
- establish conditions for trouble-free operation; avoid installation-related malfunctions and any resulting consequential damage

It is essential when installing and operating diesel engines also to comply with the necessary guidelines of the local authority.

S. I. Moteurs Baudouin is only liable for quality defects when these installation instructions have been fully observed.

Failure to comply with the installation and operating instructions defined by S. I. Moteurs Baudouin will void the warranty.



Notice:

After the diesel engine is unpacked, the user shall first check the diesel engine and its accessories as per the delivery packing list and check the engine appearance for damage and loose connections before carrying out the following tasks.

Check the water plug and oil plug check for water temperature and oil temperature sensors and ensure that all parts to be self-provided are completely fitted.

Do not start the diesel engine before it is probably installed. When the diesel engine is running in an enclosed environment, keep it well ventilated to ensure that the exhaust gas is ventilated to the open air.

When the engine is standing, it must be placed on a plane that can bear its own weight and does not deform or on a transfer rack.

When the engine is moving, the spreader must be used. Direct use of forklift is not allowed to move.

When the engine is transported, the engine must be fixed on the transport rack, and the transport rack must be fixed on the mobile equipment.

Please refer to the **Generator Set Installation and Commissioning Manual** for details.

3.2 Engine Lifting

3.2.1 Lifting device

- Use lifting devices to lift and move heavy parts over 20kg (44 lb.). Check the condition of lifting hooks and chains.
- Verify the expiration date of appropriate protective equipment (goggles, gloves, shoes, masks, overalls, helmet etc.) before beginning work.
- Do not use faulty or unsuitable tools.

3.2.2 Lifting the engine

The resistance of a lifting ring is reduced as the angle between the slings or chains and the engine hoist points fall below 90°.

- Use a lifting device with crossbars as illustrated.
- Avoid any contact between the slings and the engine parts.
- Use fastening links and properly calibrated slings or chains.

Risk of death or injury due to heavy suspended loads

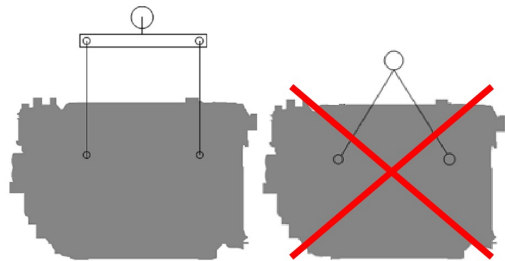


Figure 3-1 Lifting the engine



3.2.3 Lifting Points

Note

Please refer to the **Generator Set Manual** when lifting generators.

For lifting the engine, use four lifting eyes fitted on it.

During the lifting operation, never work under suspended component, imminent danger of injury or death. Place the load on the ground before leaving your workplace. Never be placed in the crane swing radius.



The lifting points of 16M55 diesel engine are illustrated as following:

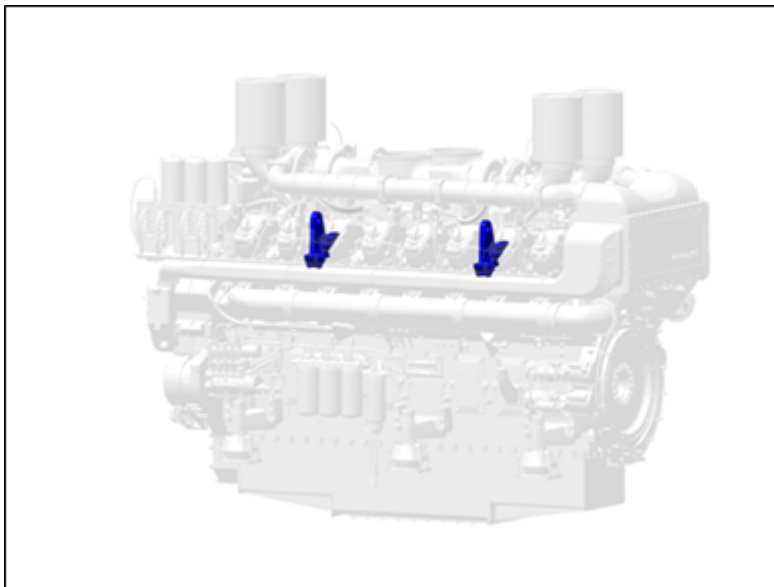


Figure 3-2 lifting eyes on the left side

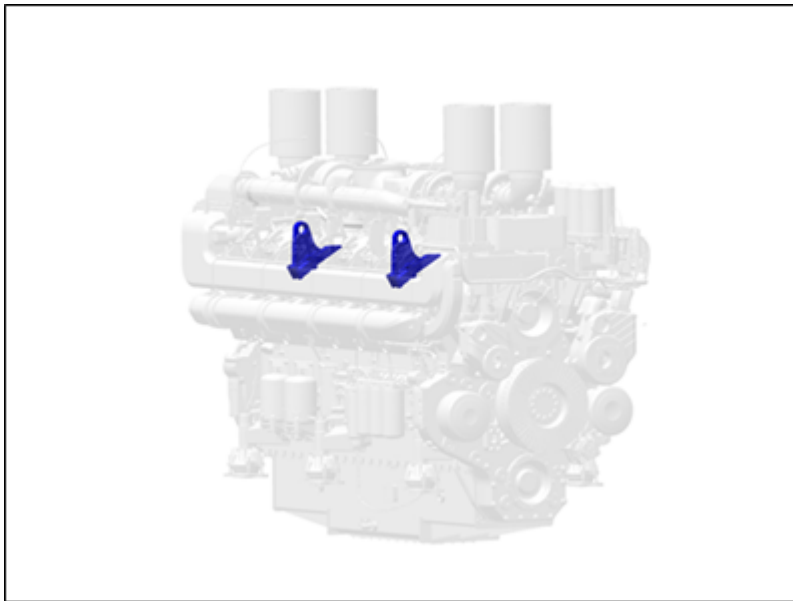


Figure 3-3 lifting eyes on the right side

3.3 Engine Mounting

In order to ensure the durability of the engine installation, the installation of the engine must meet the following criteria:

- The engine mounting brackets should be used, and six-point support should be adopted. The number of engine supports must not be reduced.
- Elastic support should be arranged on the genset to reduce engine vibration.

Note !

For 16M55 genset ,only two-bearing generator is allowed.

3.4 Air Intake System

The air intake system must avoid the followings entrance:

- Water
- Dust
- Exhaust gas
- Hot air

The max intake resistance of clean filter should be ≤ 3 kPa.

The max intake resistance of dirty filter should be ≤ 7 kPa.

The filtration efficiency of the air filter should be $\geq 99.70\%$.

Inner diameter before turbo compressor inlet should be $\geq 250\text{mm}$.

3.5 Exhaust System

The exhaust system must meet at least the following requirements:

- Exhaust back pressure must not exceed the limits in the engine data sheet.
- Exhaust system components should not exert excessive stress on the exhaust manifold or turbocharger due to their own weight, inertia, relative movement between components, or dimensional changes due to thermal expansion.
- The exhaust pipe must not have sharp turns or right-angle bends. The bend radius of the pipeline should be increased as much as possible and welding with sharp corners is not allowed.
- When the exhaust pipe is close to the intake pipe, rubber parts, plastic parts, fuel tanks, etc., an insulation board must be added in the middle and the distance should be increased as much as possible.
- The inner diameter of the exhaust pipe should not be smaller than the inner diameter of the engine exhaust port
- The exhaust system must be able to completely prevent rain, snow or splashing water from entering the engine block or turbocharger.
- The exhaust gas must be ventilated so that it does not negatively affect the function of the air filter, the efficiency of the cooling system, the surroundings of the engine or the health and safety of personnel.

3.6 Cooling System

In order to ensure good engine life and performance, the installation of the radiator must meet the following criteria:

- If the PowerKit is installed in a soundproof box, seal rubber is installed around the radiator to prevent the hot air in the engine compartment from flowing back into the air intake channel.
- Radiator grounding measures must be taken to eliminate potential differences and prevent electrical corrosion .
- The direct windward surface of the radiator should not be blocked, and the direct wind area should be greater than or equal to 120% of the radiator's positive area.

3.7 Lubrication System

For other information, users must follow the requirements listed in **Appendix**.

3.8 Fuel System

3.8.1 Fuel System Requirements

The installation of the fuel system must comply with the following requirements:

- When the engine is stopped, the fuel system does not allow the fuel to flow into the engine through the fuel inlet line or the injector return line due to gravity.
- The injection resistance of the fuel injection pump shall not exceed the specified value with a clean fuel filter. The resistance is based on the half-full fuel tank.
- The return fuel must not generate pressure fluctuations in the pipeline.
- The fuel tank must have a vent and fuel return connection to allow air and other gases to properly separate from the fuel without pressure in the fuel tank. The vent must also prevent the entry of dirt and water.
- The temperature of the fuel entering the engine must be lower than the specified value in the engine data sheet.

3.8.2 Fuel Tank

- The location of fuel tank shall be far away from the heat source. The fuel tank shall have proper space and ventilation.
- The device should be set up to periodically drain the condensed water in the fuel tank and the filter, and signs should be placed to remind the user of such.
- The fuel tank has ventilation function to prevent the pressure inside the tank from being too high and the vent hole should be dustproof and waterproof.
- The fuel tank must have 5% liquid thermal expansion space to prevent the fuel from overflowing after it expands.
- Never use tanks made of galvanized steel for fuel storage. The fuel oil reacts chemically with the zinc coating to produce powdery fragments which clog the fuel filter and may damage the fuel pump and injection nozzle.

- Recommendation for customer's fuel supply circuit installation: It is recommended to install non-return valves on the inlet and outlet pipe fuel supply circuit in order to ensure that the engine's fuel circuit is kept at its best condition and assure successful start. Use the same internal diameter of the fuel pipe between the fuel tank and the engine that you have on the engine circuit.

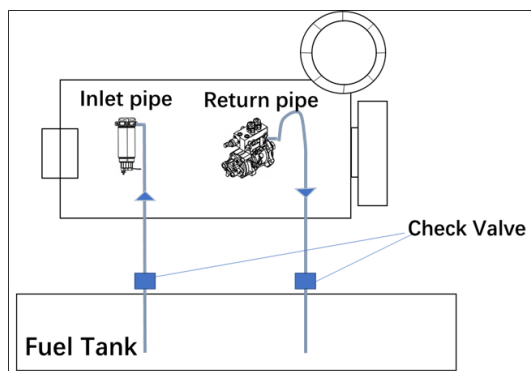
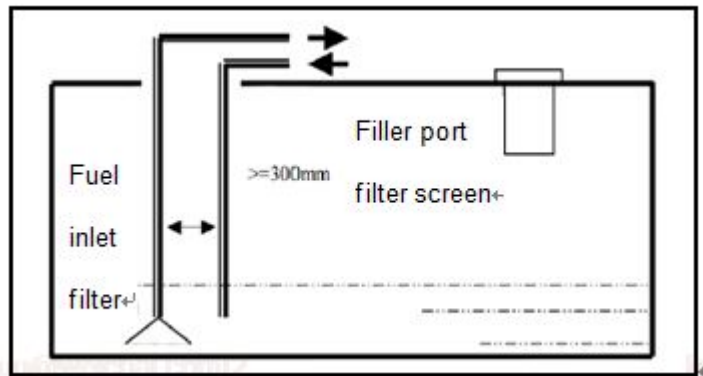


Figure 3-4

- A Gooseneck of the return pipe is also recommended to maintain the fuel in the injection pump in case of some long period without start. Also, dip tube in the fuel tank in inlet and outlet fuel supply helps to prevent air entering the fuel circuit. Please note that inlet and outlet pipes should be as far from each other as possible.

3.8.3 Fuel Line

- The fuel line shall comply with the requirements of the fuel line matching specification. Inner diameter $\geq 19\text{mm}$.
- The diesel line should be able to withstand sufficient operating vacuum without damage or collapse.
- Both suction and return lines must be installed at the bottom of the tank and must be kept at a distance ($\geq 300\text{ mm}$) from each other, and the line must be open.
- If the fuel line needs to be fixed, clamps with rubber gaskets should be used on the pipeline. No other components can be fixed on the pipeline. DO NOT tie the fuel line with the wire harnesses.
- Max fuel return resistance shall not exceed 20kPa.
- The max resistance of the fuel injection pump inlet port shall not exceed 10kPa.



3.9 Engine Control System

3.9.1 Startup Circuit

- Key switch ON (T15):
- Vehicle factory needs to connect Pin A of 9P connector, 5A fuse, battery positive pole, switch to control diode relay, this relay can't share with other vehicle electrical load. This is shown in the below figure.

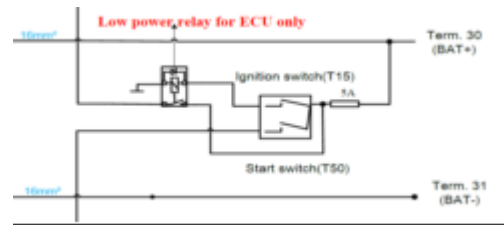


Figure 3-5

- Ignition Switch(T50):
- Vehicle factory needs to connect the key switch T50 and the D of the 9P connector, and the cable section area is at least 1.5mm^2 .
- Wire size of starting main cable: $\geq 70\text{mm}^2$
- Wire size of battery negative terminal ground wire: $\geq 70\text{mm}^2$
- Wire size of starting system control end cable: $\geq 1.5\text{mm}^2$
- The wiring terminals of starter shall be equipped with protective caps;
- Before performing electrical connection, remove the paint on connecting points;
- Battery rated voltage 24V;

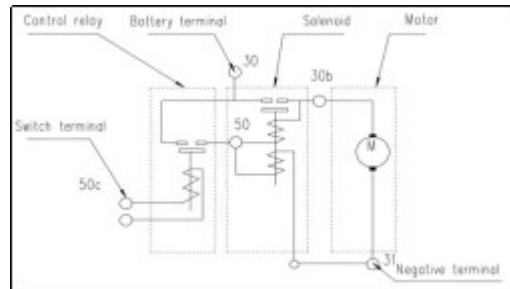


Figure 3-6

- The maximum resistance of the main circuit of the starter is $\leq 8\text{m}\Omega$.

3.9.2 Charging Circuit

- The charging cable shall be a complete cable without intermediate connector;
- The fuse specification of the charging system: 100A~120A;
- Terminals of B+/D+/W shall be provided with protective caps;
- Permissible voltage drop of charging cable: $\leq 1\text{V}$;
- Excitation current of exterior excitation circuit: $\geq 80\text{mA}$.

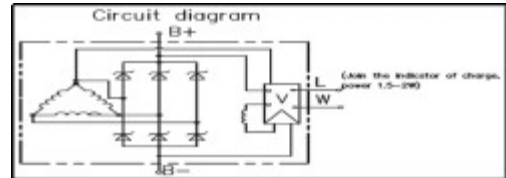


Figure 3-7

3.10 Electrical Components

3.10.1 Fuel Pre-supply Pump

- Rated input voltage of the electrical pump assembly: 24VDC.
- Fuel pre-feed pump is controlled by T15 switch, not by ECU. When operator turn on T15, the Fuel pre-feed pump will work for 3mins to vent the air in the low pressure fuel system.

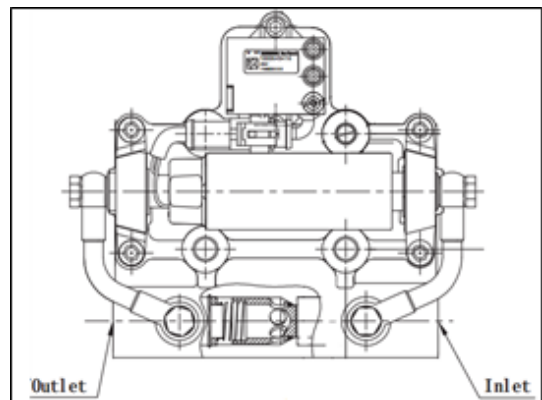


Figure 3-8 fuel pre-supply pump

3.10.2 ECU Connection Requirements

- In **Baudouin** plant, two ECU's power supply (Pins No. 4.01/4.04/4.08/4.05/4.07), Master ECU identification signal (ECU Pins No. 2.28) have been connected to Pin B of 9P connector. Please refer to the appendix drawing.

The Vehicle factory needs to connect the Pin B, battery switch to the battery anode. The total switch control of the battery anode can ensure that the power supply is completely broken.

- In **Baudouin** plant, two ECU's grounding (4.06/4.09/4.10/4.11/4.12/4.13/4.16), Slave ECU (2.28) have connected to the Pin C of 9P connector. Please refer to the appendix drawing.

The Vehicle factory needs to connect the C terminal of the 9P connector to the negative terminal of the battery. ECU negative need to connect the battery negative **directly**.

- Considering double ECU is working under the maximum load, it is recommended that the power supply line diameter is over 15mm².

3.11 Genset Installation Recommendations

Users must choose the genset installation location very carefully in order to not disturb anyone and not to cause noise pollution. If the location is not appropriate, enclosure have to be insulated for noise reduction. Also, the correct type of exhaust silencer must be used if necessary.

- The genset room should be well ventilated. The foundation of the unit should be solid and conform to local code. After compacting hard soil, the minimum precast concrete structure foundation of 200mm thick should be built on this foundation.
- When installed, the shock absorber is evenly placed under the two channel steel of the common chassis of the unit, leveling with the flat pad, and its levelness is measured with the level gauge. Keep the unit level; In addition, the packaging base is not allowed to be used as the basis for starting up operation.
- When the user is building the genset room, the steel I-beam for lifting should be embedded in the roof above the unit for further maintenance.
- The inner diameter of the exhaust pipe should not be less than minimum exhaust port , the bending pipe should not be more than 3, and the bending Angle should be greater than 90 degrees.
- There should be sufficient maintenance and inspection space around the unit. There should be at least 1.5m space around the unit.
- The machine room should be equipped with fire extinguishers and other fire tools.

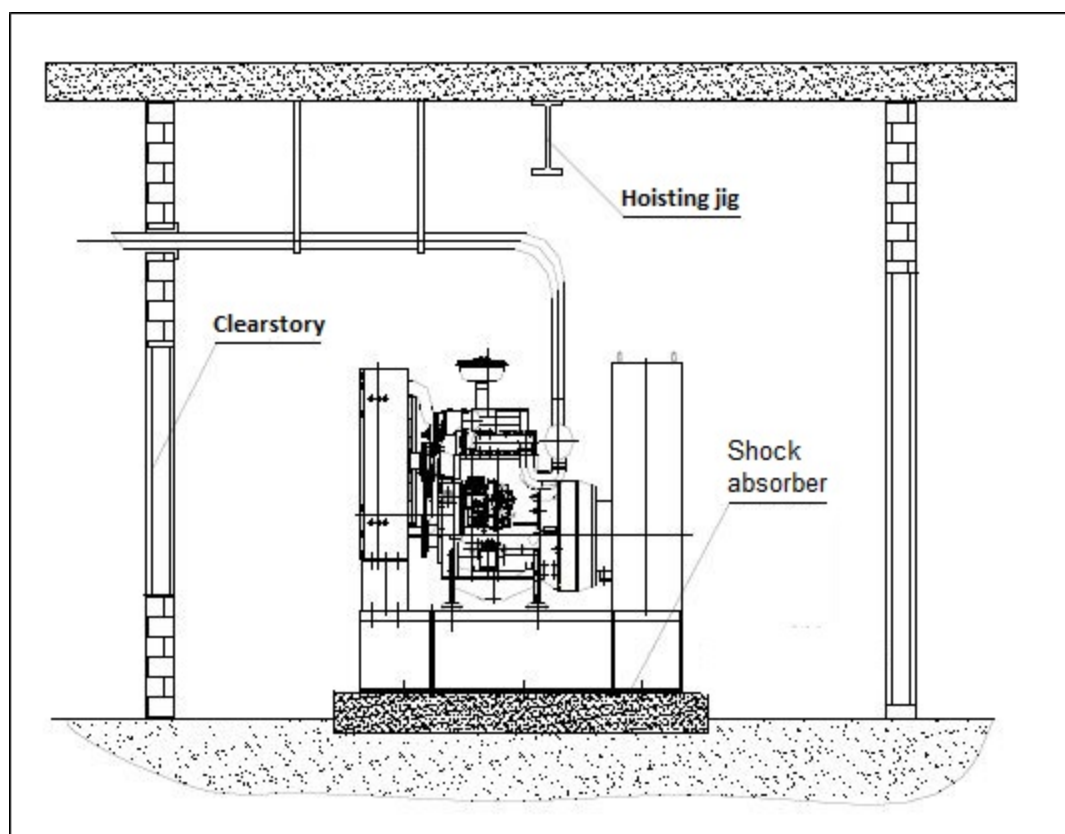


Figure 3-9 Genset installation

Chapter IV Operation

4.1 Operation Safety

The first engine commissioning process should be handled by **S. I. Moteurs Baudouin** approved personnel. The successful completion of this process, along with the checks and adjustments required by **S.I. Moteurs Baudouin**, will ensure that the engine runs efficiently, reliably, and safely.

Failure to comply with the installation and operating instructions as defined by **S.I. Moteurs Baudouin** will void the warranty.



People will be required to wear Individual Protection Equipment and use correct tools following official standards.

Make sure that the engine is correctly protected regarding its environment conditions.

Take the necessary measures for the emergency shut-off of the fuel or air supply to prevent from over-speed risks.

- Check the cleanliness of circuits.
- Check for free circulation of gases in exhaust ducts.
- Check the fuel supply.
- Check the coolant level and fill if necessary.
- Check oil level and fill if necessary.
- Check air clogging indicator.

4.2 Preparations before Start

Oil

- Adding of engine oil
 - ◆ Open the oil filler cap and add the engine oil.
 - ◆ Using the dipstick to check the oil level.

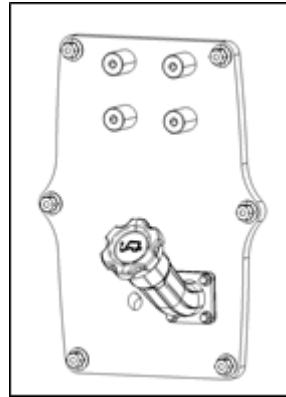


Figure 4-1 Adding of engine oil

Fuel

- Adding of fuel
 - ◆ The diesel fuel used shall meet the specification.
 - ◆ The diesel fuel used must be clean. It's better to place the diesel fuel under stationary state for more than 72 hours before adding. The diesel fuel shall be added into the fuel tank via the built-in filter screen.



Figure 4-2 The fuel level

Coolant

- Adding of coolant
 - ◆ The coolant is mixed from treated clean water and anticorrosive agent or antifreeze. Ensure to strictly abide by the specification of the additive manufacturer during mixing.

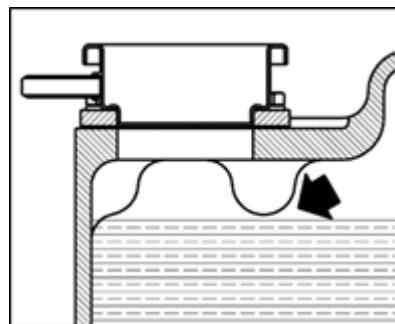


Figure 4-3 Adding the coolant

- ◆ Add coolant through the water filler port of radiator or heat exchanger and bleed the air from the cooling circulation system

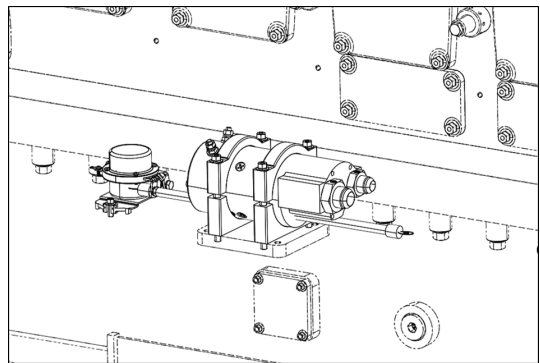
Note:

Prior to the engine start up, operator should ensure to have the alternators breakers open (genset) and switch off the AVR. The governor's potentiometer should be in the middle position.

Pre-lubricating oil pump:**NOTE!**

Such generator set must be pre-lubricated before start the engine during commissioning.

- It is recommended to monitor the main oil passage pressure of 30kPa and the pre-oil supply time of 60s at the same time, whichever comes first.
- If the customer configuration can not reach the strategy described above, you can use the strategy of only controlling the pre-supply time 60s, which will reduce the service life of the pre-supply oil pump.
- The engine that has an emergency need to start, pre-supply oil every 48 hours; Engine without emergency starting need, pre-supply oil before each start.

**Figure 4-4**

Note

After the genset is installed in site, please make sure must remove all long adjustment bolts of bellows before starting the genset.

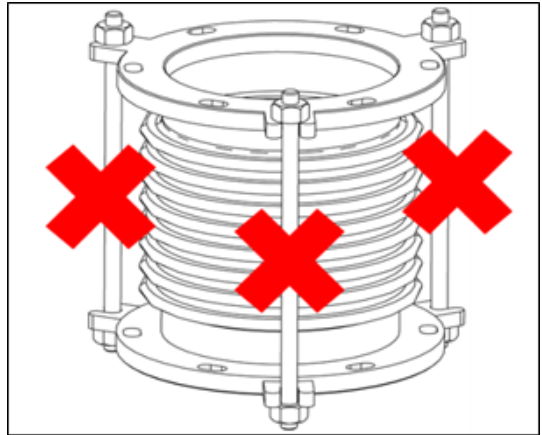


Figure 4-5

Air bleeding of fuel line**Note!**

Running engine with air in fuel system could damage the fuel pump. It is necessary to bleed air after fuel filters replacement.

Make sure the engine is stopped and the fuel tubing is properly connected.

- Loose the air vent plug on the fuel filter seat by rotating it about 2-3 turns.

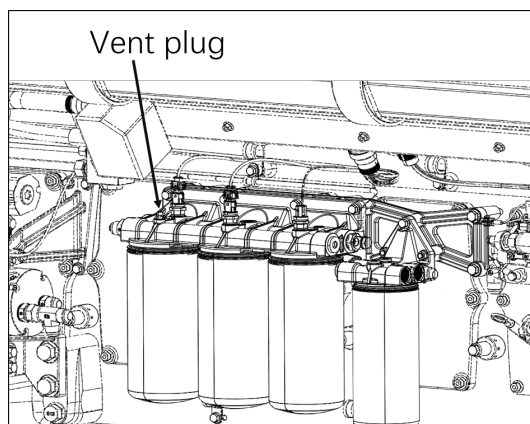


Figure 4-6

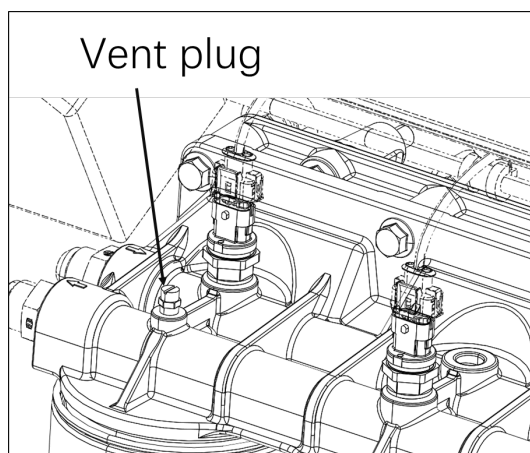


Figure 4-7

- Use electronic fuel supply pump, switch on the key to pump fuel until there is air free fuel flow out.

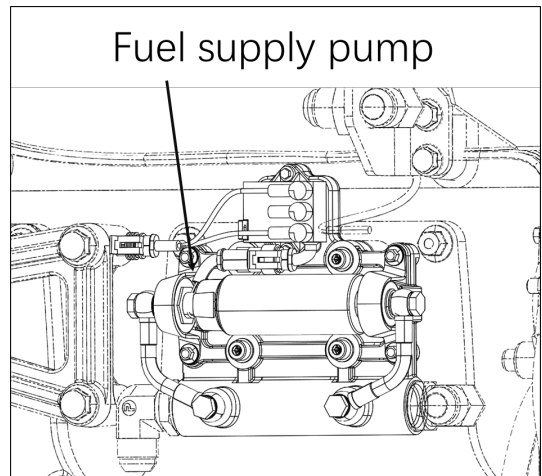


Figure 4-8

Note!

Running engine with air in fuel system could damage the fuel pump. It is necessary to bleed air after fuel filters replacement.

Make sure the engine is stopped and the fuel tubing is properly connected.

4.3 Starting Up

The following starting/stopping procedure is a simple example (not binding) and it's based on a simple starting control panel equipped with starting key. Please refer to the genset and/or genset control panel use & maintenance manual for the starting operation mode.

- Before starting the engine, operate the stop control lever on the fuel injection pump to ensure flexible motions.

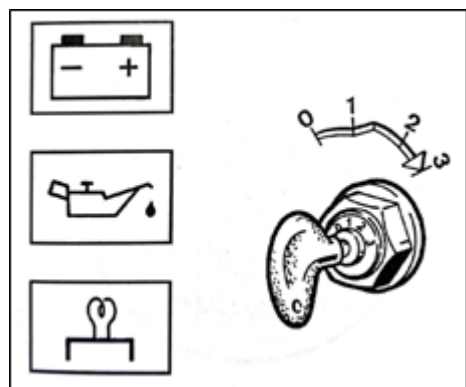


Figure 4-9 Switch

- Turn the key to position "1" to turn on the control panel. The "oil pressure warning lamp" automatically will turn on for 10s (Safety line test of ultra-low engine oil pressure). It's recommended to test the indicator lamps, bulbs, and buttons once (by pressing the touch button 10 on the control panel).
- Turn the key to position "START" TO start the engine and then release the key. The key will automatically return to position "1" .

Note!

- Speed sensor should be inspected and tested in the initial commissioning of the engine and prior to any load testing to ensure the reliable operation of the engine.
- At the start of diesel engine, if the diesel engine fails to start within 10s, immediately release the button and wait for 1min before retry.
- If the engine can't be started by three consecutive attempts, stop the attempt and find out and solve the malfunction before retry.
- During the working of engine, the "oil pressure warning lamp" and the "battery power" indicator lamps are all off.
- All indicator lamps are off during normal running of engine.
- In event of abnormality, the "horn" will issue warning sound.
 - ◆ The auxiliary starter shall be used to start the diesel engine under cold temperature.
 - ◆ By activate the electric heating flange via relay, the engine can be started successfully under low temperature environment.
- If equipped with mechanical pump, when at starting the working time limit of starter is 12 seconds, the engine speed limit is 400r/min.
- Prior to the engine start up, operator should ensure to have the alternators breakers open (genset) and switch off the AVR. The governor's potentiometer should be in the middle position.

4.4 Operation of the Powerkit Engine

- After the start of diesel engine, idle the engine for 3min, and then increase 10% load. Only when the coolant temperature is above 60°C and the oil temperature is above 50°C and the oil pressure is above 200kpa, can the engine run with full load. The load should be increased gradually to avoid abrupt load and unload. For customer equipped with auxiliary heater such as air heater/coolant heater, the idle time should be decided by ambient temperature and actual oil/coolant temperature and oil pressure.
- Note! For standby applications, data centers, or other application scenarios that require startup time, it is not required to warm up the engine after startup, but the startup conditions must meet the requirements in the Rating Definitions table.

- In the first running in period of 60h, the engine should work with load less than the moderate load.
- It is not allowed to run engine more than 1 hour under 30% load.
- Parameters to be observed always during operation are as below:
 Oil pressure of main oil passage (≥ 200) kPa (idle speed), or (400~550) kPa (rated speed).
 The oil temperature in main oil passage in rated condition: (85~105) °C.
 Allowed the lowest coolant temperature of engine running : (≥ 50 °C).
 Allowed the highest coolant outlet temperature in a short time: (103 °C).
 Exhaust temperature before turbine ≤ 740 °C.

Check the exhaust color, to estimate the performance of the injector and the load of the engine. In the case of serious black or white smoke, stop and check the engine. Check the diesel engine for presence of water, gas, and oil leakages.



Figure 4-10

Users should immediately stop the genset, check and troubleshooting if there is abnormal phenomenon!



Figure 4-11

4.5 Precautions for running in cold environments

- Fuel : choose a grade of diesel fuel depending on the environmental temperature.
- Lubricating oil : choose lubricating oil of different viscosities depending on the seasons.
- Coolant: add antifreeze additive into the cooling system and choose the coolant of different grades depending on the ambient temperature.
- Start: the auxiliary starter can be adopted if necessary in winter. After starting the engine, only operate the engine with load when the oil pressure and water temperature are normal.
- Before the cold season begins, be sure to check the electrolyte liquid level, viscosity and battery voltage. If the engine is not going to be operated for a long time and under very low temperatures, the battery should be removed and stored in a warmer room.
- Shut-down of the engine : when shutting down the engine in a cold climate, unload the engine first and then run the engine at idling speed for 1 to 2 minutes. And then stop the engine after the water and oil temperatures decrease. The coolant with antifreeze additives should not be drained out after shutdown. Otherwise, open the drain valve or plug on the engine body, oil cooler cover, and radiator and water inlet pipe to drain the coolant completely to prevent the engine from being frost cracked.

4.6 Precautions for running in high altitude area

- Perform power selection and matching according to engine derating report. Plateau environment definition: elevation $\geq 2000\text{m}$.
- The engine must be equipped with a coolant heating device in plateau environment. It is recommended that the coolant should be heated to 30°C before starting.
- If the engine is used under less than 30% load, the service time should not exceed one hour.
- It is necessary to manually turn the crankshaft more than two circles before each starting.
- It is recommended that the engine be idle for 1~3 minutes before rising at high speed.

4.7 Stopping the PowerKit Engine

Avoid shutting down the engine at full load. Before the shut-down, engine load should be reduced, and the engine should operate at idle condition for 1 to 2 minutes. This allows the piston, cylinder head, liner, bushing and turbocharger to cool down, avoiding cylinder and bearing damage. This is particularly important for turbocharged engines because the bearing and oil seal in the turbocharger can be affected by the high temperature of the exhaust gas. When the engine is running, the heat will be transferred away by the cycling lubricating oil. When the engine shuts down suddenly, the turbocharger temperature will increase greatly and cause the bearing or the oil seal to fail.

- Turn the key switch to position “0” or press the stop button to stop running of engine, till the engine stops rotation or the speed indicator on the instrument panel points 0.
- For the engine that don't use antifreeze in the engine coolant, drain the coolant after shut-down in cold weather to prevent freezing damage to the engine. The draining valve under the oil cooler can be used to drain the water inside the engine. The drain plug on the radiator should be removed to discharge the coolant in the radiator.

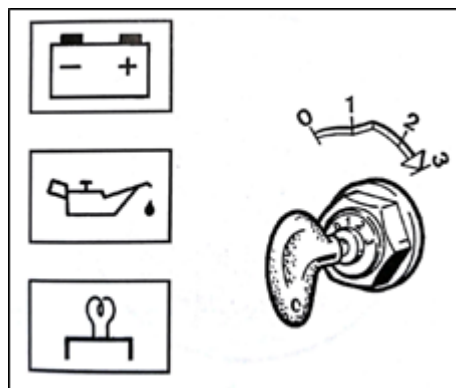


Figure 4-12

Note!

For the engine with ECU, in order to use the emergency button successfully during cranking, Customer can connect the Battery switch with E-Switch button for emergency use, but customer can not use this button as a normal way to stop the engine. Customer can have this option only as an exceptional way to operate the E-switch during cranking.

In general, the ECU B+ needs to be connected with Battery positive, not the emergency button. If customer connect it to the emergency button, then ECU memory data will be lost and the customer can lose warranty.

4.8 Electronic control system

Reading the fault code via the diagnostic switch:

- Press the diagnostic switch (diagnostic lamp comes on), and then release to reset the diagnostic switch (diagnostic lamp turns off).
- The diagnostic lamp flashes and reports the fault code.
- Repeat step 1st for several times, the subsequent fault codes will be shown one by one. When the first fault code is repeated, it indicates that all the fault codes have been read.
- Check the "List of fault codes" to find the explanation corresponding to each fault code and you can determine the current fault.

Please check the code sheet at **Common Faults and Troubleshooting**.

Note!

Clearing the memory of historical errors manually:

- Press the fault request switch before ignition switch (T15) is on, then turn on the Ignition switch (T15) and hold the diagnostic request switch for 4-30s before releasing.
- If you fail to delete a fault code, it means there is a current fault.

You need to resolve the current fault before clearing the error memory in ECU.

If you fail to clear the fault code, please notify your local Baudouin representative as soon as possible.

Chapter V Maintenance

5.1 General Safety Conditions for Maintenance

SAFETY WARNING

Users should carefully read the safety instructions before installation and operation of the engine.

Electrical insulation controls must NOT be done with a voltage higher than 50VDC

Safety conditions for preventive and corrective maintenance operations are intended to check.

- Engine and generator alignment
- The tightness of the entire engine unit on the frame.
- The tightness of the couplings and all elements transmitting power.
- The isolation and condition of electrical equipment.
- The condition and tightness of electrical connections.
- Control of gas, lubricating oil and coolant levels.
- Operation of the alarm safety devices.
- Replacement of gas, lubricating oil and air filters.

5.2 Maintenance Table

Maintenance table for continuous use

MOTEURS BAUDOUIN									
Check =	•	In operation hours or period, every.							
Adjust =	o	Hours and Months: A first-come-prevail.							
Clean =	Δ								
Replace =	□	MD	M1	M2	M3	M4	R1	R2	R3
OPERATION	Hour	8	500	1000	2000	4000			
	Month		12	12	12	24			
Coolant level		•							
Drain any water/sediment from the fuel pre-filter/water separator filter		•							
Oil level		•							
Fan		•							
Lube grease quantity for fan pulley bearing and fan belt tensioner bearing		o							
Control Panel		•							
Engine Protective Devices		•							
Walk-Around Inspection		•							
Air filter service indicator(if equipped)		•							
Belt		•	•		□				
Drain any water/sediment from the fuel tank		•							
Tensioner			o						
Engine oil			□						
Oil filter cartridge			□						
Centrifugal oil filter cartridge(s)				□					
Fuel primary filter			□						
Fuel secondary filter			□						

Hoses and clamps		•						
Air filter		□(1-)						
Defaults recorded in ECU		•/Δ						
Breather cleaning		Δ						
Engine and generator connection		•/Δ						
Valve and cross-bar clearance			o					
Radiator			•/Δ					
Battery, battery electrolyte level, battery charger, battery cables			•					
High-pressure fuel pipes				•(2)				
Elastic support of engine				•				
Electrical system and wiring					•			
Sensors					•/Δ/□			
Hoses					•(3)			
Coolant					□			
The low-pressure fuel pipes					•(4)			
Thermostatic valves					•			
Overhaul(Top)						□(5)		
Overhaul(Structure)							□(6)	
Overhaul(Major)								□(7-)

NOTE

Hours and Months: A first-come-prevail

(1) Replace the air filter every 1000H if the working condition is good enough (the intake restriction should be less than 7kPa).

(2) Check high pressure pipe connector every 3000h/ one year.

(3) Replace the hoses every two years.

(4) Replace the low-pressure fuel lines every two years.

- (5) Reference to Chapter Overhaul (Top).
- (6) Reference to Chapter Overhaul (In-Structure).
- (7) Reference to Chapter Overhaul (Major)
- (8) Injector gasket must be replaced when replacing or check the injector / injector nozzle.

Maintenance table for standby use

MOTEURS BAUDOUIN					
Check =	•	M55 Series			
Adjust =	o				
Clean =	Δ				
Replace =	□	M0	M1	M2	M3
OPERATION		Every week	Every year	Every 2 years	Every 3 years
Coolant level		•			
Drain any water/sediment from the fuel pre-filter/water separator filter		•			
Oil level		•			
Fan		•			
Lube grease quantity for fan pulley bearing and fan belt tensioner bearing		o			
Control Panel		•			
Engine Protective Devices		•			
Walk-Around Inspection		•			
Air filter service indicator(if equipped)		•			
Drain any water/sediment from the fuel tank(if equipped)		•			
Fuel System - Prime		o			
Belt			•	□	
Tensioner			•/o/□		
Engine oil			□		
Oil filter			□		
Centrifugal oil filter cartridge(s)			□		
Fuel primary filter			□		
Fuel secondary filter			□		
Breather filter cartridge			Δ/□		
Clamps/exhaust pipe/thermal shroud /thermal-protective coating			•/□		
Hoses			•	□	

Air filter		•/Δ/□		
Defaults recorded in ECU		•/Δ		
Valve and cross-bar clearance		o		
High-pressure fuel pipes		•		
Intercooler(outside)		•/Δ		
Radiator(outside)		•/Δ		
Battery, battery electrolyte level, battery charger, battery cables		•		
Elastic support of engine		•		
Electrical system and wiring		•		
Sensors		•		
Prelubricating Pump		•		
Starter		•		
Coolant pump		•		
Low-pressure fuel pipes			□	
Fuel injector			•	
Intercooler(inside)				•/Δ
Radiator(inside)				•/Δ
Coolant				□
Thermostat				□
Turbocharger				•

(1) Injector gasket must be replaced when replacing or check the injector / injector nozzle.

5.3 Maintenance Operation

5.3.1 Maintenance Operation Note

Note!

Before performing any maintenance work, the engine must be turned off and have cooled off, the battery main switch must be switched off and the ignition key removed, put 'Do not start the engine' sign aside the gen-set.

5.3.2 MD Maintenance Operations

Check the coolant level

NOTE!

Risk of scalding!

The cooling system is under pressure and the coolant is hot. Never open the radiator filler neck to check the coolant level while the engine is in operation or immediately after it is stopped to avoid the skin burns.

- Inspect the coolant level gauge on the radiator tank to check if the coolant level is appropriate.

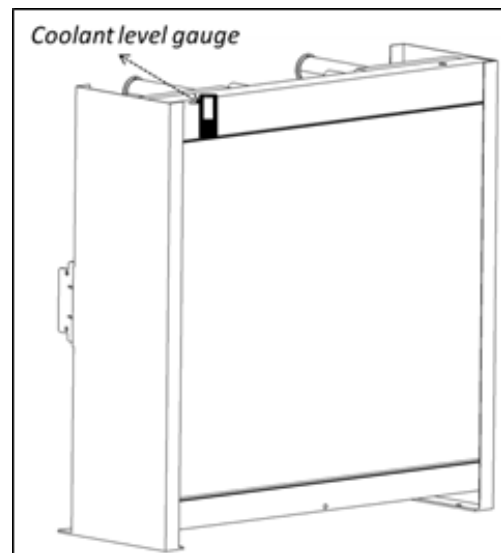


Figure 5-1

Filling Coolant

NOTE!

Do not let coolant drip or leak out onto the ground or into the bodies of water while filling. Otherwise, the environment will be damaged.

The engine's cooling system is to be filled with a mixture of coolant, glycol, and special additives .Never add the normal plain water only. Specific requirement about coolant, see the Part "Annexes" .

Coolant can only be filled at the filler.

The engine damage can be caused by excessive temperature difference. When filling with cold coolant in an engine at operating temperature there is a risk of engine damage caused by excessive temperature difference. For this reason, do not add cold coolant to a warmed-up engine.

- Slowly fill coolant until the coolant higher than the min. mark. For the first time filling, the air should be released thoroughly. After the air is released thoroughly, fill the coolant until its level higher than min. mark. The air releasing method listed in below.
- Close cap.
- Run engine for apporx.15 minutes at rated speed.
- Check the coolant level gauge. If it is need to fill, shut off engine and carefully unscrew cap with safety valve to the first stop to release pressure. Let the engine cool down, and then fill the coolant.
- Check coolant before the next commissioning (with engine cold). Add coolant if necessary.
- Repeat this procedure until coolant no longer is added.

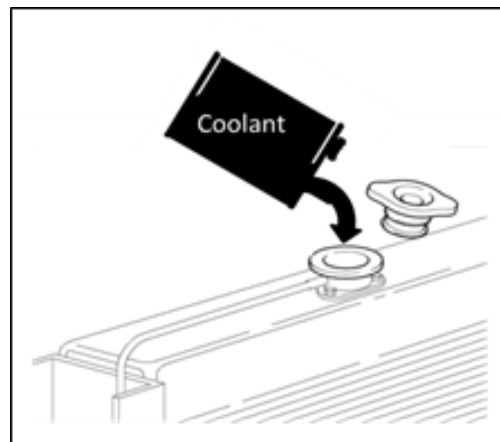


Figure 5-2

Check the fuel water separator

Check the water collecting vessel 1, draining water as follows:

- Open the Drain Plug 2 at bottom of water collecting vessel 1 and drain out the water.
- Retighten up the water drain plug 2.

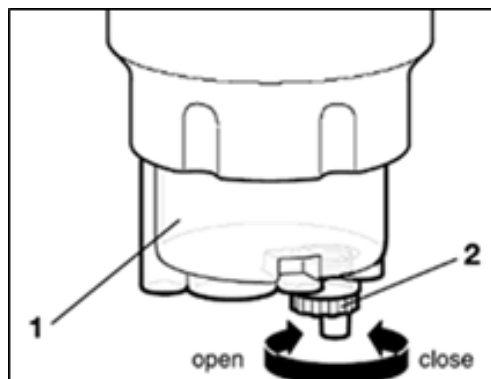


Figure 5-3

Check the oil level

NOTE!

Check the oil level when the engine is horizontal at idle speed or engine stopped. If check the oil level when engine stopped only after at least 20 minutes have passed since the engine was switched off.

- Pull out oil dipstick.
- Wipe off oil dipstick with a lint-free cloth.
- Reinsert oil dipstick all the way.

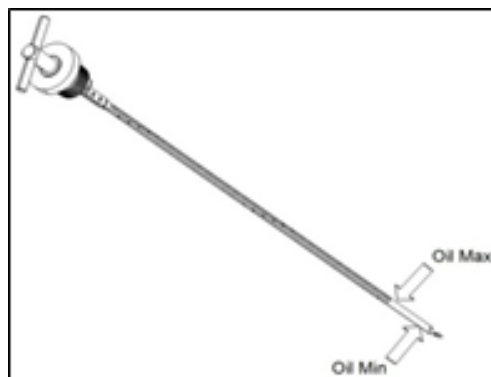


Figure 5-4

- Pull out oil dipstick again and check oil level. The oil level should be between both of the marks on the dipstick and should never drop below the lower mark. If the engine is stopped, check the 'STOP' side; if the engine is at idling, check the 'IDLE SPEED' side.

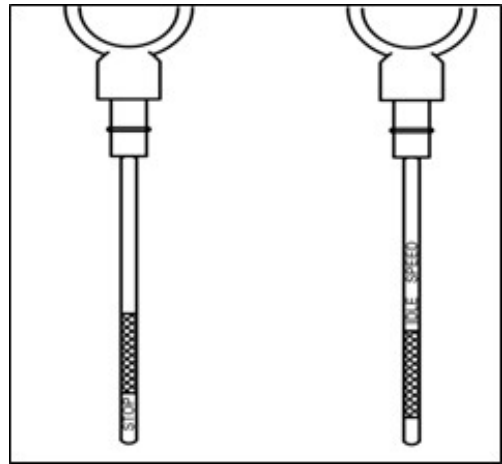


Figure 5-5

- Reinsert the oil dipstick all the way. If the oil level is too low, refill with new oil.

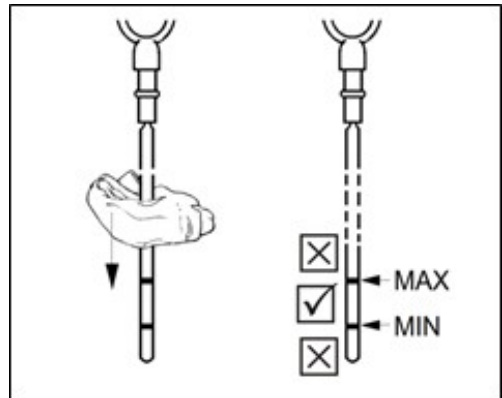


Figure 5-6

Check the air cleaner service indicator (if equipped).

- If equipped with a dust indicator, conduct maintenance only when the clog warning sign appears.

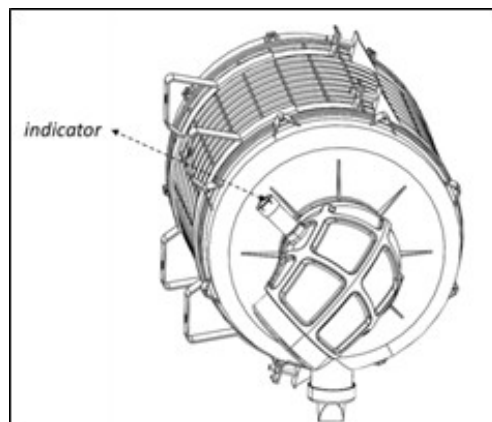


Figure 5-7

- A red signal appears as a warning when the air cleaner element becomes clogged and causes an abnormally large pressure difference between before and after the air cleaner. When a red signal appears, clean the air cleaner element immediately or replace it with a new element.
- After the element is cleaned or replaced, press the reset button located at the upper part of the indicator to cancel the red signal.
- While serving the air cleaner, do not enter dust into the air cleaner or damage the element.

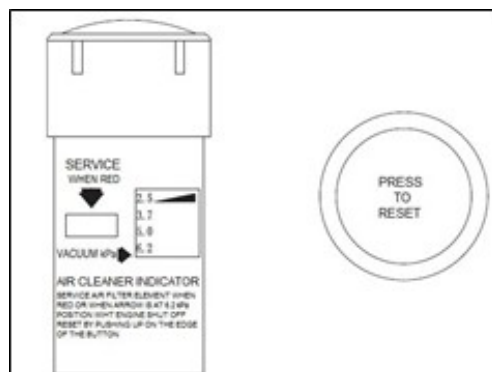


Figure 5-8

Check the belt

- Make sure all belts are fully engaged on all pulleys and riding in the correct grooves. Look for cracks on the ribs of the belt, fraying at the edges of the belt, or any other signs of unusual wear.

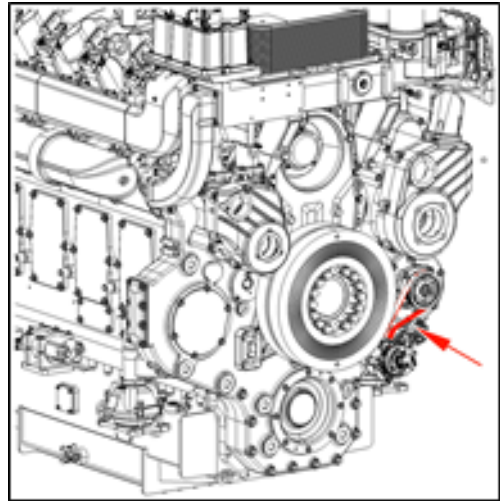


Figure 5-9

Check the fan

NOTE!

Do not rotate the engine by pulling or moving the fan. Otherwise, it will damage the fan blades, cause fan failure and cause personal injury or property loss. The crankshaft should be rotated using an accessory drive shaft or crankshaft turning tool.

- Visually inspect the cooling fan daily. Check for cracks, rivet looseness, blade bend or looseness. Check the fan and make sure it is firmly installed. Tighten the screws if necessary.
- Replace the damaged fan on the original equipment with a fan of the same part number. Refer to the tightening torque of bolts in the maintenance manual.

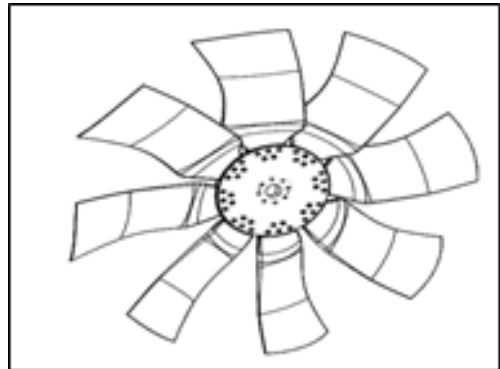


Figure 5-10

Walk-Around Inspection

A careful and thoroughly walk-around inspect can find problems in advance and avoid costly losses and serious breakdowns.

- Check for any type of leak, inspect the exterior of the engine to make sure there is no fuel, oil and coolant leakage, if leak is observed, clean the leaking area, find the reason and repair it.
- Check if the vibration is in normal condition, and if the speed is stable. If the foundation vibration is more serious than before, stop the engine and check if there are problem on the engine parts or engine mounting system. If the problem cannot be solved, consult your Baudouin dealer in time.
- During the normal running of engine, observe exhausts color, when the color is abnormal, check the cause and do troubleshooting.
- Check the air inlet pipe for wear, damage, loose clamp, which causes dirt to enter the intake system.
- Check the exhaust system for leaks, if leak is observed, find the reason and repair it.
- Check the wiring and the wiring harnesses for loose connection or worn.
- Check the fuel lines for leaks, if leak is observed, find the reason and repair it. Do not allow dirt to enter the fuel system. Dirt in the fuel system will seriously damage the fuel injection equipment and could be expensive to repair.
- Check the coolant pump, the pump seal is lubricated by coolant in the cooling system, it is normal for a small amount of leakage to occur when the engine cools and the parts contract. Excessive coolant leakage may indicate the need to replace the water pump seal.
- Check and drain condense water from intercooler pipe drain valve.

Check the control panel

- Inspect the situation of the panel. If damaged part is found, ensure that the part is repaired or replaced. Make sure that the electronic displays are operating properly. Inspect the wiring for good condition. Ensure that the wiring connections are secure.
- Check the gauges and check the indicators frequently during normal operation. Record the data in a log. Compare the new data to the data that was previously recorded. Comparing the new data to the recorded data will establish the normal gauge readings for the engine. A gauge reading that is abnormal may indicate a problem with operation or with the gauge.

Check the engine protective devices

- Alarms and shutoffs function must function rightly. Alarms provide timely warning to the operator, which helps to prevent damage to the engine.

- Visually check the situation of all sensors, gauges, and wiring. Look for wiring and components that are loose, broken, or damaged. Damaged wiring or components should be repaired or replaced immediately.
- The oil pressure pilot light (if equipped, Figure4) comes on with operating voltage on and engine off. The oil pressure pilot light should go out when the engine is running.

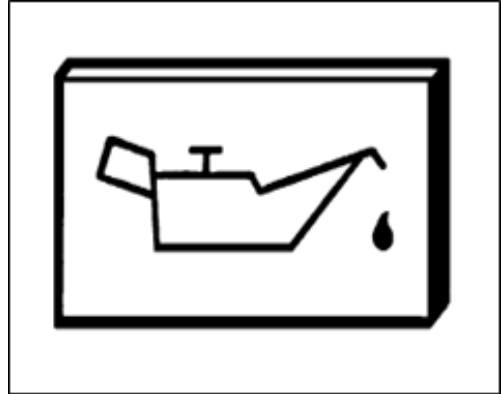


Figure 5-11

- The oil pressure gauge pointer (if equipped, Figure5) should indicate the oil pressure normally over the entire operating range.



Figure 5-12

- The coolant temperature gauge pointer (if equipped, Figure 6) should indicate the coolant temperature normally over the entire operating range. Most of the running time, the gauge pointer should remain in the normal sector. It should rarely enter the abnormal sector.



Figure 5-13

5.3.3 M1 Maintenance Operations

"M1" maintenance Includes all the items listed in the "MD Maintenance" and the following.

Replace oil filter

- Remove oil filters.
- Clean filter seat.
- Lubricate seal ring on new filter with clean engine oil.
- Tighten the filter by hand, till the seal surface comes into contact with the installation flange.
- Continue to tighten the filter by special tool, till the filter is securely installed (about 3/4 turn).



Figure 5-14

Clean Centrifugal oil filter

- Stop engine.
- Unscrew the top nut using a wrench.
- Remove the bowl assembly.
- Remove the filter and the seal.
- Clean the bowl interior.
- Clean the filter
- Replace the seal.
- Refit the bowl and tighten the nut

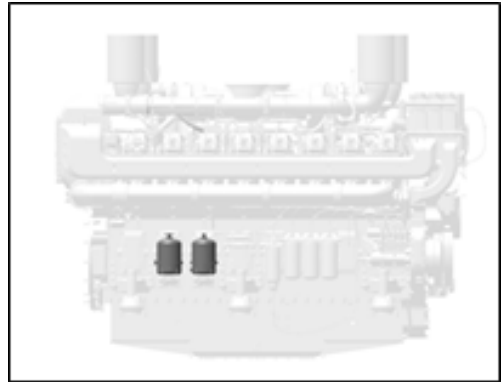


Figure 5-15

Replace engine oil

- Run engine to warm oil slightly.
- Stop engine. Loosen drain nut. Drain oil into the container.
- Screw up the drain nut.
- Add proper amount of oil at fill port .
- Check the oil level after finished.
- Oil capacity (oil pan) is 500L and the total oil capacity including the filters is 582L

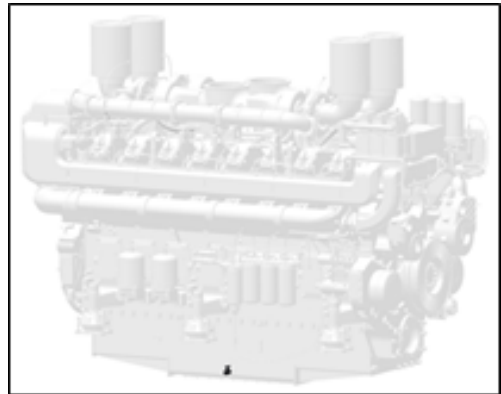
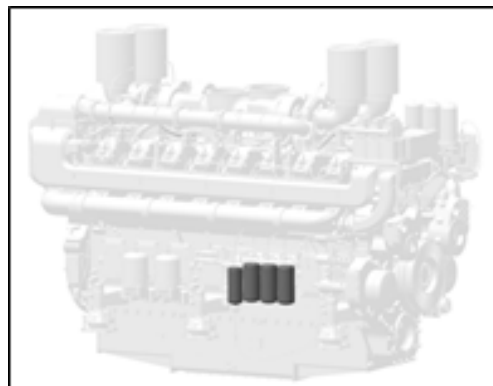


Figure 5-16

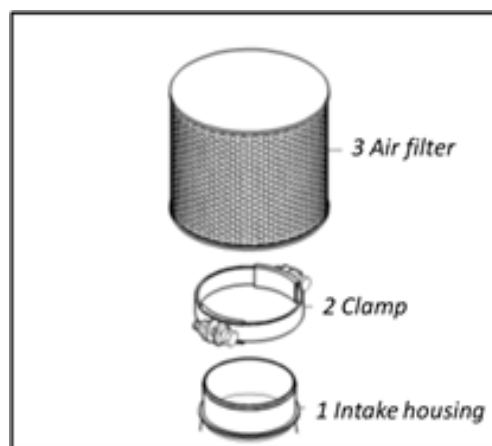
Replace fuel filter(include coarse filter)

- Stop engine and loosen the dirty filter.
- Fulfill the fuel into the filtration material outside, it's forbidden to fill fuel into the inside of the filter without filtration.
- Assembly a new rubber ring onto the filter and add some oil on the ring. Tighten the filter onto the filter seat until you cannot tighten it by hand any more
- Use the special tool to continue to tighten the filter about 3/4 circle more.
- Check the belt tension status by special instrument. Detail technical specification, please contact the Baudouin distributor.

**Figure 5-17**

Change the air filters

- Release clamp (2).
- Remove air filter (3) and clamp (2) from flange of intake housing (1).
- Verify that there are no objects in the flange of the intake housing (1) and clean it.
- Place new air filter (3) with clamp (2) onto intake housing (1).
- Tighten clamp (2).

**Figure 5-18**

Replace the fuel water separator

Note!

Fuel is flammable. If these liquids are leaking onto hot surfaces they can cause a fire which can cause injury and/or damage.

- Clean the area around the fuel water separator
- Drain the water from water collecting vessel screw 2;

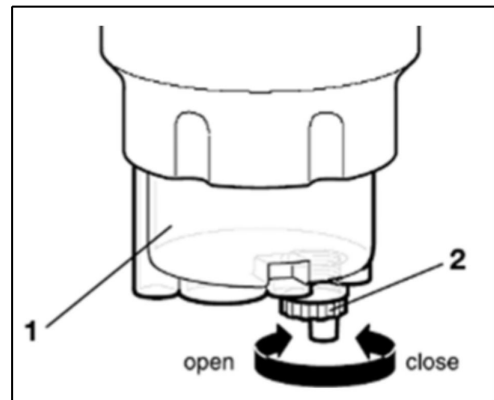


Figure 5-19

- Using the filter wrench, remove the fuel filter element.

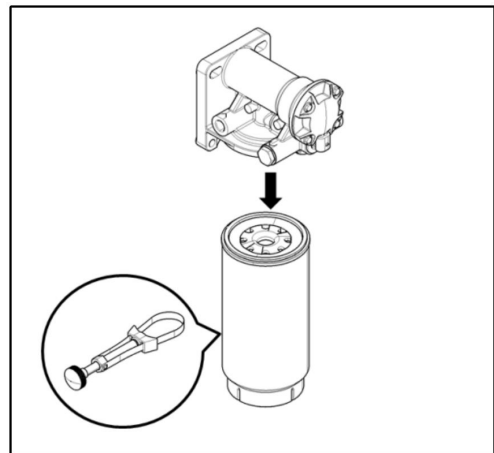


Figure 5-20

- Remove the water collecting vessel from the fuel water separator.

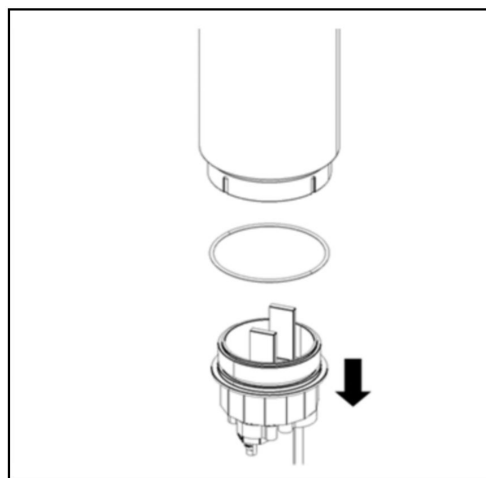


Figure 5-21

- Assemble the water collecting vessel by hand, and tighten it up.
- Exhaust the air until no bubble appears.

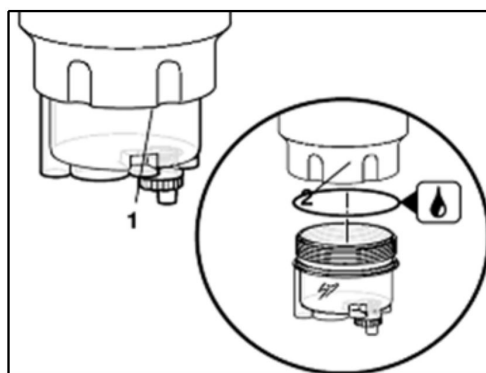


Figure 5-22

- Apply oil (instead of lubricating grease) onto the new sealing gasket of fuel filter.

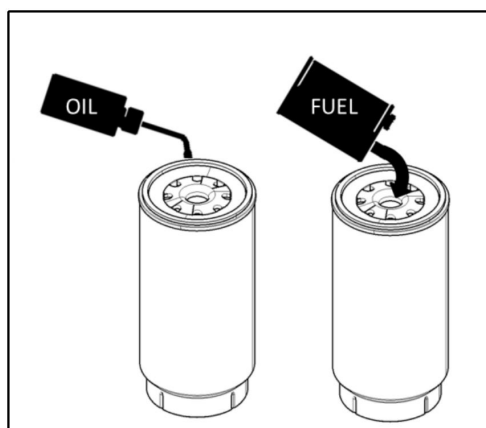
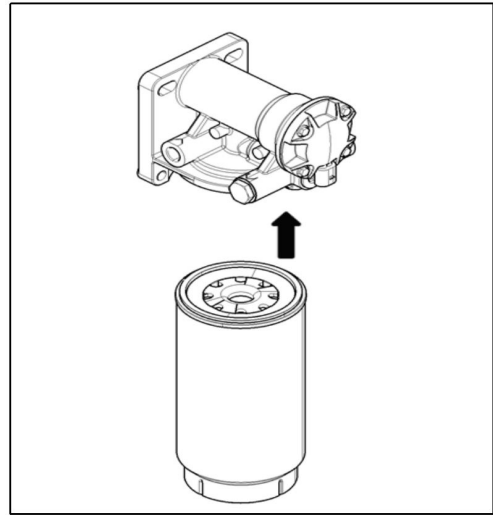


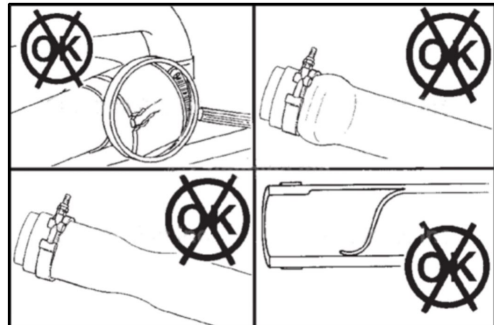
Figure 5-23

- Screw the filter by hand until the seal combines with the port; Continue to screw the filter by hand until the filter is securely installed (by about 3/4 round).
- Start the engine, and let it under no load low idling for several minutes. Check each fuel filter for fuel leaks. If fuel leaks from a filter, loosen the filter and check the gasket for scratches or other abnormalities.

**Figure 5-24**

Check the hose clamps

- Inspect all clamps, tighten any loose clamps. Make sure there is no crack on clamps.

**Figure 5-25**

Check the hoses and lines

- Inspect any loose or damaged of lines; tighten all connections to the recommended torque.
- Make sure there is no crack, swell, collapse, rubber peeling on the hoses and lines.

Check the engine and generator connection

- Check if the engine and generator connection is tight; if not, retighten it. Reference to the Appendix about the torque.

Check defaults recorded in ECU(if equipped)

- Reading the fault code via the diagnostic smart. Contact Baudouin dealer for the diagnostic smart purchasing and using.

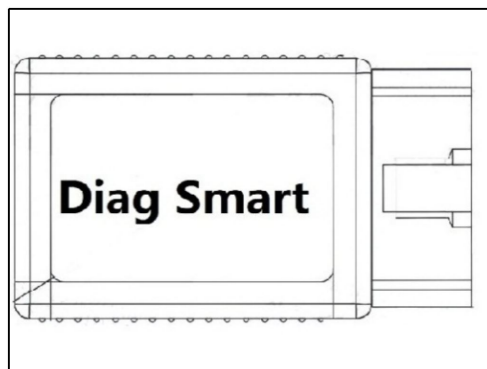


Figure 5-26

- Refer to "List of fault codes" to find the text explanation corresponding to each fault code and you can determine the current fault.
- Clearing the memory of historical errors after solving the problems.

Note!

If you encounter electronic control problems, please contact a professional Baudouin representative to consult; Refer to the diagsmart operation manual for the operation of the diagnostic smart.

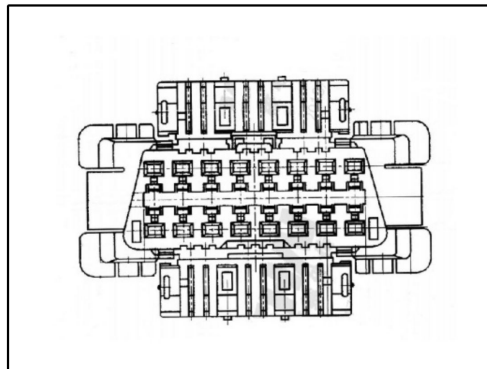


Figure 5-27

5.3.4 M2 Maintenance Operations

"M2" maintenance Include all the items listed in the "M1 Maintenance" and the following.

Clean the radiator and cooling system

- Clean radiator cooling fins with compressed air. Cleaning should be done always in opposite direction of air flow.

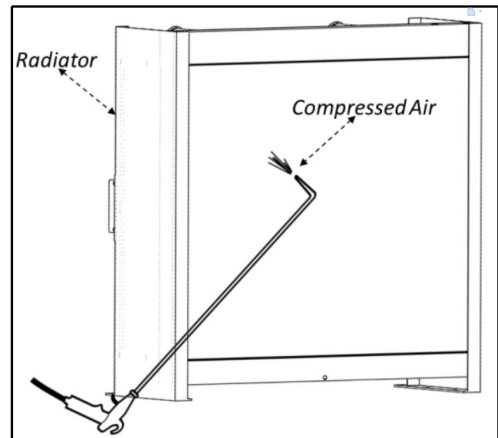


Figure 5-28

- Check and adjust the valve clearance, please contact the person has been certified by Baudouin to do this operation.

Check the battery, battery electrolyte level, battery charger, battery cables

Note!

Clean the top surface of the battery after performing maintenance work. Dust on the battery may cause short-circuit.

Before inspecting or servicing any electrical component, disconnect the ground cable from the negative (-) battery to prevent short-circuits and fire.

Do not use flames near the battery. When handling the battery, be careful of sparks generated by accidental shorting.

If electrolyte is spilled on the eyes, skin or clothes, wash immediately with plenty of water. If electrolyte enters the eyes, flush immediately with lots of fresh water and see a physician.

- Check the battery electrolyte level. Electrolyte evaporates during use and the fluid level gradually decreases. The fluid surface should be between the LOWER LEVEL and UPPER LEVEL lines. If the fluid level is lower, remove the caps and add electrolyte to the proper level.

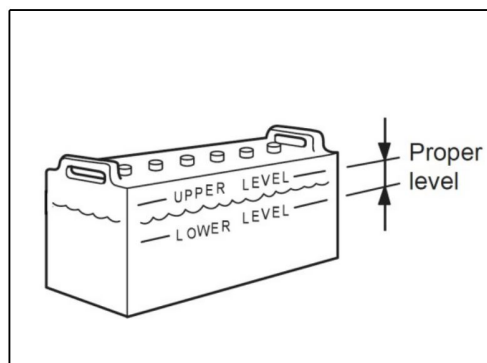


Figure 5-29

- Measure the specific gravity of the electrolyte. If the specific gravity measured is lower than the minimum values the battery dealer gives, charge the battery.
- Check battery cables and connectors for cracks or corrosion. Replace broken terminals, joints, or cables.

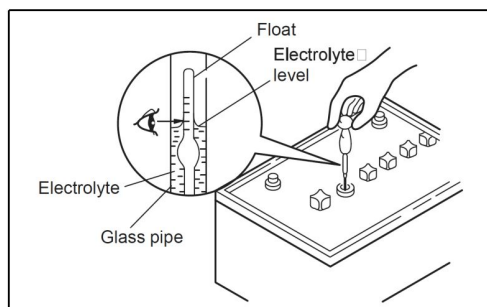


Figure 5-30

Check the high-pressure fuel pipes

Note!

When the high-pressure pipe needs to be removed, both gland nuts must be loosened at the same time. Do not only loose the nut at one end or pull the pipe !

- Check the joint between gasket of high pressure pipe head and pipe body, and replace with new parts if there is a cracking.
- Check the surface of the high pressure pipe head and the sealing ring of the gland nut. If there is any damage, replace it with new parts.

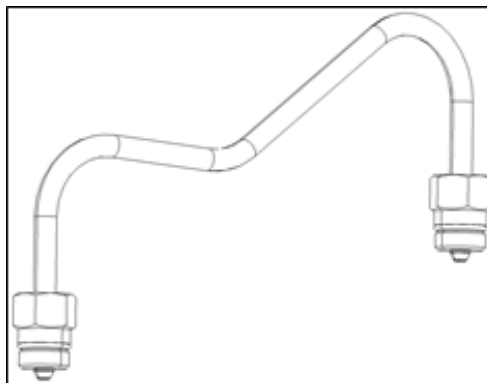


Figure 5-31

- Check the surface of the high pressure pipe and gland nut, replace it with a new one if there is obvious corrosion.

5.3.5 M3 Maintenance

"M3" maintenance includes all the items listed in the "M2 Maintenance" and the following.

Check engine mounts

NOTE!

Excessive vibration of the engine and the driven equipment can be caused by the failures of the engine mounts system.

- **Deflection** -The loaded height should be monitored to examine the effects of creep, contamination, overloading. If the mount appears to have excessive deflection, remove the mount and replace.
- **Visual Inspection** - A visual inspection of the metal is recommended. To aid inspection, clean the metal to remove any contaminants such as oil and grease Any bent or cracked metal parts should be closely examined to see if the rubber section is not trapped and there are no sharp edges in contact with the free rubber surface
- **Fixing Bolts** - All fixing bolts should be checked for tightness and any signs of degradation i. e. cracks. The torque should meet the requirement and tighten if necessary.

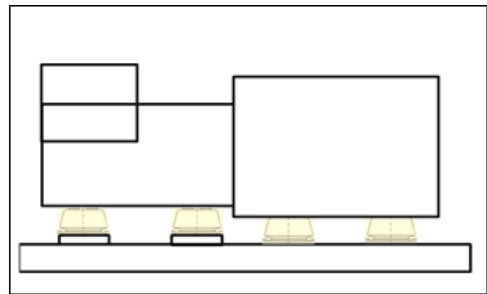


Figure 5-32

Change Belt

Note!

The belt idler is under tension. Do not allow your hands to get between the idler and the belt or the hub. Personal injury can result.

- Use a wrench to hold the belt tensioner to relieve the tension on the belt.
- Remove the belt.
- Install the new belt. Make sure it is fully seated on the pulley grooves. Relieve the belt tensioner to tension the belt.

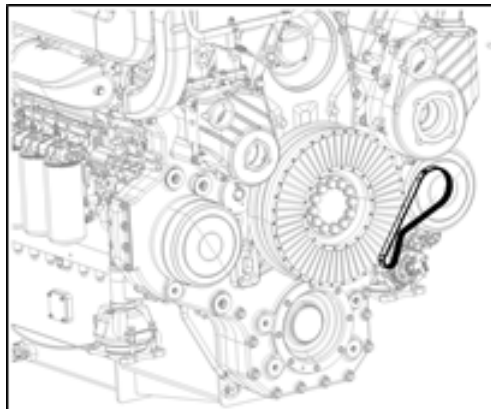


Figure 5-33

5.3.6 M4 Maintenance

"M4" maintenance includes all the items listed in the "M3 Maintenance" and the following.

Check Thermostatic valves

Note:

The failures of thermostat can cause severe engine damage. Never operate the engine without the thermostat correctly installed.

Thermostat that fails in the closed position can cause excessive overheating. Excessive overheating could result in cracking of the cylinder head or a seizure of the pistons.

Thermostat that fails in the open position will cause the engine operating temperature to be too low during partial load operation. Low engine operating temperatures during partial loads could cause an excessive carbon build-up which could result in an accelerated wear of the piston rings and wear of the cylinder liner. Also, a low temperature can allow moisture to condense in the oil. This can form damaging acids.

- Inspect the thermostat whether its components are damaged or not and check if there is any foreign substance in the thermostat.
- Put the thermostat into water and heat the water slowly to check its operation.
- Thermostats Control Range: High circuit 82-92°C ,Low Circuit 44-56°C

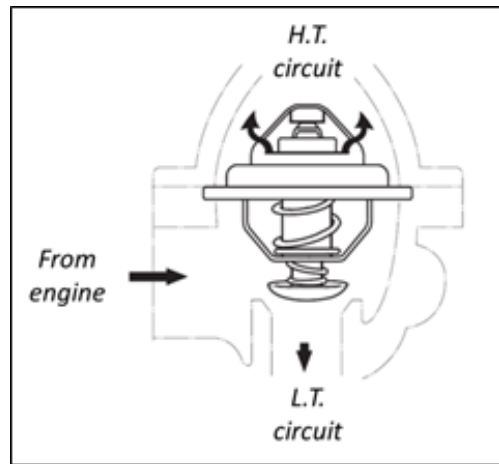


Figure 5-34

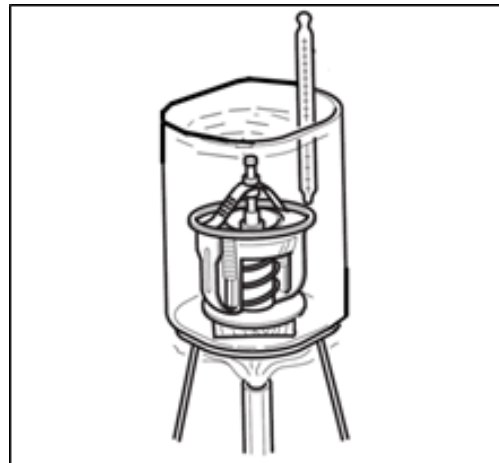


Figure 5-35

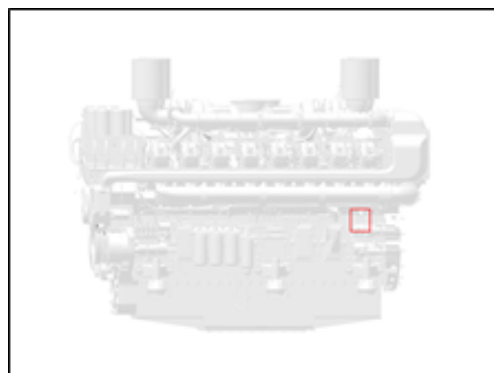
Replace the Coolant

Note!

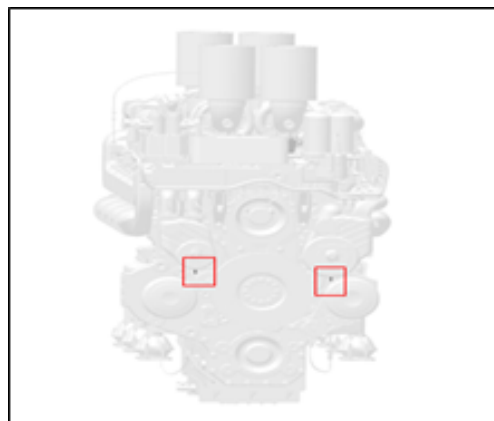
For information regarding the disposal and the recycling of used coolant, consult your Baudouin dealer.

Stop the engine and allow the engine to cool. Ensure that the engine will not start when the cooling system is drained.

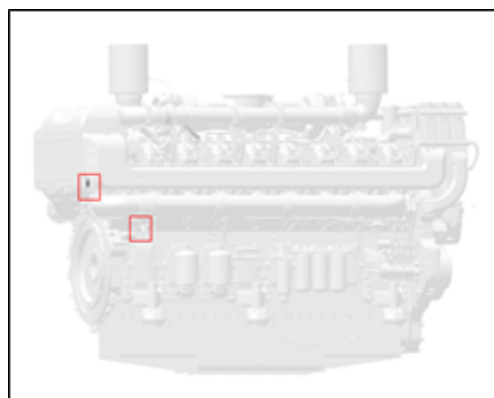
- Stop the engine, add the special cleaning detergent for engine cooling system to the old coolant.

**Figure 5-36**

- Start the engine, run engine for 15min at idle speed.

**Figure 5-37**

- Stop the engine, drain the old coolant completely to the container by opening the drain valves of cooling system and radiator.

**Figure 5-38**

- Remove the thermostats, fill the cooling system with clean water, run engine until it has reached operating temperature for approximately 20-30 minutes.

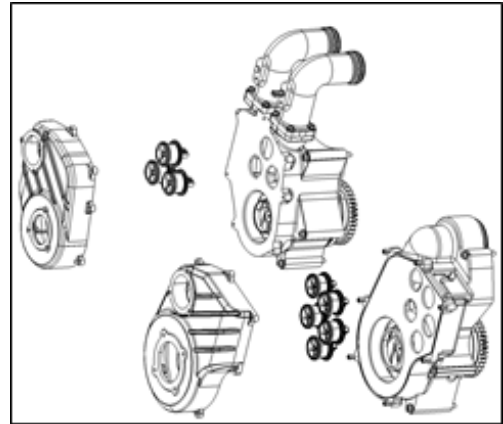


Figure 5-39

- Shut the engine OFF, allow it to cool to 50° C, and drain the cooling system. If the water drained is still dirty, the system must be flushed again until the water is clean.
- Assemble the thermostats.
- Make sure the radiator drain valves are closed, fill new coolant.
- Check the o-ring of the cooling system filler cap. If the o-ring is damaged, replace the old cooling system filler cap with a new cooling system filler cap.

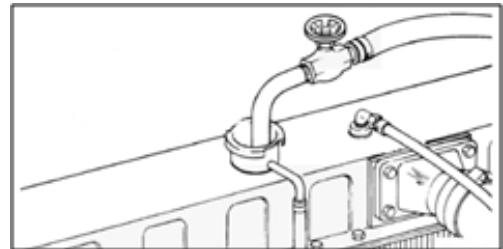


Figure 5-40

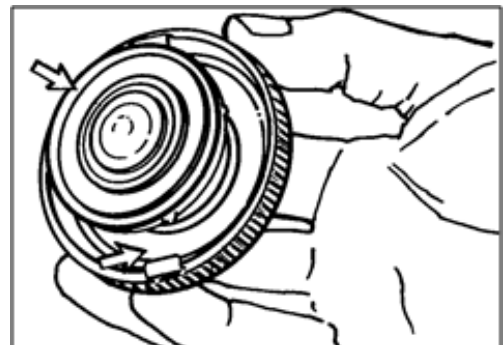


Figure 5-41

Check conditions and tightness of electrical connections(if equipped)

- Do not splash water on electrical parts. Water can cause electrical leakage and short-circuiting, resulting in equipment damage. Wet electrical parts can also cause electric shock.
- When cleaning the engine, keep water away from electrical parts.

- If malfunctioning of electrical parts is suspected, consult a Baudouin dealer.
- Also, do not use disassembled or reassembled electrical parts.

Check the sensors

Speed sensor

- Disassemble the speed sensor from the flywheel housing, clean the top surface of the speed sensor and mounting holes of the flywheel housing.
- Thread-in the sensor until it touches the tip of the flywheel ring, then unscrew the sensor out about 1/2-3/4 circle, the gap between the sensor and the gear ring is 0.5-0.75mm, hold the sensor still and tighten the nut, Torque should not exceed 20 N·m.

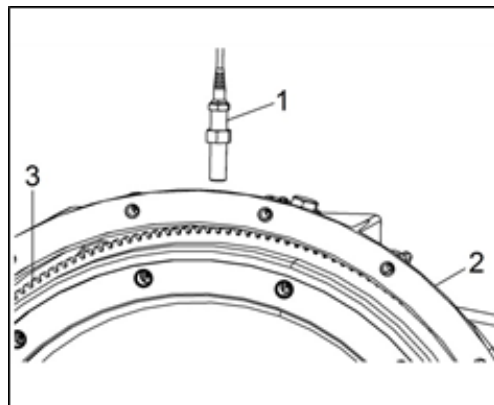


Figure 5-42

Oil pressure sensor

- Start the engine, use the diagnostic tool to read the oil pressure value when the engine is at idle speed, the value should be 200-400kPa, if there is no value or the value deviation is large, replace the sensor and read again.

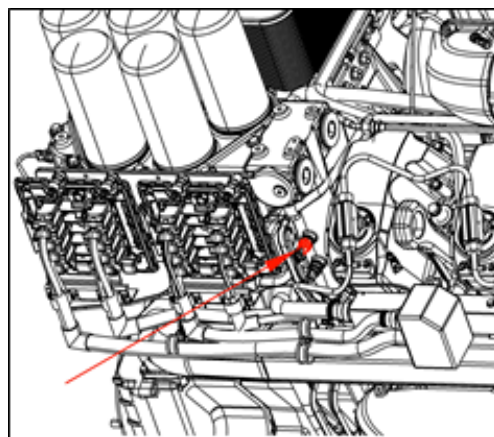


Figure 5-43

Coolant temperature sensor

- Start the engine, run the engine at the idle speed, when the engine is heated, use the diagnostic tool to read the coolant temperature value, the value should be (initial opening temperature of thermostat ± 3) °C. If there is no value or the value deviation is large, replace the sensor and read again.

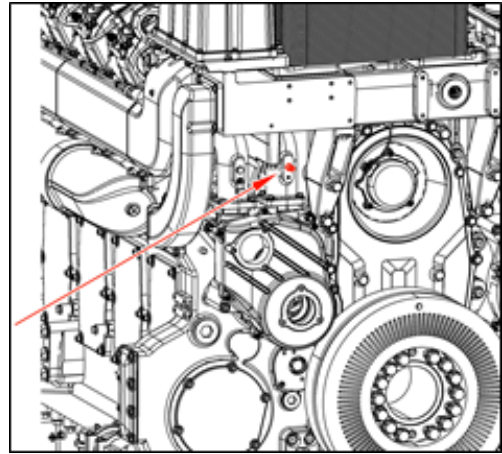


Figure 5-44

5.3.7 Overhaul Operations

5.3.7.1 Overhaul Information

An overhaul is replacing the major worn components of the engine. An overhaul is a maintenance interval that is planned. The engine is rebuilt with certain rebuilt parts or new parts that replace the worn parts.

An overhaul also includes the following maintenance:

- Inspection of all the parts those are visible during the disassembly
- Replacement of the seals and gaskets that are removed
- Cleaning of the internal passages of the engine and the engine block

5.3.7.2 Overhaul (Top)

■ Scheduling a Top Overhaul

Top overhauls are scheduled according to the recession of the exhaust valve stems. This measurement provides an accurate indication of the rate of valve wear. This measurement can be used to predict when a cylinder head requires replacement.

Plan for the top overhaul as the valve stem projection approaches the maximum limit. Perform the top overhaul when the valve stem projection has increased by a total of 1.78mm (intake valve), 2.68mm (exhaust valve). Do not allow the projection of the exhaust valve stems to exceed this limit. The inner diameter of valve guide is also considered as one factor for planning top overhaul, the limit of the diameter is 12.143mm.

Note: Generally, cylinder heads wear out at different rates. In some cases, servicing the cylinder heads at different times may be the most economic decision. This depends on the valve stem projection of the individual cylinders. However, this decision must include the costs of additional downtime that is caused by this procedure. Perform an economic analysis in order to determine if cylinder heads should be serviced as a group or divided into smaller groups.

Note: The generator or the driven equipment may also require service when the engine overhaul is performed. Refer to the literature that is provided by the OEM of the driven equipment.

■ Top Overhaul

A top overhaul involves servicing the cylinder heads and turbochargers. Also, some other engine components are inspected.

The recommendations of parts for top overhaul is as followed:

Inspect ■ Generator alignment	
Inspect Replace ■ Starter ■ Pushing rod ■ Exhaust manifold and bolts ■ Exhaust bellows ■ Intake valve and exhaust valve ■ Valve-spring retainer ■ Valve guide ■ Valve stem seal ■ Rocker arm ■ High-pressure fuel pipes	■ Alternator ■ Thermostatic valves ■ Pre-lubricating pump ■ Valve rotating mechanism ■ Valve spring ■ Valve seat ■ Valve collet ■ Valve bridge ■ Rocker arm shaft
Inspect Rebuild Replace ■ Turbocharger and bolts ■ Fuel supply pump	■ Coolant pump
Replace ■ Hoses ■ Low-pressure fuel pipes	■ Injector

Unexpected problems may be found during a top overhaul. Plan to correct these problems, if necessary.

- Buildup in the cylinders from excessive oil consumption
- Buildup in the cylinders from contamination of the fuel

- Plugging of the intercooler from coolant that is poorly maintained
- Plugging of the intercooler from contamination of the inlet air
- Degradation of the oil cooler from hydrogen sulfide in the fuel

5.3.7.3 Overhaul (In-Structure)

Scheduling an In-Structure Overhaul

Generally, an in-structure overhaul is performed for every second top overhaul. Scheduling an in-structure overhaul normally depends on the following two conditions:

- 300% initial oil consumption
- Fuel consumption rise $\geq 10\%$

Each individual condition may not indicate a need for an overhaul. However, evaluating the two conditions together is the most accurate method of determining when an in-structure overhaul is necessary.

Periodically measure each of the two conditions. The first measurement should occur during the engine commissioning. This establishes a baseline for future measurements. Additional measurements are scheduled at regular intervals in order to determine a schedule for the next in-structure overhaul.

Note!

These indications do not require an engine to be shut down for service. These indications only mean that an engine should be scheduled for service in the near future. If the engine operation is satisfactory, an immediate overhaul is not a requirement.

Note!

The generator or the driven equipment may also require service when the engine overhaul is performed. Refer to the literature that is provided by the OEM of the driven equipment.

In-Structure overhaul

An in-structure overhaul includes all of the work that is done for a top overhaul. Additionally, some other components that wear are replaced. The condition of components is inspected. Those components are replaced, if necessary.

Extra needed tools are as followed:

The recommendations of parts for in-structure overhaul is as followed:

Inspect ■ Generator alignment	
Clean Inspect Test ■ Intercooler	■ Oil cooler
Inspect Replace ■ Starter ■ Pushing rod ■ Exhaust manifold and bolts ■ Exhaust bellows ■ Connecting-rod ■ Crankshaft ■ High-pressure fuel pipes	■ Alternator ■ Thermostatic valves ■ Pre-lubricating pump ■ Flywheel ring gear ■ Piston pins ■ Pistons
Inspect Rebuild Replace ■ Turbocharger and bolts ■ Fuel supply pump	■ Coolant pump ■ Fuel injection pump
Replace ■ Intake valve and exhaust valve ■ Valve spring ■ Valve-spring retainer ■ Valve guide ■ Valve stem seal ■ Rocker arm ■ Piston rings ■ Anti-polishing rings ■ Connecting-rod bolts	■ Valve rotating mechanism ■ Valve seat ■ Valve collet ■ Valve bridge ■ Rocker arm shaft ■ Injector ■ Cylinder liners ■ Damper and fixing screws ■ Connecting-rod bearings

5.3.7.4 Overhaul (Major)

Generally, a major overhaul is performed for every fourth top overhaul. The need for a major overhaul is determined by several factors. Some of those factors are the same factors that determine the in-structure overhaul:

- A decrease of main oil pressure at rated speed $\leq 360\text{kPa}$ (Main factor)
- An increase of oil consumption

- An increase of crankcase blowby

Other factors must also be considered for determining a major overhaul:

- Power output
- The service hours of the engine
- Reduced oil pressure
- The wear metal analysis of the lube oil
- An increase in the levels of noise and vibration

An increase of wear metals in the lube oil indicates that the bearings and the surfaces that wear may need to be serviced. An increase in the levels of noise and vibration indicates that rotating parts require service.

A major overhaul includes all of the work that is done for top overhauls and structure overhauls. A major overhaul includes additional parts and labor. Additional parts and labor are required in order to completely rebuild the engine. In some cases, the engine is relocated for disassembly.

For the major overhaul, all of the bearings, seals, gaskets, and components that wear are disassembled. The parts are cleaned and the parts are inspected. If necessary, the parts are replaced. The crankshaft is measured for wear. The crankshaft may require regrinding. Alternatively, the crankshaft may be replaced.

The recommendations of parts for major overhaul is as followed:

Table 5–1

Clean ■ Oil Suction Strainer	
Clean Inspect Test ■ Intercooler	■ Oil cooler
Inspect Replace ■ Starter ■ Flywheel ring gear ■ Flywheel	■ Alternator ■ Gear ■ Gear shaft

Table 5 - 1 (continued)

■ Camshaft ■ Crankshaft ■ Wiring harnesses ■ Oil pump relief valve	■ Connecting-rod ■ Oil pump ■ Pre-lubricating pump
Inspect Rebuild Replace ■ Fuel injection pump	■ Cylinder block
Replace ■ Turbocharger and bolts ■ Cylinder head assemblies ■ Piston pins ■ Piston rings ■ Pistons ■ Cylinder liners ■ Anti-polishing rings ■ Connecting-rod bolts ■ Connecting-rod bearings ■ Injector ■ Valve bridge ■ Rocker arm ■ Rocker arm shaft ■ Thermostatic valves ■ Fuel supply pump ■ Oil Seal	■ Exhaust manifold and bolts ■ Exhaust bellows ■ Damper and fixing screws ■ Coolant pump ■ Camshaft bearings ■ Camshaft thrust plate ■ All gaskets and seals ■ Main bearings ■ The bolts of main bearings, timing gear, cylinder heads, flywheel, and flywheel cover ■ Bracing bolt ■ Crankshaft thrust plate set ■ Piston nozzle ■ Push rod

Turbocharger inspect**NOTE!**

Turbocharger bearing failures can cause large quantities of oil to enter the air inlet and exhaust systems. Loss of engine lubricant can result in serious engine damage.

Periodic inspection and cleaning is recommended for the turbocharger. Fouling of the turbine wheels can contribute to loss of engine power and overall loss of engine efficiency.

If the turbocharger must be removed for inspection, work with caution. Do not break deposits from the turbine wheel. Do not attempt to clean the turbine wheel. For information regarding removal and installation, see the repair manual or consult your Baudouin dealer. For information about repair of the turbocharger or about replacement of the turbocharger, consult your Baudouin dealer.

- Remove the exhaust outlet piping and remove the air inlet piping from the turbocharger. Visually inspect the piping for the presence of oil.
- Turn the compressor wheel and the turbine wheel by hand. The assembly should turn freely. Inspect the compressor wheel and the turbine wheel for contact with the turbocharger housing. There should not be any visible signs of contact between the turbine wheel or compressor wheel and the turbocharger housing. If there is any indication of contact between the rotating turbine wheel or the compressor wheel and the turbocharger housing, the turbocharger should be reconditioned.
- Check the compressor wheel for cleanliness. If only the inlet side of the wheel is dirty, dirt and/or moisture is passing through the air filtering system. If oil is found only on the back side of the wheel, there is a possibility of a failed turbocharger oil seal.

The presence of oil may be the result of extended engine operation at low idle. The presence of oil may also result from restriction of the inlet air (Plugged air filters) or the PCV system. This causes oil to leak past the seal for the turbocharger compressor.

Water pump inspect

A failed water pump might cause severe engine overheating problems that could result in cracks in the cylinder head, a piston seizure or other potential damage to the engine.

Visually inspect the water pump for leaks. If leaking of the water pump seals is observed, replace all of the water pump seals. Refer to the repair manual.

Inspect the water pump for wear, cracks, pin holes and proper operation. Consult your Baudouin dealer if repair is needed or replacement is needed.

Clean oil suction strainer

NOTE!

Hot oil and components can cause personal injury. Clean the oil suction strainer after the engine oil has been drained.

- Remove the oil pan.
- Remove the oil suction strainer.
- Clean the oil suction strainer with cleaner.
- Inspect strainer assembly for good condition. Change a new strainer assembly, if necessary. Install the strainer assembly and the oil pan.

Inspect gear

Inspect the condition of the gears:

- Whether the tooth surface of each gear is peeling and broken.
- Whether the bearing surface of the bolt is crushed.
- Whether the threaded hole or through hole on the gear is deformed.

If replacement is necessary, consult your Baudouin dealer for assistance.

Inspect gear shaft

Inspect each intermediate gear shaft for:

- Peeling
- Pitting
- Discoloration
- Eccentric wear
- Clear wear stripes

If replacement is necessary, consult your Baudouin dealer for assistance.

Pre-lubricating Pump

Manual Pump Group

Inspect the pre lube pump for the following conditions:

- Cracks
- Pin holes
- Proper operation
- Wear

Inspect the pre lube pump for leaks. Replace all of the seals if a leak is observed.

If repair or replacement is necessary, consult your Baudouin dealer for assistance.

Electrical Pre-lubricating Pump

Inspect the pre lube pump for the following conditions:

- Cracks
- Pin holes
- Proper operation
- Wear

Inspect the pre lube pump for leaks. Replace all of the seals if a leak is observed.

Inspect all of the components in the electric circuit for the pre lube pump. Inspect all of the wires and connections for leaks. Ensure that the components in the electric circuit are in good condition.

If repair or replacement is necessary, consult your Baudouin dealer for assistance.

Starter

Inspect the starter for proper operation. Listen for grinding when the engine is started. Inspect the teeth of the starter pinion and the flywheel ring gear. Check for patterns of wear on the teeth. Check teeth that are broken or chipped. If damaged teeth are found, the starter pinion and the flywheel ring gear must be replaced.

Problems with the electric starter can be caused by the following conditions:

- Malfunction of the solenoid
- Malfunction of the solenoid

Inspect the electrical system for the following conditions:

- Loose connections
- Corrosion
- Wires that are worn or frayed
- Cleanliness

Rebuild the starter if necessary. Consult your Baudouin dealer for assistance on the removal and installation of the starter.

Intercooler

Inspect

- Check if there is any deformation
- Check any debris or bump on the fins.

Clean

Water Side

Remove the cover and inspect the interior of the tubes. In normal conditions, the scale is soft and can be removed by special brush which is available in tool kit. Rotate the brush clockwise

carefully by avoiding disintegration of the brush. Or brush can be installed on electric drill in this operation and take necessary action for safety.

Air Side

Remove the cover and inspect the fins. Most of the scale can be removed by nylon brush (fur brush is not permitted). Severe scaling can be removed with compressed air <5bar. It is allowed to use alkaline cleaning solution with PH <9 and it is strictly forbidden to use acidic cleaning solution.

Test

There should be no leakage in one minute with 0.35Mpa compressed air blown in the intercooler.

Oil cooler

Clean

- Remove the core.
- Turn the core upside-down in order to remove debris.
- Back flush the core with cleaner.

Severe scaling can be removed with compressed air <5bar. It is allowed to use alkaline cleaning solution with PH <9 and it is strictly forbidden to use acidic cleaning solution

- Clean the core with steam in order to remove any residue. Flush the fins of the core. Remove any other trapped debris.
- Wash the core with hot, soapy water. Rinse the core thoroughly with clean water.
- Dry the core with compressed air. Direct the air in the reverse direction of the normal flow.
- Inspect the core in order to ensure cleanliness. Pressure test on the core. If necessary, repair the core.
- Install the core.

For more information on cleaning the cores, consult your Baudouin dealer.

Test

Check any leakage at test: make sure there is no any leakage in one minute when the oil duct in pressure of (1.0-1.2) Mpa, water duct in pressure of (0.4-0.5) Mpa.

Intake and exhaust manifold

Inspect any crack or leakage from the manifold. If there is any problem, replace it as instruction of repair manual.

Cylinder head assemblies

The valves and the valve seats are worn over time. This causes the valves to recede into the cylinder head. This condition is called valve recession.

In order to determine the wear condition between the valve seat and the valve, it is necessary to further measure the valve recession. Valve recession is the vertical distance between the valve bottom face and the bottom plane of the cylinder head.

- Perform sealing pressure test of cylinder heads.
- Measure the valve recession with a depth gauge.
- Check whether the upper and lower end face of valve guide has eccentric wear, damage, etc. Measure inner diameter of valve guide with inner diameter gauge.
- If valve recession and valve guide wearing exceeds the limit, need to rebuild the cylinder.
- Rebuild the cylinder head: replace new valves, valve seats, valve guides, valve stem seals all together if any of them need to be replaced.
- Grind to ensure the seal ability between valve and valve seat.

5.4 Storage Protection Instruction

5.4.1 Necessity of Anti-rust Protection

NOTICE !

The engine seal period can be maintained for one year, if over the one year seal period, the engine shall be protected against rust according to the storage protection instructions in this section.

If your engine is out of operation and using, and is not expected in short term, precautions should be taken to protect your engine from damage and ensure proper operation when you return to full production.

The recommendations indicated below are designed to prevent damage to the engine when it is withdrawn from service for a prolonged period. Use these procedures after the engine is withdrawn from service. Where necessary protect the engine against frost damage.

5.4.2 Storage Environment Requirement

If the engine is placed into storage, the following precautions should be taken to protect it.

- **Equipment must be kept clean.**
 - ◆ Store indoors, cover it with a VCI plastic bag.
 - ◆ Keep covered to eliminate airborne dust and dirt.

- ◆ Cover openings for ventilation, conduit connections, etc., to prevent entry of rodents, snakes, birds, insects, etc.

■ **Equipment must be kept dry.**

- ◆ Store in a dry indoor area .
- ◆ Temperature swings should be minimal to prevent condensation.
- ◆ If stored in an unheated or damp building, space heaters will be required to prevent internal condensation.
- ◆ Treat unpainted flanges, shafts, drive discs, and fittings with a rust inhibitor.
- ◆ Check insulation resistance of all windings before starting the engine. If readings are low, the windings must be dried.

5.4.3 Preparation before Storage

- Clean the engine for dirt, rust, grease, and oil. Inspect the exterior. Paint the damaged paint area with good quality paint.
- Remove the dirt from the air filter(s). Check all seals, gaskets, and the filter elements for damage.
- If the engine is stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

5.4.4 Shorter Term Storage

- **Up to one week**
 - ◆ No special treatment is necessary.
 - ◆ Just clean the area around the engine body.
- **Up to three months**

Each week start the engine until the normal temperature of operation is reached. If the engine doesn't have the start conditions, for example, doesn't have the start equipment, etc., turn the crankshaft manually, in the normal direction of rotation (anti-clockwise as seen on the flywheel), a minimum of three revolutions.

5.4.5 Necessary Materials

■ **Calibration oil**

Calibration Oil is a low viscosity mineral oil based test fluid.

Calibration Oil is a calibration and storage oil for diesel fuel system, the rust preventative properties of this oil are such that, without cleaning of the equipment after calibration, proper functioning of the equipment is ensured after one year storage in normal conditions.

Safety protection is recommended when in contact with this product, such as barrier cream or rubber gloves.

■ VCI oil

Volatile corrosion inhibitor (VCI) provides liquid and vapor protection to ferrous metal surfaces against corrosion caused by moisture. In a closed compartment, protection is either by direct contact with VCI oil or by contact with VCI vapors. Contact your local supplier for similar type oil

VCI oil can be used in all tanks, engine, hydraulic tank, power steering tank, transmission, differential, and other components. The inhibitor is an oil stabilizer and rust preventive.

To be successful when treating an engine with VCI oil, the engine must be sealed when stored. VCI oil is so volatile that any opening left unsealed will allow the vapors to escape, causing the engine to lose protection.

Note!

- ◆ **VCI oil should not be used full strength on non-ferrous metals where the inhibitor will have direct, prolonged contact.**
- ◆ **The inhibitor can be used in combination with any petrochemical. Apply by using a spraying or fogging pattern. The VCI oil must be diluted according the instruction of suppliers.**

VCI oil cleaning method

- ◆ Drain the VCI oil from the engine.
- ◆ Refilled standard-compliant engine lubricating oils. For lubricating oil, please refer to the manual “Fluids RECOMMENDATIONS Diesel” .
- ◆ Operate the engine for 5 minutes at low idle rated speed.
- ◆ Drain the oil and refilled new lubricating oil, complete cleaning.

■ Sprayer

Load the VCI oil dilution into the sprayer, then can be used to prepare the engine for storage.

Change the nozzle adjustment in order to provide either a spray or a fog pattern.

VCI oil dilution: mixture of 50 percent VCI oil and 50 percent engine oil.

■ Plastic bag

Use ultraviolet light resistant plastic bags. If a Volatile Corrosion Inhibitor (VCI) oil is used inside of the bag and the bag is sealed, the bag must have a minimum thickness of 0.10 mm (0.004 inch).

■ Waxed paper

Wax paper is a surface-coated wax that has excellent water and oil resistance.

Wrap parts and sealing to prevent rust.

■ **Adhesive tape**

Use a sealing tape with appropriate adhesive properties. DO NOT use duct tape because duct tape will loosen over a short time. Rolls of sealing tape that are 2 inches wide are recommended.

An appropriate quality sealing tape is available from the following suppliers: 3M Product Information Center.

■ **Biocide**

Diesel Fuel Biocide prevents the growth of small organisms in the diesel fuel, use diesel fuel biocide such as Biobor JF or equivalent.

5.4.6 Long Term Storage (More Than Three Months)

Note!

In the long term storage, anti-rust process should be operated every six months.

■ **Lubricating oil system**

Drain and replace the crankcase oil and change the oil filters.

Add VCI oil to the crankcase at the rate of 3 to 4 percent by the volume of the crankcase. Or use special engine rust-proof oil, such as Houghton Ensic Engine Oil 30、Shell Rimula R6lm, or other equivalent effects product, please follow the supplier's instructions.

Note!

If the engine crankcase is full, drain enough engine oil so the mixture can be added.

■ **Coolant system**

Drain coolant and flushing of cooling system, such as engine blocks, separate circuit after-coolers, and other related components. It is not necessary if engine is to be stored less than three months. However, for extended storage periods of three months or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant.

Recommend Total Glacelf Auto Supra concentrates、BASF Glyscorr P113 concentrates, or other equivalent effects product, please follow the supplier's instructions.

Note!

- ◆ If the stored engine is subjected to below freezing temperatures, completely drain the freshwater system. Drain the system by removing the drain plugs from the engine block, oil cooler, heat exchanger body, and radiator.
- ◆ The mixture must NOT contain less than 45% inhibited ethylene glycol or propylene glycol and may contain up to 60% by volume

Fresh Water Systems

Drain coolant from cooling system and thoroughly flush with clean water. The system then should be refilled with mixture of clean water and any of the coolant preservative containing VCI. If the storage less than three months, drain mixture of clean water and any of the VCI coolant from cooling system after finished running of the engine.

For clean water, please refer to the manual "Fluids RECOMMENDATIONS Diesel".

Raw Water Systems

Completely drain the raw water system by removing all the drain plugs from the raw water pump, water shield manifolds, heat exchanger bonnets, and aftercooler. After the system has been drained, inspect all zinc plugs (normally painted red) for corrosion damage.

Note!

To ensure complete drainage and evaporation during storage, DO NOT install the drain plugs and zinc plugs. Place all removed plugs in a cloth bag and fasten the bag to the engine for storage.

Caution!

When finished all above operations of lubricating oil system and coolant system, then start the engine for 5 minutes at low idle rated speed.

Turn off the engine, and wait about 30 minutes, fully cooled, then make operations as follows.

■ Fuel system

Calibration oil

Calibration oil is the preferred choice as a preservation fluid because the calibration oil contains Rust and Oxidation inhibitors.

Recommend Castrol Calibration Oil 4113, SRS SchmierstoffVertrieb GmbH Calibration Fluid, Shell V-Oil1404, or other equivalent effects product, please follow the supplier's instructions.

Fuel filter

Remove the fuel from the secondary fuel filter housing or empty and reinstall the spin-on fuel filter element to remove any dirt and water. Drain the fuel injection pump (sleeve metering

only). Clean the primary fuel filter. Fill with calibration oil. Install the primary fuel filter and operate the priming pump. This will send clean oil to the secondary filter and engine.

Fuel tank

Open the fuel tank drain valve and allow any water or dirt to drain from inside the fuel tank. Apply a VCI oil of 30 ml per 30 L (1 oz per 7.50 gal) of fuel tank capacity to prevent rust in the fuel tank. Add 0.15 ml per L (.02 oz per 1 gal) of commercial biocide such as Biobor JF or an equivalent to the fuel.

Fuel nozzle or spark plug

Remove the fuel nozzles or spark plugs and apply 30 ml (1 oz) of VCI oil mixture (50 percent VCI oil and 50 percent engine oil) in each cylinder.

Use a bar or turning tool to rotate the engine slowly to put the oil on the cylinder walls. Install all the fuel nozzles or spark plugs and tighten to the correct torque.

■ Intake and exhaust system

Air filter

Remove the air filter elements. Seal the air filter inlets, with VCI plastic bag and adhesive tape.

Use the starter to drive the engine, but no fuel. Then use a sprayer to add VCI oil dilution into the air inlet and turbocharger inlet, multiple times, total 60s.

Exhaust openings

Use a sprayer to apply VCI oil dilution into the exhaust openings. The minimum application rate is 5.5 ml per L (3 oz per 1000 cu in) of engine displacement. Seal the exhaust pipe, including any drain holes in the muffler.

Vents

All vents i.e. engine inlet pipe, exhaust pipe, air cleaner inlet, coolant inlet & outlet, crankcase breather, the crankcase breather and all other openings etc. must be carefully sealed with VCI plastic bag and adhesive tape.

Note!

VCI oil mixture can also be added to the inlet by removing the plug for checking turbocharger boost pressure. The minimum application rate is 5.5 ml per L (3 oz per 1000 cu in) of engine displacement.

■ Electrical system

Battery

Battery for engine starting, if provided, should be disconnected and stored in a cool, dry place after ensuring electrolyte level (refill with distilled water if necessary). It is recommended to recharge the battery every one month.

Starter

Clean electric starter and wire harness, keep dry, then cover the alternator in mouldable waxed paper, and seal with adhesive tape.

Alternator

Cover the alternator in mouldable waxed paper, and seal with adhesive tape

Engine wiring harness

Clean the engine wiring harness, and keep it dry.

■ The others**V-belt**

Loosen all the belt (tension, fan, alternator, etc.)

Flywheel

Spray a thin amount of VCI oil mixture on the flywheel, ring gear teeth, and starter pinion. Install the covers to keep in the VCI vapors.

Note!

Use a VCI plastic bag cover over the engine. Ensure the engine cover is secure, but loose enough to allow air to circulate around the engine to prevent damage from condensation, and put some desiccants, then seal with adhesive tape.

Attach a tag to the engine with a notation of the date that the unit was preserved.

Remove the waterproof cover every three months and check the engine for corrosion. If the engine has signs of corrosion at the check period, repeat the protection procedure.

5.4.7 Removal from Storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

- Remove all outside protective covers. Unseal all openings in engine and remove covering from electrical systems.

- Change the oil and filters. Then drain the oil and refilled with new lubricating oil. For lubricants, please refer to the manual” Fluids RECOMMENDATIONS” .
- Drain the VCI coolant from the engine. Use clean water to flush any compartment that contains VCI coolant in order to removal all residual VCI coolant. Then drain the clean water and refilled new coolant. For coolant, please refer to the manual” Fluids RECOMMENDATIONS” .
- Replace the fuel filter elements and fill the fuel tank with diesel fuel (Gas machine does not need to do this operation).
- Check the battery level.
- Check the condition of the fan and alternator belts. Replace the belts, if necessary. Tighten the belts as specified in the Operation & Maintenance Manual.
- Check the engine harness if the harness is not aging. Replace the harness, if necessary.
- Remove the batteries from storage. Install batteries (fully charged) and connect the electric wires.
- Install fan/alternator poly-vee belt if removed earlier.
- Perform all appropriate pre-starting checks.
- Please assemble all the others parts back in engine.

5.4.8 Initial Running after Storage

The purpose of this operational check is to ensure that the correct pressures and temperatures are maintained in the lubrication, cooling, and fuel systems. Also, these operation ensures that any leaks are corrected.

To ensure a safe, uniform check at initial start, use the following procedure:

- Before starting the engine, use hand oil pump or electric pre-supply pump to establish the oil pressure of the engine.
- Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
- Start the engine and run at low idle and no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
- Operate the engine for 10 minutes at idle speed.
- Operate the engine for 15 minutes at half rated load and full rated speed.
- Operate the engine for 30 minutes at full rated load and full rated speed.
- Check regularly for leaks such as oil, coolant, and gas during the first few hours of operation. Repair any leaks as soon as detected.

- Check all kinds of indicators to confirm that there is no abnormality, if there are any abnormal parameters, please handle it promptly.

Chapter VI Appendix

6.1 Coolant Recommendation

The coolant ensures the best efficiency of the cooling system and protection against corrosion (chemical and galvanic). It improves also boiling temperature, resistance to rust and avoids scale deposit formation.

- The coolant used in Baudouin engines should meet the **ASTM D6210** standard, and the coolant used in Baudouin engines should not contain **2-ethylhexanoate**, which has compatibility problems with silicone rubber.
- Do not use a commercial coolant that only meets the **ASTM D3306** specification. This type of coolant is made for light-duty engine applications.
- The coolant recommended in ‘**Fluids Manual**’ is preferred for Baudouin engines.

Important Note

- 45% glycol content is the minimum required values to maintain the best boiling temperature. Do not use ethylene glycol content that exceed **60%**.
- Please select the coolant with appropriate freezing point according to the local ambient temperature. The freezing point of the coolant is at least 10 ° C lower than the local lowest temperature.

6.2 Lubricant Recommendation

It is important to comply with the oil drain and filter change intervals to guarantee the proper operation of your **S. I. Moteurs Baudouin** equipment.

Lubricant grade for the engine

Present lubricant certification process according to API and ACEA standards is adequate to guarantee adequate quality and performances.

Therefore **S. I. Moteurs Baudouin** requires use of following lubricants:

API CI-4 or ACEA E7

- **Quality Grade**

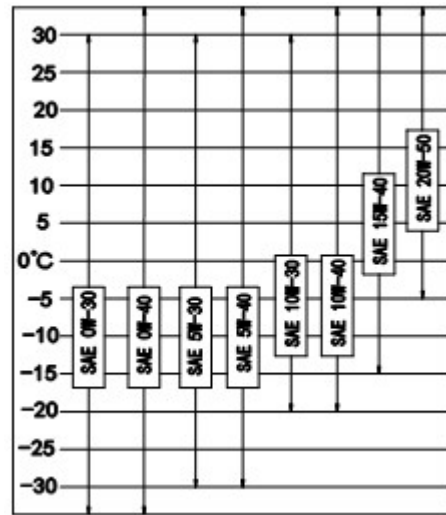
Lubricating oils are differentiated according to their performance and quality class. Oils with comparable specifications can be used.

Approved Oil	
Baudouin Engine	Grade
API	CI-4
ACEA	E7

■ Viscosity

As the viscosity of lubricating oil is dependent on temperature, the choice of SAE grade should be governed by the ambient temperature prevailing at the engine operating site. Should the temperature fall temporarily below the limits of the SAE grade selected, cold start-ing may be affected but the engine will not be damaged. In order to keep wear to a minimum, do not exceed application limits for extended periods of time. Synthetic lubricating oil features an improved temperature and oxidation stability.

Viscosity selection based on ambient temperature



Viscosity and temperature properties specification

Project	Low-temperature kinematic viscosity /mPa·s(°C) ≤	Viscosity (100°C) /mm²/s	High-temperature and high-shear viscosity (150°C, 10 ⁶ s ⁻¹) /mPa·s ≥	Pour point/°C ≤
Test method	GB/T 6538 ASTM D5293	GB/T 265 ASTM D-445 /ISO 3104	SH/T 0618 SH/T 0703 SH/T 0751 CECL-36-T-84 ASTM D4741-87 ASTM D 4582-95 ASTM D4624-93	GB/T 3535 ASTM D 97
Viscosity grade				
0W-20	6200(-35)	5.6~<9.3	2.6	-40

0W-30	6200(-35)	9.3~<12.5	2.9	
0W-40	6200(-35)	12.5~<16.3	2.9	
5W-20	6600(-30)	5.6~<9.3	2.6	-35
5W-30	6600(-30)	9.3~<12.5	2.9	
5W-40	6600(-30)	12.5~<16.3	2.9	
5W-50	6600(-30)	16.3~<21.9	3.7	
10W-30	7000(-25)	9.3~<12.5	2.9	-30
10W-40	7000(-25)	12.5~<16.3	2.9	
10W-50	7000(-25)	16.3~<21.9	3.7	
15W-30	7000(-20)	9.3~<12.5	2.9	-25
15W-40	7000(-20)	12.5~<16.3	3.7	
15W-50	7000(-20)	16.3~<21.9	3.7	
20W-40	9500(-15)	12.5~<16.3	3.7	-20
20W-50	9500(-15)	16.3~<21.9	3.7	
20W-60	9500(-15)	21.9~<26.1	3.7	

6.3 Fuel Recommendation

Improper fuel additive usage may cause damages to fuel injection equipment of diesel engines.

■ Quality Grade

Use commercially available diesel fuel with less than **0.035%** Sulphur content.

The following fuels can be used on Baudouin engine:

— **European standard EN 590.**

— **ASTM D-975**

— **BS 2869 Class A 2**

■ Winter-grade Fuel

When temperature is low and the fuel you currently use is not proper, there will be wax in the fuel. Wax can clog the fuel system and reduce engine performance. If the ambient temperature is less than 0°C, winter-grade fuel should be used.

When temperature is below -20°C, please choose proper diesel fuel that can be used in this temperature range.

For more information about fuel selection, please consult your local fuel supplier.

The pour point of diesel fuel should be at least 6°C lower than the minimum ambient temperature. The proper pour point is essential for engine start-up and running performance.

If diesel fuel with proper pour point is unavailable, Baudouin recommends using fuel heater to resolve the wax problem. Fuel heater is a low cost solution in most application.

6.4 Common Faults and Troubleshooting

6.4.1 Troubleshooting

■ Engine Turns, But It Does Not Start

Table 6–1 Engine turns, but it does not start

Problem	Cause	Remedy
A: Engine emits hardly any exhaust smoke	(1) No fuel supplied to fuel injection pump	
	a) Air trapped in fuel supply system	Bleed air from fuel filter and fuel feed pipes, and inspect each part for damage and air leaks. Disassemble and repair, if necessary.
	b) Empty daily fuel tank	Add fuel.
	c) Fuel filter is blocked	Disassemble and clean, or replace filter element.
	d) Fuel feed pipe is blocked	Clean inside of pipe.
	e) Fuel is not supplied due to malfunction of fuel feed pump or drive unit	Disassemble and inspect, or replace fuel feed pump or drive unit.
	f) Electronic governor problem for mechanical pump	Check the governor power, speed controller set, and the actuator, or replace the controller.
	(2) Fuel supplied to fuel injection pumps	
	a) Loose fuel injection pipe and low injection pressure	If loosened, tighten.
	b) Seized or damaged parts in fuel injection pump Malfunction of fuel lever Control rack does not move	Inspect control link. If there is a fuel lever linkage problem, disassemble and repair. Remove cam chamber cover, and operate by hand. If parts are defective, disassemble and repair, or replace.

Table 6 – 1 Engine turns, but it does not start (continued)

	c) Seized plunger	Replace, if defective.
	d) Clogged two-way delivery valve	Inspect two-way delivery valve, and disassemble and clean.
	e) Broken plunger spring	Disassemble and repair, or replace if defective.
B: Engine emits small amount of exhaust smoke. (Check the cause of insufficient injected fuel. Check all items in A-(1) and (2)- b, and also check items at right.)	a) Fuel lever does not open fully	Check relation of movement with fuel lever, and disassemble and repair if defective.
	b) Seized tappet in fuel injection pump	Check for uneven movement, and disassemble and repair, or replace.
	c) Worn tappet roller or camshaft in fuel injection pump (reduced amount of injected fuel)	Replace, if worn.
	d) Seized or worn plunger in fuel injection pump, worn broken plunger spring (reduced amount of injected fuel)	Check for uneven movement, and disassemble and repair, or replace.
	e) Loose tightening screw of control rack of fuel injection pump	Tighten screw.
	f) Defective oil sealing performance of two-way delivery valve, or broken two-way delivery valve spring	Disassemble and repair, or replace.
	g) Fuel viscosity too high to allow smooth flow	Use fuel with viscosity suitable for ambient temperature. If fuel quality is improper, change fuel.
	h) Large amount of fuel leaks from fuel injection nozzles, and insufficient injected fuel	Check leak-off pipe for amount of fuel leaks, check with nozzle tester, and replace defective parts if necessary
C: Engine emits large amount of exhaust smoke. (Check the cause of ignition failure despite sufficient amount of injected fuel.)	(1) Improper fuel injection timing	
	a) Malfunction of camshaft drive	Inspect camshaft drive section, and adjust fuel injection timing correctly.

Table 6 - 1 Engine turns, but it does not start (continued)

	b) Deviation of fuel ignition timing due to worn fuel injection pump tappet roller or camshaft cam	Replace if worn.
	(2) Poor spray condition of fuel injection nozzles	
	a) Sticking of needle valve in fuel injection nozzle, or improper valve seat sealing	Check with nozzle tester, and disassemble and repair, or replace.
	b) Low fuel injection nozzle valve opening pressure	Using nozzle tester, adjust adjustment screw so that fuel is injected at specified valve opening pressure.
	c) Damaged or broken nozzle spring	Replace if damaged.
	d) Large amount of fuel leaks from nozzle	Clean mounting surfaces of nozzle and holder. Replace if necessary.
	(3) Insufficient compression pressure (cylinder internal temperature does not reach ignition temperature)	
	a) Inadequate rotation speed	If starting air pressure is low, increase pressure. If engine oil viscosity is high, heat oil or change oil to one with appropriate viscosity Repair if there are other abnormalities.
	b) Inlet/exhaust valve not contacting valve seat properly	Disassemble and repair by lapping valve in valve seat, or replace if necessary.
	c) Valve remaining open	Check for sticking of valve and valve guide, incorrect tappet assembly, and valve clearance, and correct abnormalities if necessary.
	d) Leaking of compression pressure due to worn cylinder liners or sticking of piston rings	Disassemble and repair, or replace if necessary.

Table 6 - 1 Engine turns, but it does not start (continued)

	e) Leaking of compression pressure from cylinder cover	Check for gas leaks, and tighten cylinder cover properly. Repair gas seal surface or replace gas seal ring, if necessary.
	(4) Inappropriate fuel	
	a) Inappropriate fuel or water in fuel	Drain fuel and check. Change to higher- quality fuel, if necessary

■ Engine Does Not Turn

Table 6-2 Engine does not turn

Problem	Cause	Remedy
A: Malfunction of starting air system	a) Malfunction of starting valve	Inspect starting valve, and repair or replace
	b) Starting air pressure lower than specified	Check air tank pressure, and increase pressure if low
B: Malfunction of mechanical engine parts	a) Seizing of moving parts in engine	Disassemble and inspect pistons, connecting rods, crankshaft, camshaft, bushings of timing gear and others, inlet and exhaust valves, etc., and repair.
	b) Deviation of timing due to incorrect engine assembly Pistons are hitting valves	Disassemble and repair.
	c) Viscosity of engine oil too high, or clotted oil	Change oil to one with lower viscosity.

■ Engine Output is Low

Table 6-3 Engine output is low

Problem	Cause	Remedy
A: Engine emits small amount of exhaust(Engine output and speed are inadequate due to insufficient injected fuel.)	(1) Tendency of engine moving parts toward seizing	
	a) Tendency toward seizing due to insufficient clearances of engine parts	Check abnormal heating of parts listed in B-a in Table 7-2, and repair defective parts
	b) Inadequate lubrication	Check oil level, oil pressure and oil viscosity, and add, adjust or replace oil, and also clean

Table 6 – 3 Engine output is low (continued)

		lubricating system if there is oil clogging
	(2) Insufficient amount of fuel supply	
	a) Clogged fuel system or loose pipe	Clean or replace. (Refer to A in Table 7-1.)
	b) Malfunction of fuel supply or injection system	Clean or replace. (Refer to B in Table 7-1.)
B: Engine emits excessive white exhaust smoke	(1) Engine knocking and excessive white smoke when engine is cold	
	Injection timing too advanced	Correct. (Refer to C-(1) in Table 7-1.)
	(2) Poor combustion due to low compression pressure	
	a) Valve remaining open.	Check for valve, valve guide sticking and valve clearances, and repair.
	b) Inlet/exhaust valve not contacting valve seat properly	Disassemble and correct by lapping valve in valve seat, or replace if necessary.
	c) Broken inlet/exhaust valve spring	Disassemble and repair, or replace if necessary.
	d) Leaking of compression pressure due to worn cylinders or sticking of piston rings.	Disassemble and repair, or replace if necessary.
	(3) Poor fuel condition (water in fuel)	Open drain cock and check fuel. Drain water or change fuel.
C: Engine emits excessive black exhaust smoke	(1) Fuel injection timing too retarded	Correct. (Refer to C-(1) in Table 7-1.)
	(2) Uneven fuel injection among cylinders (Poor combustion condition, unstable rotation with knocking)	
	a) One or more worn tappet rollers or cams on camshaft in fuel injection pumps causing deviation of fuel injection timing	Replace if worn
	b) One or more plunger springs seized, worn or broken	Disassemble, repair or replace

Table 6 – 3 Engine output is low (continued)

	(3) Poor spray condition of some fuel injection nozzles (Exhaust temperature of cylinders with poor fuel spray condition may become high.)	Refer to C-(2) in Table 7-1
	(4) Poor combustion due to insufficient inlet	
	a) Malfunction of turbocharger (damage of vanes, seizing of bearing, etc.)	Disassemble and repair, or replace if necessary
	b) Malfunction of inlet/exhaust valve	Refer to B-(2) in Table 7-3
	c) Air cleaner clogged with dust	Disassemble and clean, or replace if necessary

■ Engine Knocks

Table 6–4 Engine knocks

Problem	Cause	Remedy
A: Engine knocks slightly and emits black exhaust smoke	Fuel injection timing too retarded	Refer to C-(1) in Table 7-1
B: Knocking is severe, and exhaust smoke is white	Fuel injection timing is too advanced	Refer to C-(1) in Table 7-1
C: Knocking is severe in certain cylinders	Uneven fuel injection among cylinders	
	a) Excessive fuel injection in some cylinders	Refer to C-(2)-a in Table 7-1
	b) Fuel injection timing too advanced in some cylinders	Refer to C-(2)-b in Table 7-1
D: Ignition retardation occurs and results in simultaneous ignition to cause severe knocking.	Improper spray of fuel by fuel injection nozzles	
	Fuel is not sprayed in proper condition in some cylinders	Refer to C-(2) in Table 7-1
E: Ignition retardation occurs frequently and results in simultaneous ignition to cause severe knocking	Low engine compression	
	Amount of intake air is low in some cylinders	Refer to C-(3) in Table 7-1

Table 6 - 4 Engine knocks (continued)

F: Injection of fuel generates knocking, and engine emits large amount of black or gray exhaust smoke. When oil does not rise, engine does not knock severely and emits bluish white exhaust smoke	Engine oil rising above pistons	
	a) Oil level too high in crankcase	Discharge oil to appropriate level.
	b) Worn piston rings or sticking of piston rings, resulting in inadequate scraping of oil	Check crankcase breather pipe for gas leak, and replace if there are defective parts.
	c) Excessive clearance between cylinder and piston	Check crankcase breather pipe for gas leak, and replace if necessary.
	d) Engine oil viscosity too low	Change to high-quality oil with higher viscosity.
G: Abnormal noise produced when injection is stopped suddenly and engine is allowed to rotate by inertia (engine mechanical failure)	a) Excessive connecting rod bearing clearance, or bearing metal flaking	Disassemble and inspect, and repair or replace if necessary.
	b) Loose connecting rod cap tightening bolts	Disassemble and inspect, and repair or replace if necessary.
	c) Excessive clearance between cylinder and piston	Check crankcase breather pipe for gas leak, and replace if necessary.
	d) Piston hitting foreign item fallen inside cylinder	Disassemble and inspect.
H: Low compression temperature and retarded ignition cause severe knocking, especially after engine starts in cold weather	Engine too cold	Operate engine until it warms up before increasing engine speed

■ Engine Produces Large Amount of Smoke While in Operation

Table 6-5 Engine produces large amount of smoke while in operation

Problem	Cause	Remedy
A: Engine emits excessive white exhaust smoke	(1) Severe knocking	
	Fuel injection timing too advanced	Refer to C-(1) in Table 7-1.
	(2) Knocking produced only in cylinders with insufficient compression	
	Low engine compression	Refer to C-(3) in Table 7-1.
	(3) Improper fuel	
	a Water contained in fuel	Open drain cock and check. Remove water or change fuel.
	(4) Other	

Table 6 - 5 Engine produces large amount of smoke while in operation (continued)

	a) Large amount engine oil rising above pistons	Inspect and repair or replace as described in F in Table 7-4.
	b) Engine too cold, resulting in poor combustion	Inspect temperature regulator, and adjust it properly to prevent overcooling.
	c) Engine operating too long with no load	Unburned oil is trapped in exhaust pipe. White smoke stops after engine is operated under load.
B: Engine emits excessive black exhaust smoke.	(1) Minor knocking	
	a) Injection timing too retarded	Refer to C-(1) in Table 7-1.
	(2) Other	
	a) Excessive amount of injected fuel	Check if fuel injection pump rack set screw or bolt is loose, and repair.
	b) Fuel injection not uniform	Inspect, and repair or replace as described in C-(2) in Table 7-3
	c) Improper spray of fuel by fuel injection nozzles	Inspect, and repair or replace as described in C-(2) in Table 7-3
	d) Low engine compression	Inspect, and repair or replace as described in C-(2) in Table 7-3
	e) Large amount engine oil rising above pistons	Inspect and repair or replace as described in F in Table 7-4.

■ Engine Operates at High Speed and Does Not Stop

Table 6-6 Engine operates at high speed and does not stop

Problem	Cause	Remedy
Fuel injection pump does not set to no-injection condition	Link between fuel increase/decrease lever and governor failing to return smoothly to original position	Check if link returns without catching, and repair if necessary.
	a) Loose control link lever	Repair if rack does not move in connection with governor lever.
	b) Sticking of rack disallowing its return to original position	Check rack for smoothness, and disassemble and repair.

■ Malfunction of Lubricating System

Table 6–7 Malfunction of Lubricating System

Problem	Cause	Remedy
A: Oil pressure does not rise immediately after start	a) Engine oil level too low	Check oil level gage, and add oil if level is low
	b) Engine oil viscosity too high for smooth pumping of oil (Especially when temperature is low)	Change oil to one with appropriate viscosity
	c) Clogged oil pump suction side or strainer screen	Remove pipe from pump discharge side, and check oil discharge. If no oil is discharged, disassemble, clean and repair, or replace
	d) Malfunction of regulator valve	Repair or replace defective parts, such as broken valve spring and seized valve
	e) Clogged oil filter element	Disassemble, clean, replace
	f) Defective oil pressure gage	Disconnect oil pressure gage pipe. If oil pours out, replace oil pressure gage
B: Oil pressure drops gradually during operation	a) Clogged oil filter element	Disassemble, clean, replace
	b) Engine oil viscosity too low	Oil temperature rises and causes oil pressure to drop. Change oil to one with higher viscosity
	c) Abnormally high oil temperature	Engine is overheated. Do not operate engine until oil temperature is low
	d) Tendency toward bearing seizing	Disassemble, repair
C: Oil pressure abruptly drops during operation and remains there	a) Damage bearing causing increased oil leaks	Disassemble and repair
	b) Cracking in engine oil passage, or oil leakage from joint	Check for leaks, and repair or replace defective parts
D: Oil pressure fluctuates suddenly during operation	Engine oil level too low, causing air to mix into oil	Check oil level gage, and add oil if level is low

6.5 Recommended Torques for Bolts

6.5.1 Recommended Torques for Clamp

Clamp type	Size (mm)	Install torque (N·m)	Destroy torque (N·m)	Install speed (RPM)	Graphic
Non - perforated worm clamp	≤ 22	4.5±0.3	≥ 6	≤ 200 Recommended ≤ 60	
	27~55	5±0.3	≥ 7		
	≥ 55	5.5±0.3	≥ 7		
Perforated worm clamp	/	6±0.5	≥ 8	≤ 200 Recommended ≤ 60	
W-type lined worm clamp	/	8	≥ 11.3	≤ 60	
Skew head spring clamp	/	6±0.5	≥ 8	≤ 200 Recommended ≤ 60	
Disc spring clamp	/	Step 1: 5.1 Step 2: 8.5	≥ 16	Step 1: ≤ 200 Step 2: ≤ 60	
V-shaped band	M6	9±1	≥ 13	≤ 60	
	M8	18±1	≥ 25		
	M10	30~35	≥ 50		

Clamp type	Size (mm)	Install torque (N·m)	Destroy torque (N·m)	Install speed (RPM)	Graphic
T-shaped band	/	8.5±0.5	≥ 13	≤ 200 Recommended ≤ 60	
Spring type T clamp	/	13±1	/	≤ 200 Recommended ≤ 60	

6.5.2 Recommended Torques for Hollow Bolts

Specification	Head type	Recommended tightening torque (N·m)
M8×1	Hexagon head	7±1
M10×1	Hexagon head	17±2
	Hexagon head	13±2 (Copper bolt and small combination washer)
M12×1.5	Flange bolt	20±3
	Hexagon head	22±3
M14×1.5	Flange bolt	28±3
	Hexagon head	27±3
M16×1.5	Flange bolt	32±3
	Hexagon head	30±3
M18×1.5	Flange bolt	36±3
	Hexagon head and flange bolts	60±5

6.5.3 Recommended Torques for Standard Bolts

Friction coefficient	0.125 (zinc plated)				0.14 (polished)			
Strength grade	6.9	8.8	10.9	12.9	6.9	8.8	10.9	12.9
Bolt size	Recommended torque (N·m)							
M4	2.3	2.7	3.8	4.6	2.4	2.9	4.1	4.9
M5	4.7	5.5	8.0	9.5	5.0	6.0	8.5	10
M6	8.0	9.5	13.0	16.0	8.5	10	14.0	17
M8	19	23	32	39	21	25	35	41
M10	39	46	64	77	41	49	69	83
M12	67	80	110	135	72	86	120	145
M14	105	125	180	215	115	135	190	230
M16	165	195	275	330	180	210	295	355
M18	225	270	390	455	245	290	405	485
M20	325	385	540	650	345	410	580	690
M22	435	510	720	870	465	550	780	930
M24	560	660	930	1100	600	710	1000	1200
M27	830	980	1400	1650	890	1050	1500	1800
M30	1100	1350	1850	2250	1200	1450	2000	2400
M8×1	21	25	35	42	23	27	38	45
M10×1.25	41	49	66	82	44	52	73	88
M12×1.25	74	88	125	150	80	95	135	155
M12×1.5	70	83	115	140	76	90	125	150
M14×1.5	115	140	195	235	125	150	210	250
M16×1.5	175	210	295	350	190	225	315	380
M18×1.5	255	305	425	510	275	325	460	550
M20×1.5	360	425	600	720	385	460	640	770
M22×1.5	480	570	800	960	520	610	860	1050
M24×1.5	610	720	1000	1200	650	780	1100	1300
M27×1.5	890	1050	1500	1800	970	1150	1600	1950
M30×1.5	1250	1450	2050	2500	1350	1600	2250	2700

6.6 Recommended Stock

RECOMMENDED STOCK		
Maintenance	5	Oil Filter Element(s)
	1 set	Fuel Filter Element(s)
	1	Fuel Pre-filter / water Separator Filter Elements
	1 set	Air Filter Element
	16	Cylinder Head Cover Gasket
	1 set	Centrifugal Oil Filter Element(if equipped)
	1 set	Belts
	1 set	Breather Filter Element (if equipped)
Camshaft and crankshft	2	Thrust Plate(pair)
	1 sets	Flywheel Bolts
Cylinder head	8	Cylinder Head Bolts and Nuts
	2	Cylinder Head Assembly
	16	Cylinder Head Gasket
	1 set	Bowl Plug for one Cylinder
Piston	2	Connecting-Rod Assembly
	2 set	Connecting-Rod Bearing
	2	Cylinder Liner (if equipped)
	2	Piston
	4	Connecting Rod bolt
	2	Piston Pin
	4	Piston Pin Retainer
	3	Piston Ring (set)
	3 sets	Cylinder Liner Seals(if equipped)
Valve	4	Valve Seats (Intake)
	4	Valve Seats (Exhaust)
	4	Valve (Intake)
	4	Valve (Exhaust)
	8	Valve Rotator
	8	Valve Stem seal

	8	Valve Guide
	16	Valve Clip
	8	Valve Springs (pair)
Electical parts	2	Starter Motor
	1	Harness (if equipped)
	1	ECM(if equipped)
	1 set	Sensors
Turbocharger	1 set	Stud and Nut for Turbocharger
	1	Turbocharger
Repair kit	1	Repair Kit
Lubrication system	1	Oil Cooler
	1	Main Oil Passage Valve
	1	Pre-lubricating Pump
	1	Oil Pan Seal Gasket(if equipped)
Cooling System	1	Water Pump
	1 set	Thermostat
Fuel system	3	Fuel Injector
	3	Fuel Injector Washer
	1	Fuel Injection Pump
Exhaust system	8	Bolt for Exhaust Manifold
1. This recommended stock is not including the parts that are needed for the regular maintenance and the overhaul.		
2. The table is only a recommendation and can be adjusted according the operation.		

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Aftersales Service Center: sav@baudouin.com

Appendix 9.05

Emission datasheet

	Model : 16M55G0D3/5	Date : 07/02/26
		Revision: Rev.26.01
	PowerKit Emission Datasheet	Page : 1 / 1

Engine Basic data

Engine model	16M55G0D3/5
Max. test power @1500rpm (kWm)	2750
N° of Cylinders / Valves	16 / 64
Cylinders arrangement	At Vee
Displacement (L)	87.5
Thermodynamic Cycle	Diesel 4 stroke
Cooling System	Liquid (water + 50% antifreeze)
Injection System	Direct
Fuel System	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled
Fuel type	Diesel
Turbocharger configure	4
Emission Standard	China Stage III

Test information

Test Date	05/12/24
Test Cell No.	B08
Test Procedure	ISO 8178 ⁽¹⁾

Measured data*

Load % of PRP	Power (kWm)	Air Inlet Temp (°C)	Exhaust Temp (°C)	Exhaust Flow (kg/h)	NOx (g/kWh) / (mg/Nm ³)	HC (g/kWh) / (mg/Nm ³)	CO (g/kWh) / (mg/Nm ³)	PM (g/kWh) / (mg/Nm ³)
110%	2750	25	624	14203	N/A/ 1922.1	N/A/ 32.3	N/A/ 293.7	N/A/ N/A
100%	2500	25	588	12983	N/A/ 1666.5	N/A/ 57.8	N/A/ 267.6	N/A/ N/A
75%	1875	25	544	11865	N/A/ 1177.9	N/A/ 74.8	N/A/ 245.1	N/A/ N/A
50%	1250	25	460	8574	N/A/ 1292.1	N/A/ 95.3	N/A/ 282.9	N/A/ N/A
25%	625	25	398	6178	N/A/ 916.3	N/A/ 175.9	N/A/ 218	N/A/ N/A
10%	250	25	241	4610	N/A/ 2670.6	N/A/ 336.1	N/A/ 392.2	N/A/ N/A
Weighted Value					4.43/ N/A	0.35/ N/A	0.74/ N/A	0.12/ N/A

* Test Methods and Conditions:

1. Steady-Stage emissions recorded per ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rates stabilized.
2. Reference Conditions: 40°C Fuel inlet temperature, 100kPa Barometric pressure, 10.7g/kg of dry air Humidity.
3. mg/Nm³ values are measured dry and corrected to 5% O₂ content, standard reference conditions (0°C, 101.3kPa)
4. The emission data tabulated here are representative of test data taken from a single engine under test conditions shown above, and are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.



Date Mon 2026-02-23 16:21

To Muhammad Ali QURESHI <m.qureshi@baudouin.com>; Luke Spent | AVK <Luke.Spent@avk-seg.com>

Hello Ali,
Please see below the

Load % of PRP	Power (kWm)	Exhaust Flow (kg/h)	NOx (mg/Nm³)	NOx (g/kWh)	HC (mg/Nm³)	HC (g/kWh)	CO (mg/Nm³)	CO (g/kWh)	PM (mg/Nm³)	PM (g/kWh)
110%	2750	14203	1922.1	7.68	32.3	0.13	293.7	1.17	N/A	N/A
100%	2500	12983	1666.5	6.69	57.8	0.23	267.6	1.07	N/A	N/A
75%	1875	11865	1177.9	5.76	74.8	0.37	245.1	1.20	N/A	N/A
50%	1250	8574	1292.1	6.85	95.3	0.51	282.9	1.50	N/A	N/A
25%	625	6178	916.3	7.00	175.9	1.34	218.0	1.67	N/A	N/A
10%	250	4610	2670.6	38.09	336.1	4.79	392.2	5.59	N/A	N/A

+/-2% variation on the calculation. Calculation is done based on the following assumptions:

- Exhaust density: 1.293 kg/Nm³
- Normal conditions: 0°C, 1 atm
- Gas basis: Dry
- Power reference: Engine gross kWm
- Flow type: Total wet exhaust mass

est regards
adi



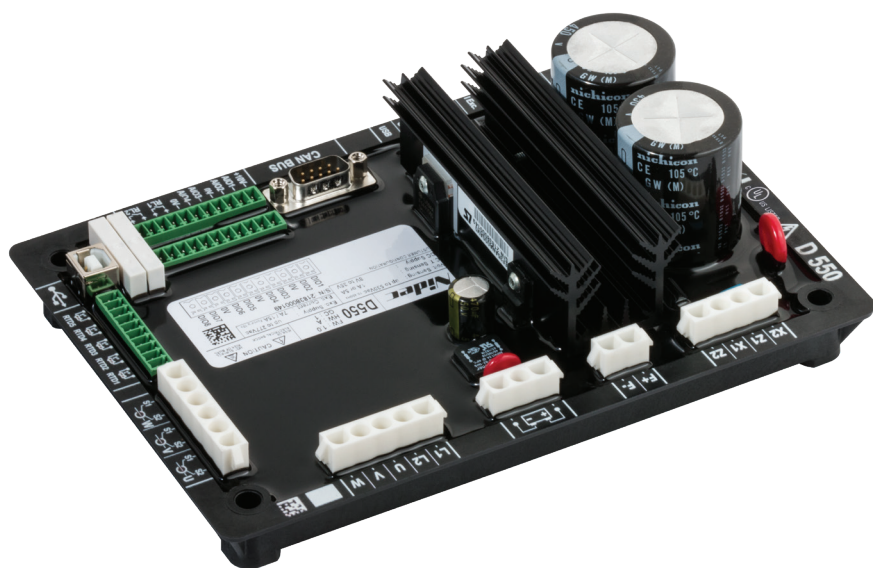
Hadi MEHDIPOUR
G-Drive Applications Engineering Manager



Appendix 9.06

AVR datasheet

D550 DIGITAL AVR FOR ALTERNATORS WITH SHUNT, AREP OR PMG EXCITATION



The D550 is a digital automatic voltage regulator (AVR) for alternators with rated field current up to 8 A at 55°C.

It offers a vast array of regulation modes suitable for all power generation applications, including grid-connected configurations.

The D550 also integrates a visual interface through the EasyReg Advanced software, which allows the user to read the configuration values and parameters. It can also be configured directly via USB without external power supply.

The D550 also includes several protections and functions to keep the alternator running in full safe operation, in particular settings to comply with public network connection instructions (grid code).

The communication port is CANJ1939 compatible.

KEY FEATURES

- **Regulation modes:**
 - Voltage regulation accuracy: $\pm 0.25\%$
 - Field current (manual mode)
 - Generator power factor
 - Grid power factor
 - Generator kVAr
- **Regulation features:**
 - Voltage equalization
 - Droop management
 - Cross current compensation
 - Soft start
 - Load Acceptance Module (L.A.M.) function to assist during heavy load application events
 - Negative field forcing
- **kW, kVAr, kVA and PF calculation**
- **Protections & Limitations:**
 - Under and over field current limitation
 - Loss of field sensing
 - Generator under/over voltage
 - Loss of sensing
 - V/Hz regulation mode
 - Diode fault monitor
- **Data logger** (option)
- **Synchronization monitoring**
- **Events log**

ELECTRICAL FEATURES

- **Generator voltage measurement:**
 - 3-phase, 2-phase
 - Range: 0-230-530 VAC
 - Consumption: < 2 VA
- **Grid voltage measurement:**
 - 2-phase
 - Range: 0-230-530 VAC
 - Consumption: < 2 VA
- **Generator current measurement:**
 - 1 or 3-phase
 - Secondary range: 1 or 5 A
 - Consumption: < 2 VA
- **AC supply input:**
 - PMG, AREP, SHUNT
 - Range: 50-277 VAC
- **Excitation:**
 - Rated field current (continuous):
 - 7 A at 70°C
 - 8 A at 55°C
 - Field forcing current (10s max):
 - 15 A at 70°C
 - Recommended field resistance:
 - > 4 ohms
- **Auxiliary supply:** 8-35 VDC
 - Consumption: < 1 A
- **Frequency range:** 30-400 Hz
- **Storage temperature range:**
 - 55°C +85°C
- **Operating temperature range:**
 - 40°C +70°C

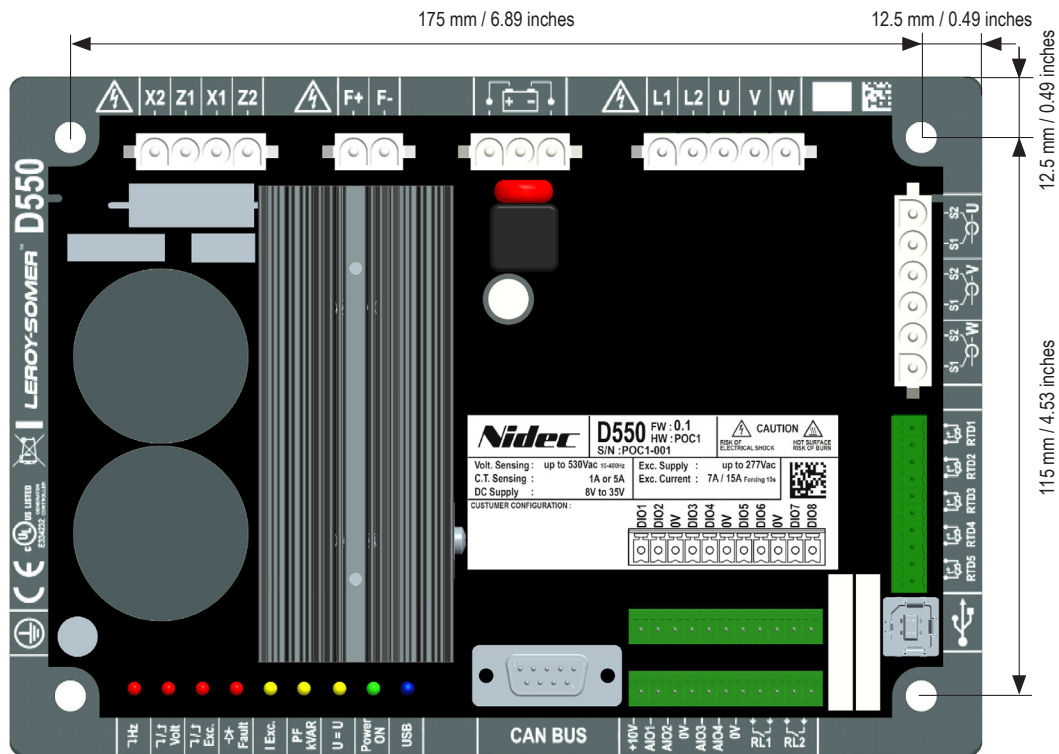
INPUTS / OUTPUTS

- **8 programmable digital inputs & outputs:**
 - Output specification: 150 mA - 30 VDC
- **4 programmable analog inputs & outputs:**
 - 4-20 mA / ± 10 V / 0-10 V / potentiometer (1 k Ω)
- **2 relay outputs:**
 - Specifications: 125 VAC - 5 A
- **5 temperature sensings:**
 - Type: Pt100/CTP
 - Programmable threshold

COMMUNICATION AND SETTINGS

- Software configuration (PC tool)
- USB port (self powered)
- CAN J1939 and Proprietary (Nidec Power protocol)

DIMENSIONS



Appendix 9.07

Battery datasheet

OPTIMA® YellowTop S 5,5



Battery Model: YT S 5,5

Part Number: 851 187 000 888 2

Nominal Voltage: 12 volts

NSN: 6140 01 502 4973

Description: High power, dual purpose engine start and deep cycle, sealed lead acid battery

Physical Characteristics:

Plate Design: High purity lead-tin alloy. Wound cell configuration utilizing proprietary SPIRALCELL® technology.

Electrolyte: Sulfuric acid, H₂SO₄

Case: Polypropylene

Color: Case: Light Gray
Cover: "OPTIMA" Yellow

Group Size: BCI: 31

	Standard	Metric
Length:	12.813"	325 mm
Width:	6.500"	165 mm
Height:	9.375"	238 mm (height at the top of the terminals)
Weight:	59.8 lb	26.5 kg

Terminal Configuration: SAE / BCI automotive.

Performance Data:

Open Circuit Voltage (fully charged): 13.1 volts

Internal Resistance (fully charged): 0.0025 ohms

Capacity: 75 Ah (C/20)

Reserve Capacity: BCI: 155 minutes
(25 amp discharge, 80°F (26.7°C), to 10.5 volts cut-off)

Power:

CCA (EN -18°C): 975 amps

MCA (BCI 0°C): 1125 amps

Recommended Charging:

The following charging methods are recommended to ensure a long battery life: (Always use a voltage regulated charger with voltage limits set as described below.)

Model: YT S 5,5

These batteries are designed for starting and deep cycling applications and for use in vehicles with large accessory loads.

OPTIMA® YellowTop S 5,5

Recommended Charging Information:

Alternator:	13.65 to 15.0 volts
Battery Charger (Constant Voltage):	13.8 to 15.0 volts; 10 amps maximum; 6-12 hours approximate
Float Charge:	13.2 to 13.8 volts; 1 amp maximum (indefinite time at lower voltages)
Rapid Recharge: (Constant voltage charger)	Maximum voltage 15.6 volts. No current limit as long as battery temperature remains below 50°C (125°F). Charge until current drops below 1 amp.
Cyclic or Series String Applications:	14.7 volts. No current limit as long as battery temperature remains below 50°C (125°F). When current falls below 1 amp, finish with 3 amp constant current for 1 hour. All limits must be strictly adhered to.

Recharge Time: (example assuming 100% discharge – 10.5 volts)

Current	Approx. time to 90% charge
100 amps	52 minutes
50 amps	112 minutes
25 amps	210 minutes

Recharge time will vary according to temperature and charger characteristics. When using Constant Voltage chargers, amperage will taper down as the battery becomes recharged. When amperage drops below 1 amp, the battery will be close to a full state charge.

(All charge recommendations assume an average room temperature of 25°C, 77°C)

Always wear safety glasses when working with batteries.

Always use a voltage regulated battery charger with limits set to the above ratings. Overcharging can cause the safety valves to open and battery gases to escape, causing premature end of life. These gases are flammable! You cannot replace water in sealed batteries that have been overcharged. Any battery that becomes very hot while charging should be disconnected immediately.

Not fully charging a battery can result in poor performance and a reduction in capacity.

Shipping and Transportation Information:

OPTIMA batteries can be shipped by AIR. The battery is nonspillable and is tested according to ICAO Technical Instructions DOC. 9284-AN/905 to meet the requirements of Packing Instructions No. 806 and is classified as non-regulated by IATA Special Provision A-48 and A-67 for UN2800. Terminals must be protected from short circuit.

Manufacturing Location:

OPTIMA Batteries
17500 East 22nd Avenue
Aurora, CO 80011
United States of America
Phone: 303-340-7400
Fax: 303-340-7474

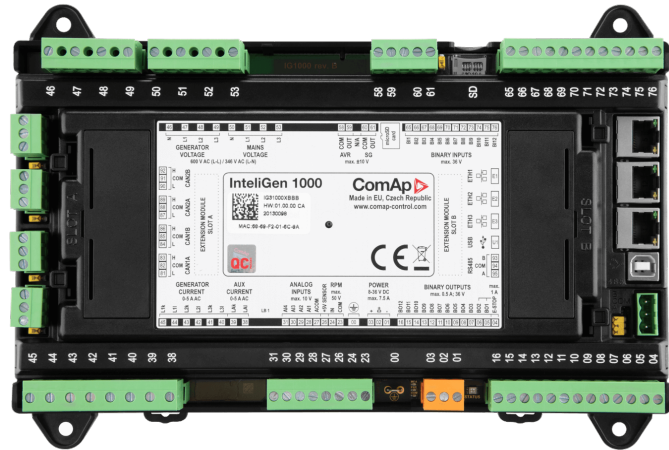
BCI = Battery Council International

OPTIMA Batteries
Product Specifications: Model YT S 5,5
June 2005

Appendix 9.08

ComAp datasheet

InteliGen 1000



Order code: IG31000XBBB

Datasheet

Paralleling gen-set controller for switchgear applications

Product description

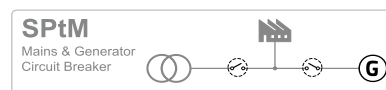
- True RMS measurement is used with Voltage, Current and Power measurement.
- Comprehensive paralleling Gen-set controller for island or mains parallel operation
- Cooperation with up to 64 gen-set / mains / tie controllers
- Direct communication with ECU
- Secure Remote control and monitoring
- Highly flexible yet configurable solution for switchgear applications

Key features

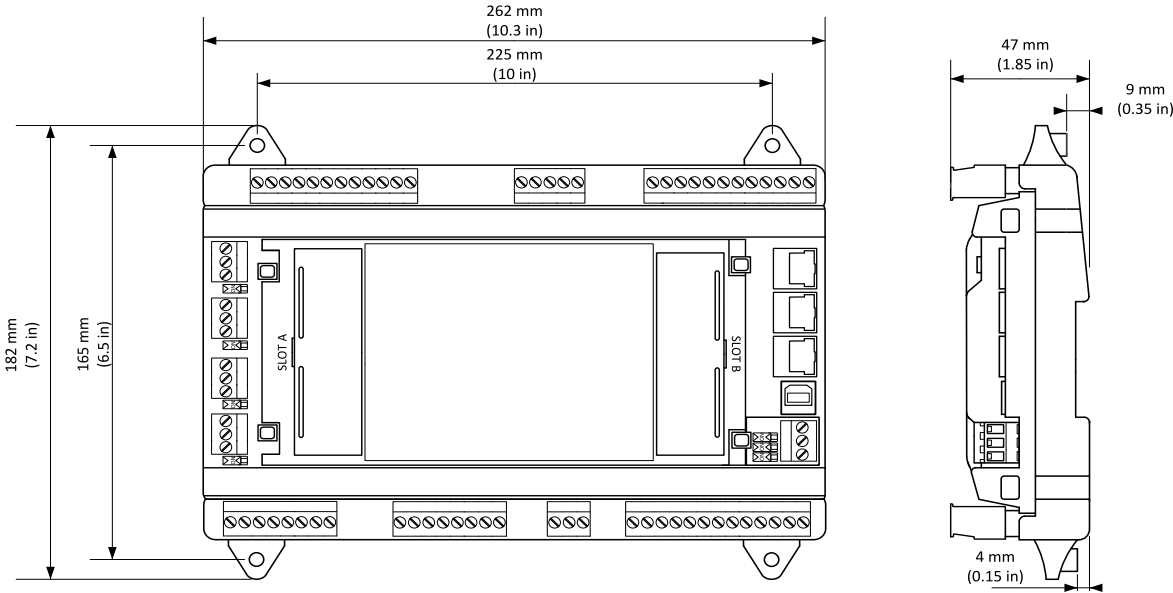
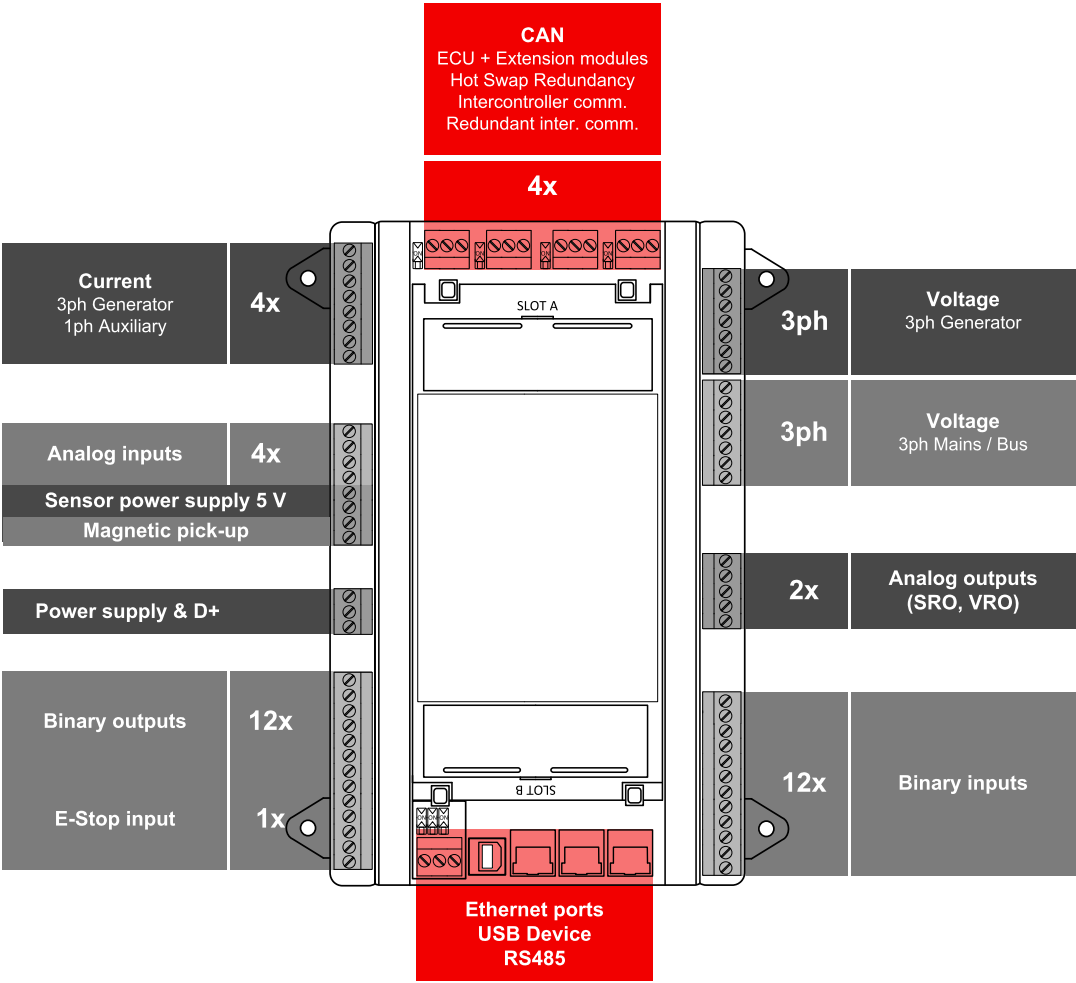
- Hardware compliant to the latest switchgear market needs
- State of the art AC accuracy measurements which allows to participate on primary frequency control mechanism, grid balancing and demand response projects
- Cybernetic security by design, based on the ANSI/ISA-62443 standard
- Large portion of both local and remote monitoring options, with high number of at once connected clients split into "trusted" and "untrusted" zones
- Mains parallel operation with support of Grid codes, compliant to European Grid codes (Requirements for Generators, VDE-AR-N 4110:2018, VDE-AR-N 4105:2019, G99), American IEEE 1547
- Multiple Island operation with cooperation up to 64 additional gen-set/mains/tie controllers
- Several load transfer options with possibility of less than 100ms load transfer
- Redundant inter-controller line for critical applications like datacentres, hospitals

- Double redundancy of the kW and kVAr sharing
- User management allowing to handle up to 30 unique users
- AirGate 2.0 makes sure that the connection to the controller is established faster from all around the world, and is more reliable than ever before.
- Internal PLC interpreter with easy to use PLC Editor, for simple and fast creation of specific logic
- Up to 31 characters in texts, parameters, Alarms for system clarity and easy troubleshooting
- Compatibility with ComAp IG/IS/IM-NT line, IG200, IG500 controllers
- ENABLE/DISABLE concept of features and protections makes the system highly versatile yet simple and easy for both commissioning engineers and operators
- Support for 400 Hz generators (measurement up-to 520 Hz)

Application overview



Terminals and dimensions



Technical data

Power supply

Power supply range	8-36 V DC
Power consumption	16 W
RTC battery	Replaceable, type CR1632 3V
Fusing power	8 A
Consumption	2.5 A Controller + 10 x 0.5 A BOUTs @ 8 V
Fusing E-STOP	1 A
Max. Heat Dissipation	16 W

Operating conditions

Operating temperature	-40 °C to +70 °C
Storage temperature	-40 °C to +80 °C
Operating humidity (norm 60068-2-30)	25/55°C, 48hours, 95 % non-condensing (EN 60068-2-30)
Protection degree (enclosure)	IP20
Vibration	5-25 Hz, ± 1.6 mm 25-100 Hz, $a = 4$ g
Shocks	$a = 500$ m/s ²
Surrounding air temperature rating 70 °C.	
Suitable for pollution degree 2.	

Weight

Controller	750 g
Package	920 g

E-Stop

Dedicated terminal for safe Emergency Stop input.
Physically disconnects BO 1 & BO 2 from power supply.

Binary inputs

Number	12, non-isolated
Close/Open indication	0-2 V DC close contact 6-36 V DC open contact
Configurable	Pull-up / Pull-down
Pulse input	Bin 9 and 10 max. 50 Hz

Binary outputs

Number	12, non-isolated
Max. current	0.5 A
Switching to	Positive supply terminal

Analog inputs

Number	4, switchable (R/U/I)
Range	R = 0-10000 Ω ; U = 0-10 V; I = 0-20 mA
Accuracy	R: 2 % from value for 0-250 Ω R: 4% from value for 250-2500 Ω R: 6 % from value for 5000-10000 Ω U: 1% from value ± 100 mV I: 1% from value ± 200 uA

Voltage regulator output

Protection	Reinforced isolation
Type	Switchable: U ± 10 V, I ± 20 mA, PWM: 0 V/5 V
Accuracy	U: 1 % from value ± 100 mV I: 1 % from value ± 200 uA

Speed governor output

Protection	Basic isolation
Type	Switchable: U ± 10 V, I ± 20 mA, PWM: 0 V/5 V
Accuracy	U: 1 % from value ± 100 mV I: 1 % from value ± 200 uA

Magnetic pick-up

Minimum input voltage	4 V pk-pk to 50 V pk-pk in range 4 Hz to 1 kHz
Working voltage range	6 V pk-pk to 50 V pk-pk in range 4 Hz to 5 kHz 10 V pk-pk to 50 V pk-pk in range 4 Hz to 10 kHz
Frequency input range	4 Hz to 10 kHz
Frequency measurement tolerance	0.2 % from range 10 kHz

AC Current measurement

Measurement inputs	3ph Gen current 1ph Mains current (Auxiliary current)
Measurement range	1 A / 5 A
Maximum continuous current	2 A / 10 A
Allowed overload	18 A for 15 sec.
Accuracy	± 3 mA / ± 15 mA for 0.0 to 0.4 A / 0.0 to 2.0 A 0.75 % of value for 0.4 to 1.0 A / 2.0 to 5.0 A
Frequency range	33-67 Hz (accuracy 0.002 %) 267-520 Hz (accuracy 0.01 %)
Input impedance	< 0.1 Ω

AC Voltage measurement

Measurement inputs	3ph-n Gen voltage 3ph-n Mains voltage
Measurement range	115 V ph-N / 200 V ph-ph suitable also for VTs output VT not present 231 V ph-N / 400 V ph-ph UL, cUL: 346 V ph-N / 600 V ph-ph
Linear measurement and protection range (maximal voltage)	433 V ph-N / 750 V ph-ph
Accuracy	0.25 %
Frequency range	33-67 Hz (accuracy 0.002 %) 267-520 Hz (accuracy 0.01 %)
Input impedance	0.72 M Ω ph-ph , 0.36 M Ω ph-n
Upper-harmonics filtering	Active Low-Pass filter, Cutoff frequency 3100Hz (-3dB)
Rated Insulation Voltage	600 V
Dielectric Test Voltage	600 V
Measurement category CAT III, overvoltage category III	

Communications

USB Device	Basic isolation, USB type B
RS 485	Basic isolation
ETH1 ETH2 ETH3	10/100 Mbit
CAN 1A CAN 2A CAN 1B CAN 2B	Basic isolation, 1000/250/50 kbps , nominal impedance 120 Ω

Available simulator

Product	Order code
InteliGen1000 StarterKit	SM4IG1K5BAB

Available plug-in modules

Product	Description	Order code
CM-4G-GPS	An easy-to-use and highly efficient solution for connecting the controllers online via 4G network.	CM24GGPSXBX
CM-RS232-485	Communication module enabling integration of the controller into the local monitoring system	CM223248XBX
*EM-BIO8-EFCP	Binary I/O plug-in module with 8 binary inputs or outputs.	EM2BIO8EXBX

Note: Controller has 2 slots for plug-in modules.

Note: *EFCP is already included on the CU as aux current measurement, EFCP on BIO8 module is not available.

Note: Plug-in modules are supported on controller HW version 01.01.xx and higher.

Available external displays

Product	Description	Order code
InteliVision 5.2	5" TFT external display with 800x480 px resolution	RD2IV5BXBAA
InteliVision 10Touch	10.1" Touchscreen display unit with 1280 x 800 px resolution	RD1IV10TBPF
InteliVision 13Touch	13.3" Marine certified display unit with 1920 x 1080 px resolution	RD1IV13TBME
InteliVision 18	18.5" Touchscreen display unit with 1366 x 768 px resolution	RD31840PBIE

Available CAN modules

Product	Description	Order code
Inteli AIN8	8 Analog Input Channels and 1 RPM/Impulse Input Module	I-AIN8
Inteli AIN8TC	8 Analog Input Channels for termocouples measurement	I-AIN8TC
Inteli AIO9/1	4 Analog Inputs for differential voltage measurement, 4 Analog Input equipment channels, 1 Analog Input for resistance measurement and 1 Analog Output	I-AIO9/1
Inteli IO8/8	16 Configurable Binary Inputs/Outputs and Analog Outputs Module	I-IO8/8
IGL-RA15	Remote Annunciator w/ 15 programmable LEDs	EM2IGLRABAA
IGS-PTM	4 Analog Inputs, 1 Analog Output, 8 Binary Inputs and 8 Binary Outputs	IGS-PTM
I-AOUT8	8 configurable analog outputs	I-AOUT8
IS-AIN8	8 configurable analog inputs	IS-AIN8
IS-BIN16/8	16 galvanically separated inputs, 8 binary outputs, 2 pulse inputs	IS-BIN16/8
InteliFieldbus Gateway	Modbus TCP/RTU Communication gateway	CM1IFGATBBB
I-CR	CAN Repeater Module, compatible when using 32C/8C CAN Intercontroller Comm Mode	I-CR
InteliGateway 300	Communication gateway with configurable interfaces between Modbus TCP/RTU, ComAp CAN, WebSupervisor and InteliScada protocols allowing user-defined interconnection of all attached devices	CM2GW300BAB

Functions and protections

Support of functions and protections as defined by ANSI (American National Standards Institute):

Description	ANSI code	Description	ANSI code	Description	ANSI code
Master unit	1	Reverse power	32R	Power factor	55
Stopping device	5	Master sequence device	34	Overvoltage	59



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Web: www.comap-control.com

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Multi-function device	11	Undercurrent	37	Pressure switch	63
Overspeed	12	Excitation loss	40	Liquid level switch	71
Underspeed	14	Unit sequence starting	44	Alarm relay *	74
Speed and frequency matching device	15	Current unbalance	46	Vector shift	78
Data communications device	16EFT 16SC	Voltage unbalance	47	Reclosing relay	79
Starting-to-running transition contractor	19	Incomplete sequence relay	48	Overfrequency	81H
Synchronizing-check	25	Temperature monitoring	49T	Underfrequency	81U
Thermal relay	26	Overcurrent	50/50TD	ROCOF	81R
Undervoltage	27	Earth fault current	50N+64	Auto selective control/transfer	83
Annunciator	30	Overcurrent IDMT	51	Regulating device	90
Overload	32	Earth fault current IDMT	51+64		
Load shedding	32P	AC circuit breaker	52		

* extension module IGL-RA15 required

Certifications and standards

> EN 61000-6-2 > EN 61000-6-4 > EN 61010-1 > EN 60255-1:2009 > EN 60529 (IP20)	> EN 60068-2-1 (-40 °C/16 h) > EN 60068-2-2 (70 °C/16 h) > EN 60068-2-6 (2÷25 Hz / ±1,6 mm; 25÷100 Hz / 4,0 g) > EN 60068-2-27 (a=500 m/s²; T=6 ms) > EN 60068-2-30 (25/55 °C, RH 95%, 48 h)	> UL6200 * > UKCA	   
---	--	--	--

* ULC 6200:2019 Certified (see the NFL File for the FW version with the Witness test if it is required by the certification of the end product)

Grid codes

European Requirements for Generators, 2016/631	
> German VDE-AR-N 4110:2018 > American IEEE 1547	> UK ENA EREC G99 > Austrian TOR

List of SW Key Features

SW Key Feature	Order Code
CAN bus redundancy	SKREDCAN201
Hot Swap Redundancy	SKHOTSWAP01
Modbus Client	SKMODBCLI01
PLC package	SKPLCPCKG01
Variable Speed Generator	SW1VSGXXXXX



E-mail: info@comap-control.com
Web: www.comap-control.com

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Appendix 9.09

ComAp HMI datasheet

InteliVision 5.2



Order code: RD2IV5BxBAA

5" display for ComAp controllers

Datasheet

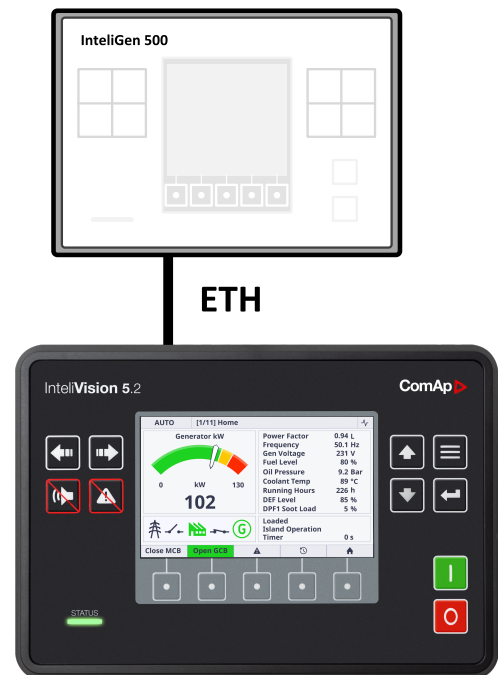
Product description

InteliVision 5.2 is an industrial 5" remote color display for ComAp controllers. It is designed as an easy-to-use Plug&Play display for monitoring and control of single gen-set in various applications.

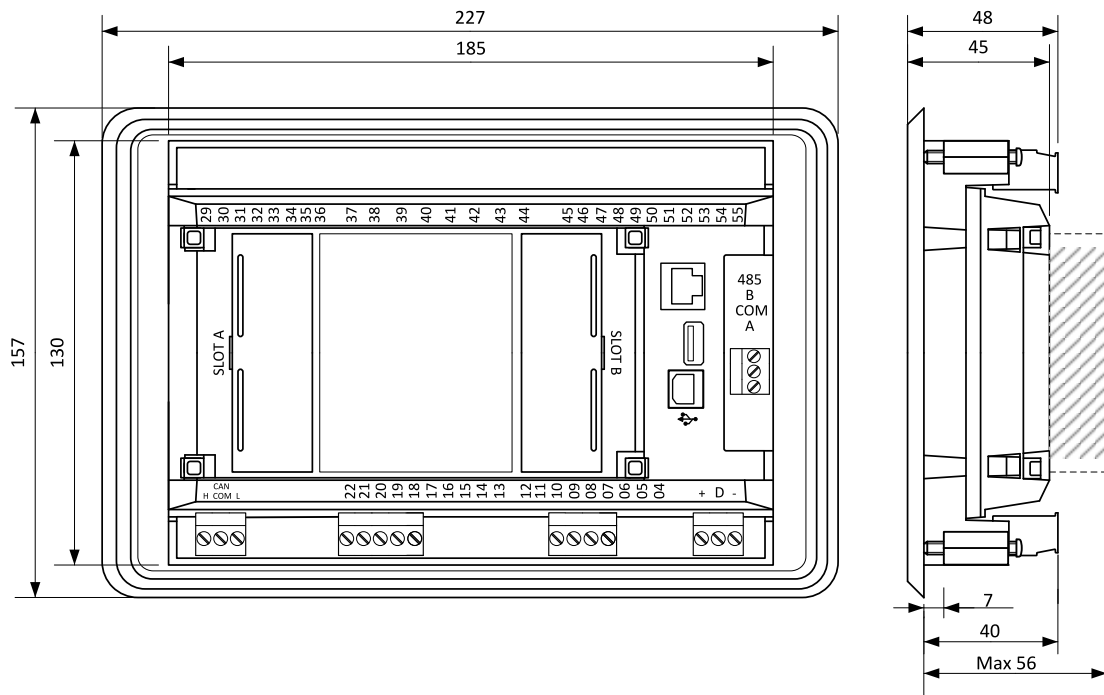
Key features

- 5" colour screen with resolution of 800 × 480 pixels
- Plug & Play operation
- Possibility of screens customization (Screen Editor)
- 5 configurable user buttons under the screen
- Modern look and graphical user interface
- Trends monitoring screen (up to 4 channels)
- Communication with controller via Ethernet
- Operating temperature: -30 °C to +70 °C
(-40 °C to +70 °C if the device is powered on above -30 °C)
- Front protection compliant with IP65
- 1x Analog Input, 1x Binary Output

Application overview



Dimensions, terminals and mounting



Note: Intelivision 5.2 can be mounted into the panel doors. Four holders are used for Display unit mounting. The recommended cut-out dimension for the unit is 187 mm × 132 mm (7.362 in × 5.196 in), approximately 2 mm wider than the unit size on each side.

Technical data

Power supply

Power supply range	8-36 VDC
Power consumption (typical values)	6 W (Actual consumption depends on LCD backlight intensity and actual CPU consumption.)

Operating conditions

Operating temperature	-30 °C to +70 °C (-40 °C to +70 °C)*
Storage temperature	-30 °C to +80 °C
Front panel protection	IP65
Humidity	95 % non-condensing (EN 60068-2-30)
Vibration	5-25 Hz, ± 1.6 mm 25-100 Hz, $a = 4$ g
Shocks	$a = 500$ m/s ²
Surrounding air temperature rating 70 °C.	
Suitable for pollution degree 2.	

Note: *) Device must be powered on above -30 °C to operate at temperatures to -40 °C.

Interfaces

Ethernet port	10/100 Mbit RJ45
RS-485	Not used
CAN	Not used
USB Device	Non-isolated type B connector
USB Host	Non-isolated type A connector

Analog inputs

Resistive input	R = 0-2400 Ω R: ± 2 % from value ± 5 Ω for 0-250 Ω R: ± 4 % from value for 250-2400 Ω (Dedicated for external LCD backlight control, 5-2400 Ω corresponds to 0-100% backlight)
-----------------	---

Binary outputs

Specification	1x, Non-Isolated max. 0.5 A (Active when controller's Horn output is activated)
---------------	---

LCD specification

LCD panel	TFT 5"
Resolution	800 × 480 px

Mechanical

Housing	Plastic
Mounting	4 clips
Recommended cut-out	187 × 132 mm (7.362 × 5.196 in)

Related products

Product	Description	Order code
InteliGen 500	ComAp's advanced paralleling gen-set controller with 5" colour display.	IG3500XXBAA
InteliGen 500 G2	ComAp's advanced paralleling gen-set controller with 5" colour display.	IG4500XXBAA
InteliGen 500 Microgrid	New software solution for total microgrid control and energy management.	SKMICROGR01
InteliGen 1000	ComAp's advanced gen-set controller for multiple gen-sets with paralleling operations	IG31000XBBS
InteliSys 2000	ComAp's advanced power generation control unit tailored for gas gensets.	IS32000XBBS , IS32000XBBSNU
InteliMains 510	Mains supervision controller.	IM4510XXBAA
InteliMains 1010	ComAp's mains/utility/tie-breaker supervision controller for complex applications.	IM31010XBBS
InteliNeo 5500	ComAp's master controller for renewables and storage devices.	INEO5500BAA
InteliNeo 6000	ComAp's controller for managing and optimising on-grid and off-grid hybrid microgrid systems .	INEO6000BBS
InteliNeo 530 BESS	ComAp's advanced energy management system .	INEO530BBAA

Certificates and standards

> EN 61000-6-2 > EN 61000-6-4 > EN 60068-2-1 (-20 °C/16h) > EN 60068-2-2 (70 °C/16h) > EN 60068-2-6 (2-25 Hz/±1.6mm; 25-100 Hz / 4.0 g) > EN 60068-2-27 (a=500 /m²; T=6 ms) > EN 60068-2-30:2005 25/55°C, RH 95%, 48hours > EN 60529 (front panel IP65, back side IP20) > UL 6200	    
List of standards is available on: https://webstore.iec.ch/	



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Web: www.comap-control.com

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Appendix 9.10

UTI letter

Generator Model	Hz	Rpm	Voltage	kVA	kWe
WPG3000B7	50	1500 (hp/rpm)	400V	3000	2400

***DCR: Exclusive Baudouin rating acceptable for Tier III and Tier IV Uptime Institute classification**

This letter is to confirm the established policy regarding the unlimited runtime rating for Weichai/Baudouin engine generators used for Uptime Institute Tier III and Tier IV Certifications.

Tier Standard: Topology requires that the engine generator systems are capable of supporting the design load for an unlimited number of hours.

2.5.2. Manufactures' Runtime Limitation

Engine generators for Tier III and IV sites shall not have a limitation on consecutive hours of operation when loaded to 'N' demand. Engine generators that have a limit on consecutive hours of operation at 'N' demand are appropriate for Tier I or II.

As per Uptime Institute Tier Standards manufacturers may attest to the unlimited runtime rating of an engine generator that may not meet Tier requirements with the nameplate rating. The approach requires the manufacturer to provide a statement in writing, signed by a technical authority that understands how the units are designed and how they are capable of performing.

Currently, Weichai/Baudouin has an agreement with Uptime Institute for their units as to the language required in each letter and approved signers. These letters are required for each project individually where these units are provisioned. As long as the letters detail the agreed upon language and are signed by the previously approved signers, these letters are accepted to establish the units capacity for Tier III and Tier IV Certifications.

Sincerely,



Head Office

AVK-SEG (UK) Ltd
Power Systems House
1-3 Malvern Road,
Maidenhead,
Berkshire
SL6 7RE

sales@avk-seg.com

UK

Tel: (+44) 300 373 0912

Ireland

Tel: (+353) 1431 9847

avk-seg.com

	Model : 16M55G6D2/5	Date : 01-01-25
	Exhaust Emission Datasheet	Page : 1 / 1

Engine Basic data

Engine model	16M55G6D2/5
Max. test power @1500rpm (kWm)	3300
N° of Cylinders / Valves	16 / 64
Cylinders arrangement	At Vee
Displacement (L)	87.5
Thermodynamic Cycle	Diesel 4 stroke
Cooling System	Liquid (water + 50% antifreeze)
Injection System	Direct
Fuel System	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled
Fuel type	Diesel
Turbocharger configure	
Emission Standard	EPA TIER2

Test information

Test Date	05/12/24
Test Cell n°	B04
Test Procedure	ISO 8178 ⁽¹⁾

Measured data^{*(2)(3)}

Load % of ESP	Power (kWm)	Ambient Temp (°C)	Exhaust Temp (°C)	Exhaust Flow (kg/h)	NOx (g/kWh) /(mg/Nm ³)	HC (g/kWh) /(mg/Nm ³)	CO (g/kWh) /(mg/Nm ³)	PM (g/kWh) /(mg/Nm ³)
100%	3302	25.7	492.6	17410.7	7.9/ 3885	0.08/ 35.7	0.18/ 85.2	0.01/ 5.84
75%	2476	25.7	478.4	15178.5	5.8/ 2923	0.11/ 48.6	0.30/ 145.7	0.03/ 15.08
50%	1651	25.7	462	11534.8	4.6/ 2440	0.17/ 82.41	0.32/ 164.5	0.05/ 24.16
25%	825	25.7	428.8	7061.6	4.3/ 2434	0.31/ 156.6	0.82/ 444.8	0.16/ 79.09
10%	330	25.5	320.5	5386	4.9/ 3387	0.81/ 510.4	1.25/ 839.9	0.22/ 138.22
Weighted Value					5.39/ -	0.17/ -	0.36/ -	0.06/ -

* Notes:

1. Steady-Stage emissions recorded per ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rates stabilized.
2. mg/Nm³ values are measured and corrected to 5% O₂ content, measured under standard reference conditions (0°C, 101.3kPa).
3. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.
4. This data was taken from a single engine test according to the Test Methods and Conditions specified. This data is subject to instrumentation, measurement, fuel quality, and engine-to-engine variability. Field emissions test data is not guarantee to these levels,the deviation can even be 10%. For air permit programs, please contact Application Engineering for expected site variation.

Generator

***Technical
Submittal
TS01***

***E2024-3031
Saunderton***



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

1.0 – Technical Submission Front Page

Trade Contractor:	AVK-SEG (UK) Ltd	From:	L.Spenst
Trade Contractor Sub No:	TS01	Date:	12/02/25
Revision:	0		
Reason for Revision:	First Issue		

Approval for the following equipment is required:

Equipment:	Diesel Generating Set	Make:	AVK
Equipment Reference:	WPG3000B7 Generating Set	Areas Used:	
Description:	Supply and installation of 7 no. DataCenter Rated with UTI Letter Diesel Generating Set comprising: • 12M55G10D2/5 (Tier 2) Emissions Optimised Diesel Engine • Leroy Somer LSA 54.2 ZL17 / 4p Brushless Synchronous Alternator • Mechanically Driven Cooling Package • DeepSea Generator Controller		
Planned on Site Date:	TBC		

Attached detail documents:

(Tick if included and insert references within boxes identifying supporting documentation included within this submission)

Section	Description	Tick	Section	Description	Tick
1.0	Technical Submission Front Page	✓	6.0	Interfaces and Dependencies Schedule	✓
2.0	Equipment Description	✓	7.0	Builders Work Requirements	X
3.0	List of Exceptions & Clarifications	✓	8.0	Schedule of Comments	✓
4.0	Manufacturers Documents	✓	9.0	Appendices	✓
5.0	Certified Drawings	X			

Signed by:	L.Spenst / Head of Engineering
Date:	12/0/2025

Approval:

Company	Name	Date	Status	Comments

Note: If client sign off and/or comments have not been received within 2 weeks of the date stated on this technical submission then the products and/or services detailed in the technical submission are deemed to be acceptable and final technical submission from AVK Projects will be based upon the scope covered within this document.



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

2.0 – Equipment Description

2.1 Requirements

We are required to provide of 7 no. 3000kVA/2400kW net, emission optimised (Tier 2), Datacenter rated with UTI letter, LV diesel generating set. Complete with mechanically driven cooling package and generator mounted controller

2.2 Generator

WPG3000B7 diesel generating set with 12M55G10D2/5 turbocharged diesel engine and Leroy Somer LSA 54.2 ZL17 / 4p brushless synchronous alternator.

Generating set sized to support a standby rated load of 3000kVA/2400kW net, at 400V, 3-phase, 50Hz, 1500 rev/min, for an unlimited number of operating hours per year with varying load conditions (average load factor <100%), as stated in the UTI letter, in accordance with ISO 8528-1 and ISO 3046-1. No overload capability for this rating.

Generating set designed to performance class G3.

Generating set supplied with:

- Integrated digital automatic voltage regulator (AVR)
- Dual 24V electrical starter motor with battery charging alternator (redundant operation)
- Dual 24V low maintenance lead acid starting batteries.
- 24V battery chargers
- Air, fuel, and lube oil filters
- Electronic engine management
- Common rail electronic injection system
- Low lube oil pressure protection switch
- High water temperature protection switch
- Low coolant level alarm
- Common skid frame with spring type anti-vibration pads between base frame and floor to provide a degree of isolation.
- Thermostatically controlled water jacket heater and circulating pump.
- Flanged exhaust bellows
- CE label

See the following appendices for further details:

[Appendix 9.01 – Generator Datasheet](#)

[Appendix 9.02 – Engine Datasheet](#)

[Appendix 9.03 – Alternator Datasheet](#)

2.2.1 Engine

Vee Configuration, liquid-cooled, four-stroke 12M55G10D2/5 (Tier 2) emissions optimised turbocharged diesel engine. Electronically controlled common rail fuel injection system with electric fuel pump, fuel pressure accumulator, high pressure fuel lines, duplex fuel filter.

Forced-feed lubrication system with piston cooling, lube oil circulation pump with lube oil filter, lube oil heat exchanger, oil filler neck and oil dipstick for measurement on non-running engine.

Thermostatically controlled water jacket heater with coolant circulation pump and coolant thermostat for charge air cooling circuit.

The power output is based on the below, site conditions:

- Designed ambient temperature – 40°C
- Altitude above sea level – <150m
- Exhaust Back Pressure – <140bar

See the following appendices for further details:

[Appendix 9.02 – Engine Datasheet](#)

2.2.2 Alternator

Leroy Somer LSA54.2 ZL17 / 4p brushless self-excited, self-regulating, double bearing, p2/3 winding type, IP23 drip proof, class H/F alternator sized to support a standby rated load of 3000kVA/2400kW net, at 400V, 3-phase, 50Hz, 1500 rev/min, for an unlimited number of operating hours per year with varying load conditions (average load factor <100%), as stated in the UTI letter, in accordance with ISO 8528-1 and ISO 3046-1. No overload capability for this rating.

Integrated digital type automatic voltage regulator (AVR) included to maintain alternator output voltage of 400V $\pm 5\%$ from no load to full load, unity to 0.8 lagging power factor, 3-phase, 50 Hz, 400V, 1500 rev/min and a total harmonic distortion (THD) of < 3.5%.

See the following appendices for further details:

[Appendix 9.03 – Alternator Datasheet](#)

[Appendix 9.04 – AVR Datasheet](#)

2.2.3 Cooling System

The generating set is supplied with a set mounted two-circuit type radiator assembly complete with expansion tank & cap and mechanically driven cooling fan.

Specifications:

- | | |
|---------------------------------|-----------------------|
| • Cooling ambient design: | 40°C |
| • Cooling altitude design: | <150m |
| • Engine coolant capacity: | 306 litres |
| • Intercooler coolant capacity: | 50 litres |
| • Coolant Type: | Glycol-Ethylene 50/50 |
| • Thermostat: | 79-92°C |

2.2.4 Starting System

The generating set starting system comprises:

- 24V 10kW electrical starter motor and redundant starter motor.
- 24V dual set low maintenance lead acid starting batteries (each sized for maximum 3 x genset starting attempts, 6 total crank cycles of 10 seconds with redundant operation).
- Battery charging alternator.
- Dual battery chargers fed from auxiliary supply.

See the following appendices for further details:

2.2.5 Earthing

Earthing points are provided on the generator base frame.

2.2.6 Generator Controller

The generating sets are controlled via Deep Sea 8620 Mk II controllers located within the generator control panel mounted on the bedframe of the generator set. The Deepsea controller provides individual set control and monitoring. The control panel is fed from the 24V DC battery backed generator supply and is operated with an 3-inch ergonomic screen.

The Deep Sea control panel provides:

- Control of the genset in both automatic and manual mode
- Testing of the generating set both on/off load
- Display of genset measurement values (electrical and mechanical)
- Status of generating set (both current and historical)
- Time-stamped event display with log for up to defined amount of events
- Adjustment of genset parameters with appropriate user level (i.e. timer settings)
- Automatic cooldown periods with user defined time settings
- Engine oil pressure
- Engine water temperature
- Engine oil temperature
- Engine speed
- Hours run
- Number of start attempts
- Battery voltage

Event-based history (up to 500 records) with customer-selectable list of stored values; RTC; statistic values.

See the following appendices for further details:

[Appendix 05 – Controller Datasheet](#)



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

3.0 - List of Exceptions & Clarifications

To be discussed separately.

4.0 - Manufacturers Documents

Please see appendices.

5.0 - Certified Drawings

N/A

6.0 - Interfaces and Dependencies Schedule

Auxiliary Supply Required	Detail	Quantity Required	Provided By	Final Connection By
TBC	Maintained Generator Auxiliary Supply	1 per generating set	Others	Others
High Level Interface	Generator alarm monitoring (Modbus)	1 per generating set	Others	Others
Low Level Interface	Generator alarm monitoring (VFC's)	TBC	Others	Others

Note: The above list is based on initial design information and may be subject to change as the project progresses.

7.0 - Builders Work Requirements

N/A



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

8.0 – Schedule of Comments

The following table provides a schedule of all comments required against this document and details the AVK response and status of each comment.

Item	Client Comment	AVK Response	Status

Note: Client to advise status of comment from the following list:

- Accepted (no further action)
- Rejected (refer to comments)



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

9.0 – Appendices

Item	Document Name
9.01	Generator Datasheet
9.02	Engine Datasheet
9.03	Alternator Datasheet
9.04	AVR Datasheet
9.05	Controller Datasheet
9.06	UTI Letter



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

APPENDIX 9.01

Generator Datasheet

WPG3000B7

DIESEL GENERATING SET

50 Hz – EPA Emission Tier II Compliant

GENERATING SET RATINGS 50Hz – 1500rpm @ 0.8p.f

NET	DCP		PRP		ESP	
Voltage	kVA	kWe	kVA	kWe	kVA	kWe
415/240	2750	2200	2750*	2200*	3000	2400
400/230	2750	2200	2750*	2200*	3000	2400
380/220	2750	2200	2750*	2200*	3000	2400

* The indicated PRP Power is for reference only.

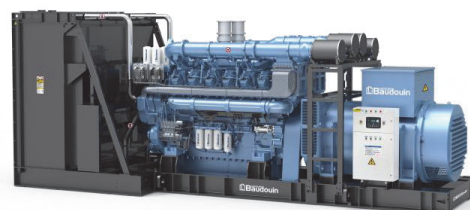


Image shown may not reflect actual configuration

PRODUCT STANDARD FEATURES

Engine and Block

- Vermicular graphite cast iron cylinder block and head
- Alloyed cast iron, wet cylinder liners with fire ring on the top
- Separate cylinder head with 4 valves, top-down cooling
- Hydraulic bolt for both the cylinder head and bearing cap
- Hardened steel forged crankshaft with induction hardened journals, crankpins and radius

Cooling System

- Two separate circuits
- High temperature circuit equipped with thermostatically-controlled system with one gear-driven coolant pump
- Low temperature circuit equipped with thermostatically-controlled system with one gear-driven coolant pump

Fuel System

- Super-high pressure common-rail fuel system for more peak fire pressure
- Pre-filter and main filters with electric fuel pump
- Multistage fuel-water separation system

Lubrication System

- Finned oil cooler, spin-on oil filters
- Bypass oil and oil thermostat to keep the oil temperature steady
- Electrical oil pre-lube pump to pre-lubricate the engine and ensure good starting ability

Electrical System

- Standard starting system comes with 2 x 24 Vdc electric starter motors and 1 x battery charging alternator
- Redundant dual starting system available as an option.

Air Intake and Exhaust System

- 4 single-stage turbochargers
- Exhaust manifold and turbocharger shield for heat isolating

Alternator

- High Efficiency Brushless, 4 Pole, IP23 drip-proof revolving field design built with Class H insulation/Class F Temperature rise
- Direct-coupled by high-elasticated coupling
- Sustained overcurrent >300% in 10 sec
- Direct drive centrifugal blower fan cooling
- Excitation by PMG

Generating Set Controller

- Baudouin's generating set controller is ideal for a wide range of applications.
- Display status message Provide protection Auto shutdown at fault detection
- The class of protection is IP4X
- See individual spec sheet for detailed specifications

1) All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271. Performance tolerance of $\pm 5\%$.

2) Test conditions: 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.

3) Power output curves are based on the engine operating with a fuel system, water pump, and lubricating oil pump; not included are the battery charging alternator, fan, and optional equipment.

GENERATING SET SPECIFICATIONS

Governor and regulation class	In accordance with ISO 8528-5 Class G3 performance
Phase number and connection	3 phase, 4 wires, Y-type
Cooling method	Closed looped water-cooled
Starting method	DC 24V Electric starter
Steady-state voltage deviation	$\leq \pm 1\%$
Steady-state frequency band	$\leq 0.5\%$

ENGINE

Brand / Model		Baudouin / 12M55G10D2/5
Gross Power	kWm	ESP – 2700/ PRP - 2420*
Cylinder / Type / Aspiration		12 / Vee Type, Turbocharged and Aftercooled
Bore x Stroke	mm	180 x 215
Displacement	L	65.65
Compression ratio		16.5:1
Brake Mean Effective Pressure	kPa	ESP – 3290

* The indicated PRP Power is for reference only

** See engine data sheet for detailed specification

ALTERNATOR

Coupling / No. of Bearing	Coupling/ Double
Winding Pitch	2/3
Type of Excitation	PMG
Cooling type	Air
Voltage regulation method	AVR
Winding temperature sensor	PT100
Bearing temperature sensor	PT100
Anti-condensation heater voltage	AC230V
Classes (Insulation / Temperature Rise)	H / F
Protection Grade	IP23

** See alternator data sheet for detailed specification

COOLING SYSTEM

Type of Coolant	Liquid(water + 50% antifreeze)	
Max coolant temperature – shutdown	°C	112
Cooling Fan Airflow	m3/min	2500

** See radiator data sheet for detailed specification

EXHAUST SYSTEM

Exhaust Gas temperature after the turbocharger	°C	550
Exhaust Gas flow	m3/min	ESP – 597.7 / PRP–534.2*
Max Exhaust back pressure	mBar	150
Noise level(Open)	dB(A)@1m(75%)	/
Noise level(Open)	dB(A)@7m(75%)	/

* The indicated PRP value is for reference only

FUEL CONSUMPTION (Tolerance +5%)

100% ESP	L/hr	642.5
100% PRP	L/hr	567.0
75% PRP	L/hr	416.2
50% PRP	L/hr	284.1
25% PRP	L/hr	156.9

GENERATING SET CONTROLLER

Baudouin's generating set controller is designed for manual/auto parallel systems.

The controller is an easy to use Synchronising Auto Mains (Utility) Failure Control Module suitable for paralleling single generating set (diesel or gas) with the mains (utility).

Key Benefits

- Real-time clock provides accurate event logging
- Ethernet communication, provides built in advanced remote monitoring.
- Can be integrated into building management systems (BMS) and programmable logic control (PLC)



Ratings definitions

Emergency standby power (ESP):

ESP is the maximum power available for a varying load for the duration of a main power network failure. The average load factor over 24 hours of operation should not exceed 70% of the engine's ESP power rating.

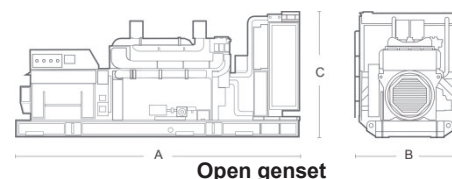
Typical operational hours of the engine are 200 hours per year, with maximum usage of 500 hours per year. This includes an annual maximum of 25 hours per year at the ESP power rating. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

Prime power (PRP):

PRP is the maximum power available for unlimited hours of usage in a variable load application. The average load factor should not exceed 70% of the engine's PRP power rating during any 24-hour period. An overload capability of 10% is available for 1 hour within every 12-hour period.

Data Center power (DCP):

DCP is the maximum power that an engine is capable of delivering while supplying a variable or continuous load and during unlimited run hours. An overload capability of 10% is available for 1 hour within every 12-hour period.



Open genset

This outline drawing is to provide representative configuration details for Model series only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Dimension and Weight

Structure	Model	Dim "A" mm	Dim "B" mm	Dim "C" mm	Dry wt. kg
Open	WPG3000B7	7570	2680	2980	24800

* Note: Sizes and weights represent a generating set with standard features and tolerance is $\pm 3\%$. See the outline drawings for the detailed configurations of sizes and weights.

Codes and standards

ISO 9001	This generator set is designed and manufactured in facilities certified to ISO 9001.	ISO 8528	This generator set has been designed to comply with ISO 8528 regulation.
CE	This generating set is designed and manufactured in facilities certified to CE certification.	UKCA	This generating set is designed to meet UKCA certification.

The generator set is designed and manufactured in facilities certified to standards ISO9001:2015 and ISO14001:2015. The generator set is prototype-tested, factory-built and production tested and is in compliance with the relevant standards:

- ISO 8528-13, ISO 3046, DIN627
- EN 60034-1, EN 60204-1
- Machinery Directive 2006/42/EC EMC Directive 2014/30/EU RoHS Directive 2011/65/EC

Data and specifications are subject to change without notice.



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

APPENDIX 9.02

Engine Datasheet

	Model : 12M55G10D2/5	Rev : 04
	PowerKit Engine Datasheet	Page : 1 / 4

Ratings

RPM	Gross Engine Output			Net Engine Output *		
	PRP	DCP	ESP	PRP	DCP	ESP
	kWm	kWm	kWm	kWm	kWm	kWm
1500	2420	2420	2700	2418.4	2418.4	2698.4

1 kWm = 1,34 BHP

* This data is calculated without radiator.

Basic data

Engine model	12M55G10D2/5
N° of Cylinders / Valves	12 / 48
Cylinders arrangement	At Vee
Bore x Stroke (mm)	180 x 215
Displacement (L)	65.65
Thermodynamic Cycle	Diesel 4 stroke
Mean Piston Speed (m/s)	10.75
BMEP @ ESP (Bar)	32.9
Cooling System	Liquid (water + 50% antifreeze)
Injection System	Direct
Fuel System	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled
Compression ratio	16.5 : 1
Flywheel housing	SAE 00
Flywheel	21"
N° of teeth on flywheel ring gear	202
Inertia of flywheel (kg•m ²)	20.78
Inertia of crankshaft (kg•m ²)	16.16
Emission standard	EPA Tier2
Overall Dimensions without radiator (Length x Width x Height) (mm)	2958 × 1544 × 2616
Engine dry weight without radiator and without radiator pipes (kg)	9550

DPK-TDS-12M55-6004-22-12-01 Moteurs Baudouin reserve the right to modify these specifications, without notice. Document not contractual.

	Model : 12M55G10D2/5	Rev : 04
	PowerKit Engine Datasheet	Page : 2 / 4

Air intake system

Air intake temperature rise (°C)	≤ 5
Air intake restriction clean filter (mBar)	≤ 30
Air intake restriction dirty filter (mBar)	≤ 70
Recommended air flow @ PRP (m³/min)	177.3
Recommended air flow @ ESP (m³/min)	181.1
Min. diameter of intake pipe (mm)	250

Aftercooling system

Aftercooler system type	Air to Water
Max. intake temperature @ 25°C ambient temperature (°C)	55
Max. difference between intake temperature and ambient temperature (°C)	30
Max. intake pressure drop of aftercooler (mBar).....	50

Lubrication system

Oil capacity Low / High (L)	330 / 380
Oil pressure in normal condition idle speed (Bar)	≥ 1.8
Oil pressure in normal condition at 1500 Rpm @ PRP (Bar)	4 - 6.5
Lowest oil pressure alarm (shutdown) (Bar)	1.8
Max. oil temperature (°C)	105
Oil flow at 1500 Rpm (L/min)	1080
Oil fuel consumption ratio based on engine fuel consumption data	≤ 0.2 %
Total system capacity (including filters) (L)	460

Heat balance test data (with ambient temperature 25 °C)

Total heat dissipation @ ESP (kJ/s)	3550
- Heat Rejection to HT Circuit @ ESP (kJ/s)	1018
- Heat Rejection to LT Circuit @ ESP (kJ/s)	556
- Radiated Heat to Ambient @ ESP (kJ/s)	110
- Heat Rejected to Exhaust @ ESP (kJ/s)	1866

Exhaust system

Max. exhaust back pressure (mBar)	150
Max. exhaust temperature before turbocharger (°C)	740
Max. exhaust temperature after turbocharger (°C)	550
Exhaust flow @ PRP (m³/min)	542.9
Exhaust flow @ ESP (m³/min)	567.1
Min. diameter of exhaust pipe (mm)	280
Max. bending moment of exhaust gas exit flange (Nm)	10

	Model : 12M55G10D2/5	Rev : 04
	PowerKit Engine Datasheet	Page : 3 / 4

Cooling system

Min. inside diameter of coolant outlet pipe LT/HT(mm)	76 / 96
Coolant alarm (shutdown) temperature (°C)	112
Thermostat opening temperature / full open temperature (°C)	80 / 92
Coolant capacity of the engine (L)	306
Max. additional restriction for external cooling circuit (Bar)	TBD
Max additional restriction - Duct allowance (Pa)	150

Fuel system

Governor	ECU
Governor steady state speed stability at constant load (ISO 8528-5 Class G3) ¹	≤ +/- 0.5 %
Max. restriction at fuel inlet (Bar)	0.1
Max. pressure at fuel inlet (Bar)	1
Max. fuel return restriction (Bar)	0.2
Max. fuel inlet temperature (°C)	70
Fuel supply flow (L/hr)	2800
Min. internal diameter of inlet pipe (mm)	19
Min. internal diameter of return pipe (mm)	19

Electrical system

Electrical system voltage (negative to ground) (Vdc)	24
Starter power (kW)	2 x 10
Battery charger current (A)	55
Battery charger absorbed power (kW)	1.6
Battery discharge current requirement at -18°C (CCA)	1800 - 2800
Max. electric resistance of starting circuit (Ω)	0.008
Min. sectional area of wire (mm²)	2 x 95
Min. ambient cold start temperature without auxiliary starting device (°C) ²	-10
Min. ambient cold start temperature with auxiliary starting device (°C) ²	TBD

¹ This refers only to the frequency response of the engine and should not be confused with the performance class of the Generator Set, which is subject to additional contributing factors such as alternator selection and control settings.

² Engines used in emergency standby application or applications that require immediate start under load, they must be equipped with coolant heaters. Baudouin recommend heaters installation to be executed by providing constant coolant circulation across all the engine components. Two heaters are required for V-type engines, one per each side.

	Model : 12M55G10D2/5	Rev : 04
	PowerKit Engine Datasheet	Page : 4 / 4

Noise

Diesel engine noise (Acoustic power level) (dB(A))	123.7
Noise - upper side (dB(A))	106.4
Noise - right side (view from flywheel) (dB(A))	106.2
Noise - left side (view from flywheel) (dB(A))	107.1
Noise – front (radiator) side (dB(A))	104.1
Noise – rear (flywheel) side (dB(A))	105.4

Notes :

- Noise test made at 100% of the ESP power, at 1 mt. distance, on engine without radiator, without cooling fan and without silencer.
- Noise test refers to GB/T 1859 norm : “Reciprocating internal combustion engines. Measurement of emitted airborne noise. Engineering method and survey method”.

Fuel consumption

Rating	gr/kWh	L/hr
100% ESP	195.8	629.4
100% PRP	197.8	576.9
75% PRP	209.2	457.7
50% PRP	221.6	323.2
25% PRP	229.8	164.1
Fuel consumption tolerance + 3 %		

Ratings definitions

Emergency Standby Power (ESP)

Emergency Standby Power is the maximum power available for a varying load for the duration of a main power network failure. The average load factor over 24 hours of operation should not exceed 70% of the engine's ESP power rating. Typical operational hours of the engine is 200 hours per year, with a maximum usage of 500 hours per year. This includes an annual maximum of 25 hours per year at the ESP power rating. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

Prime Power (PRP)

Prime Power is the maximum power available for unlimited hours of usage in a variable load application. The average load factor should not exceed 70% of the engine's PRP power rating during any 24 hour period. An overload capability of 10% is available, however, this is limited to 1 hour within every 12 hour period.

Data Centre Power (DCP)

Data Centre Power is defined as being the maximum power which a generating set is capable of delivering while supplying a variable or continuous electrical load and during unlimited run hours. Depending on the sites to supply and the availability of reliable utility, the generating set manufacturer is responsible to define what power level he is able to supply to fulfil that requirement including hardware or software or maintenance plan adaptation.

Note : The engine driven alternating current generating set is a reliable source of power for the data centre and it can be also used to back up a reliable utility. Prolonged operation at load in parallel with a utility is not permitted.

- All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271. Performance tolerance of $\pm 5\%$.
- Test conditions : 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.
- Power output curves are based on the engine operating with fuel system, water pump and lubricating oil pump; not included are battery charging alternator, fan and optional equipment.

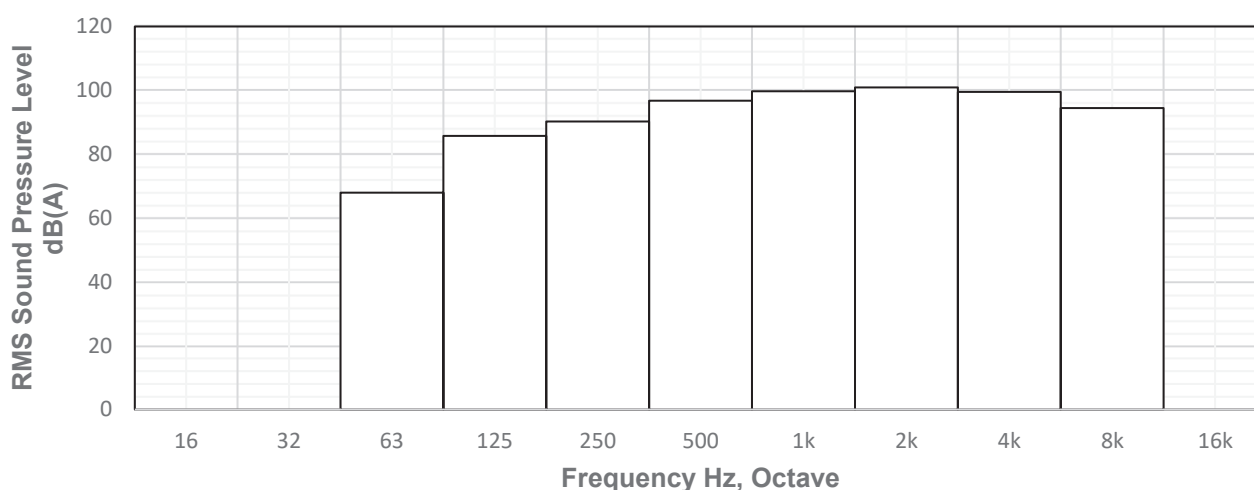
	Model : 12M55G10D2/5	Rev : 01
	AIRBORNE NOISE ANALYSIS	Page : 1 / 1

Engine Basic data

Engine model	12M55G10D2/5
N° of Cylinders / Valves	12 / 48
Bore x Stroke (mm)	180 x 215
Displacement (L)	65.65
Thermodynamic Cycle	Diesel 4 stroke
Injection System	Direct
Fuel System	High Pressure Common Rail
Aspiration	Turbocharged and Aftercooled

Test Information

Test Date	15/05/21
Test Cell n°	B08
Tested Power (kW) / Speed (rpm)	2700 / 1500
Turbocharger	4 × Garret GT55
Measuring Distance (m)	1
No. of Measuring Points	5
Sound Propagation	Free-Field
Measurement Standard	ISO 6798
Tolerance	+5 dB for single octave band, +2 dB(A) for total A-weighted level



Energy mean sound pressure levels-Engine Surface Total: LA= 106.0 dB(A)

Frequency [Hz]	16	32	63	125	250	500	1k	2k	4k	8k	16k
SPL dB(A)	N/A	N/A	67.9	85.7	90.2	96.7	99.7	100.9	99.5	94.4	N/A

1): Energy mean free-field levels of the airborne noise that is emitted by the engine surface.



AVK-SEG (UK) Ltd – Generator Technical Submittal – E2024-3031 – Saunderton

APPENDIX 9.03

Alternator Datasheet

ALTERNATOR TECHNICAL DESCRIPTION

WHA 54.2 ZL17 / 4p

Date: 06-17-2024

197 A, Fushou East Street, High-Tech Development Zone, Weifang, China

Main data				C
Generator type:	WHA 54.2 ZL17 / 4p			
Power:	3 000	kVA	2 400 kWe	2 486 kWm
Voltage:	400	V	Star serial	
Rated voltage range:	+5/-5%			
Power factor - Lagging:	0,8			
Frequency:	50	Hz		
Speed:	1 500	rpm		
Nominal current:	4 330	A		
Winding type:	p2/3			
Classes (Insulation / Temperature Rise):	H / F			
Ambient temperature:	45	°C		
Altitude:	1 000	m		
Installation		IEC	Quantity	1
Prime mover:	Reciprocating engine			
Manufacturer:	-			
Type:	-			
Duty:	Base Rating			
Mechanical construction				IM1101
Type of construction:	Two bearing			
Mounting arrangement:	Horizontal Axis			
Direction of rotation:	Clockwise (seen when facing the drive end - DE)			
Bearing type:	Anti-friction			
Bearing Lubrication:	Regreasable			
Bearing insulation:	Not insulated			
Shaft end type:	Cylindrical with keyway			
Balancing - Class (ISO 21940-11):	Half key - G2,5 (std)			
Flange:	None / without			
Shaft height:	500	mm		
Width:	1 150	mm		
Additional specificities				
Stabilized Runaway speed:	1 800	rpm - 2 min.		
Cooling Method				IC01
Degree of protection:	IP23			
Coolant:	Air / Temperature: 45 °C			
Air quality:	Clean			
Ventilation (internal):	Self-ventilated			
Filters:	Without			
Ducting for air inlet:	No			
Ducting for air outlet:	No			

ALTERNATOR TECHNICAL DESCRIPTION

WHA 54.2 ZL17 / 4p

Date: 06-17-2024

Connection, Excitation & Regulation

Parallel operation:	Island mode (0F) - no droop CT	1
Excitation:	Self-excited - Brushless - Type: PMG	1
Sustained 3-phase Isc:	> 3 x FLC for 10s.	1
AVR type:	Leroy Somer - D550 - Digital	1
AVR location:	In terminal box	1
Alternator Voltage sensing:	In terminal box	1
		-

Terminal box

Power connection:	4 connectors (brought out neutral)	1
Main terminal box location:	1 terminal box on the top	1
Line side outlet:	Left hand side (seen when facing the drive end - D)	1
Gland plate:	Non magnetic, Undrilled	1
Auxiliaries	In main terminal box	1
	-	1
		-

Protection and measurement accessories

Temperature detection

Stator windings:	6 x PT100 (3 wires)	1
Combined guide and thrust bearing - DE:	1 x PT100 per bearing (3 wires)	1
Guide bearing - NDE:	1 x PT100 per bearing (3 wires)	1
		1

Anti-condensation heating

Voltage: 230 V - 1Ph / Power: 500 W	1
	-
	-

Various items

Paint:	PE - Primary - RAL 7032	1
Documentation:	PDF manual	1
Documentation Language:	English	1
Nameplate	Sticker	1
		-

Controls

Standards:	IEC	1
QUAL/INES/006 001 => 101	Measurement of winding resistance	1
QUAL/INES/006 021 => 128	Insulation check on sensors (when fitted)	1
QUAL/INES/006 002 => 102&103	Voltage balance and phase order check	1
QUAL/INES/006 007 => 109	Overspeed test (according to test bench limitation)	1
QUAL/INES/006 009 => 111	High potential test	1
QUAL/INES/006 010 => 112	Insulation resistance measurement	1
		-

ALTERNATOR ELECTRICAL DATA

WHA 54.2 ZL17 / 4P

Date: 06-17-2024

Main data:

C

Power:	3 000	kVA	2 400	kWe	2 486	kWm	1
Voltage:	400	V	Frequency:	50	Hz		1
Rated voltage range:	+5% / -5%		Speed:	1500	rpm		1
Power factor - Lagging:	0,8						1
Nominal current:	4 330	A	Phases	3			
Insulation / Temperature rise:	H / F		Connexion	Star serial			1
Cooling:	IC01		Winding type:	p2/3			1
			Winding:	- 6 Wires			1
Ambient temperature:	45	°C					1
Altitude:	1000	m	Overspeed (rpm)	1800			1
Duty: Base Rating			Total Harmonic Distortion (THD)	< 3,5%			1

Efficiency (Base 2400 kWe)

IEC

	25%	50%	75%	100%	110%	
Power factor - Lagging: 0,8	90,66	94,78	96,03	96,56	96,67	1
Power factor - Lagging: 1	90,99	95,20	96,52	97,12	97,26	1

Reactances (%) - (Base 3000 kVA)

Unitary impedance (1 per unit) = 0,053333 ohms

		Unsaturated		Saturated		Unsaturated		Saturated	
		Direct axis				Quadrature axis			
Synchronous reactance	Xd	139	90	Xq	71	46			1
Transient reactance	X'd	15,3	13,0	X'q	71	46			1
Subtransient reactance	X''d	8,3	7,1	X''q	8,8	7,4			1
Negative sequence reactance	X2	8,5	7,3						
X0	1,8	Zero sequence reactance							1
Xl	4,2	Stator leakage reactance							
Xr	12,2	Rotor leakage reactance							
Kc	1,11	Short-circuit ratio							1

Time constants (s)

		Direct axis		Quadrature axis		
Open circuit transient time constant	T'do	4,22	T'qo	NA		1
Short-circuit transient time constant	T'd	0,466	T'q	NA		1
Open circuit subtransient time constant	T''do	0,061	T''qo	0,240		1
Subtransient time constant	T''d	0,033	T''q	0,030		1
Ta	0,057	Armature winding short circuit time constant				1

Resistances (%)

Ra	0,5	Armature resistance	R0	0,6	Zero sequence resistance	1
X/R	14,8	X/R ratio (without unit)	R2	1,7	Negative sequence resistance	

Voltage accuracy: 0,25%

Maximum inrush current for a voltage dip of 15%: 3833 kVA

when starting an AC motor having a starting power factor between 0 and 0.4

Rating is provided for the specified temperature rise, by resistance measurement according to IEC60034-1

According to: I.E.C. 60034.1 - 60034.2 - NEMA MG 1-32

Products and materials shown in this catalogue may, at any time, be modified in order to follow the latest technological developments.

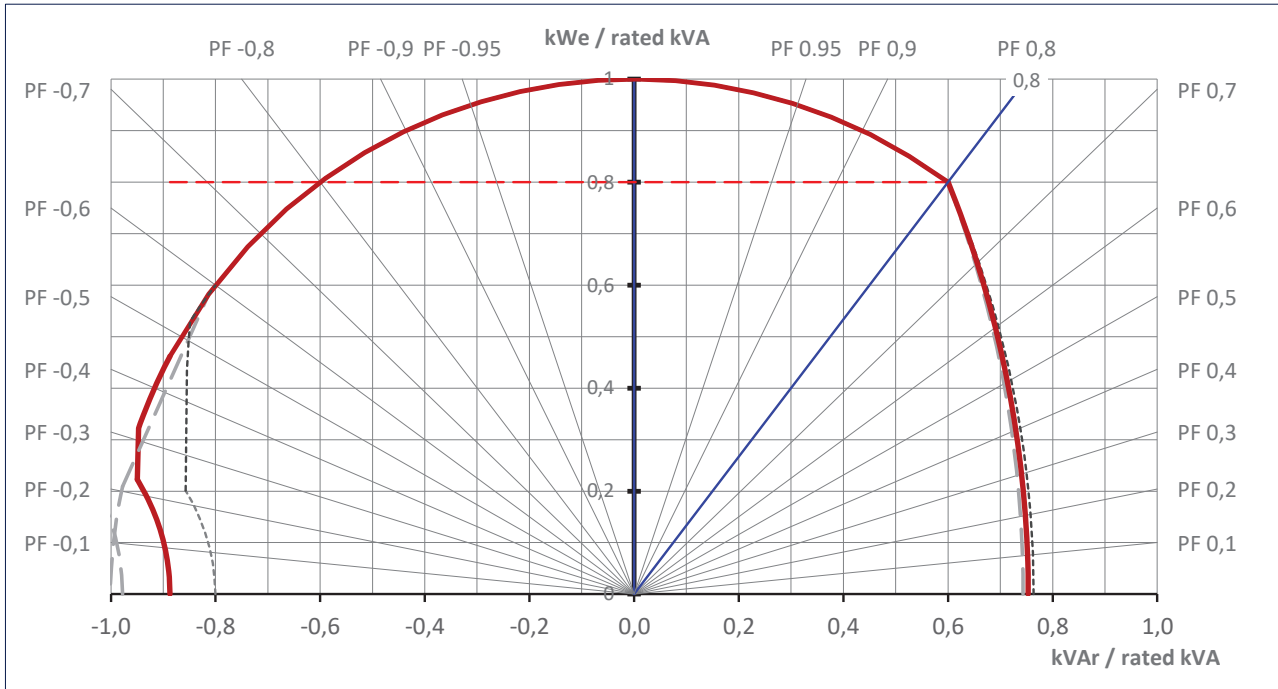
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

3000kVA - 400V - 50 Hz

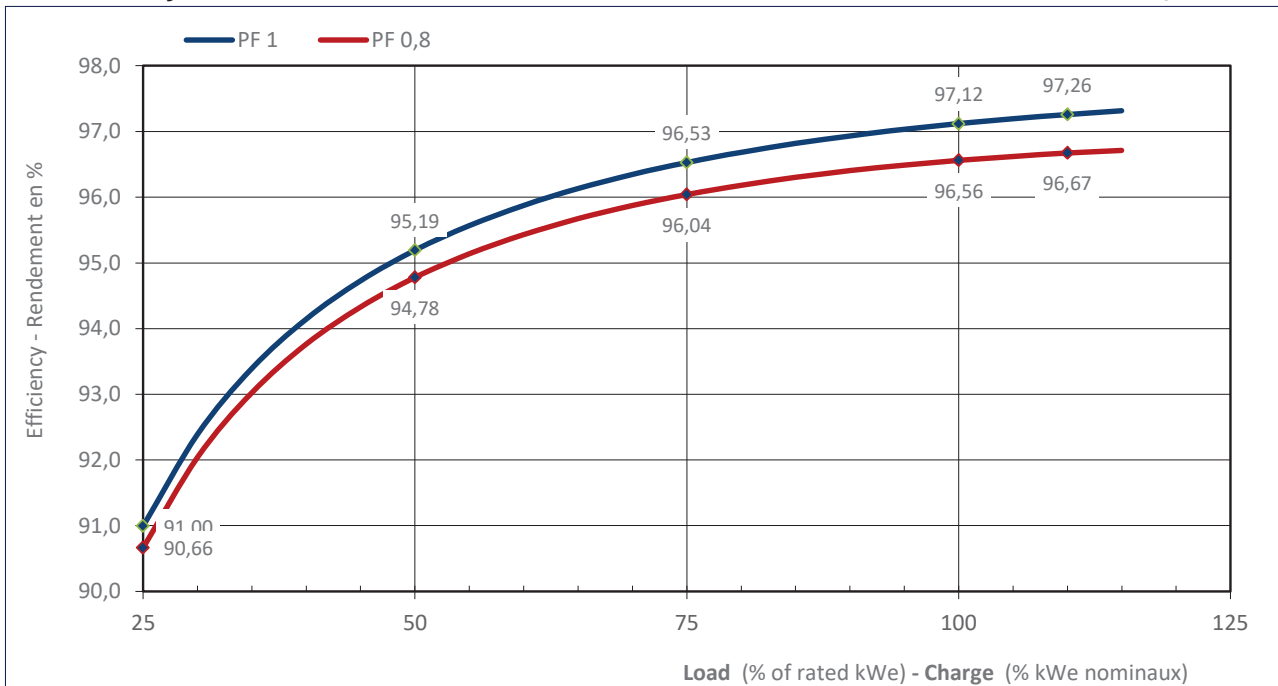
Capability Curve

---	Umax	+ 5%	420	V
—	Un		400	V
- - - -	Umin	- 5%	380	V



Efficiency Curves

According to: IEC



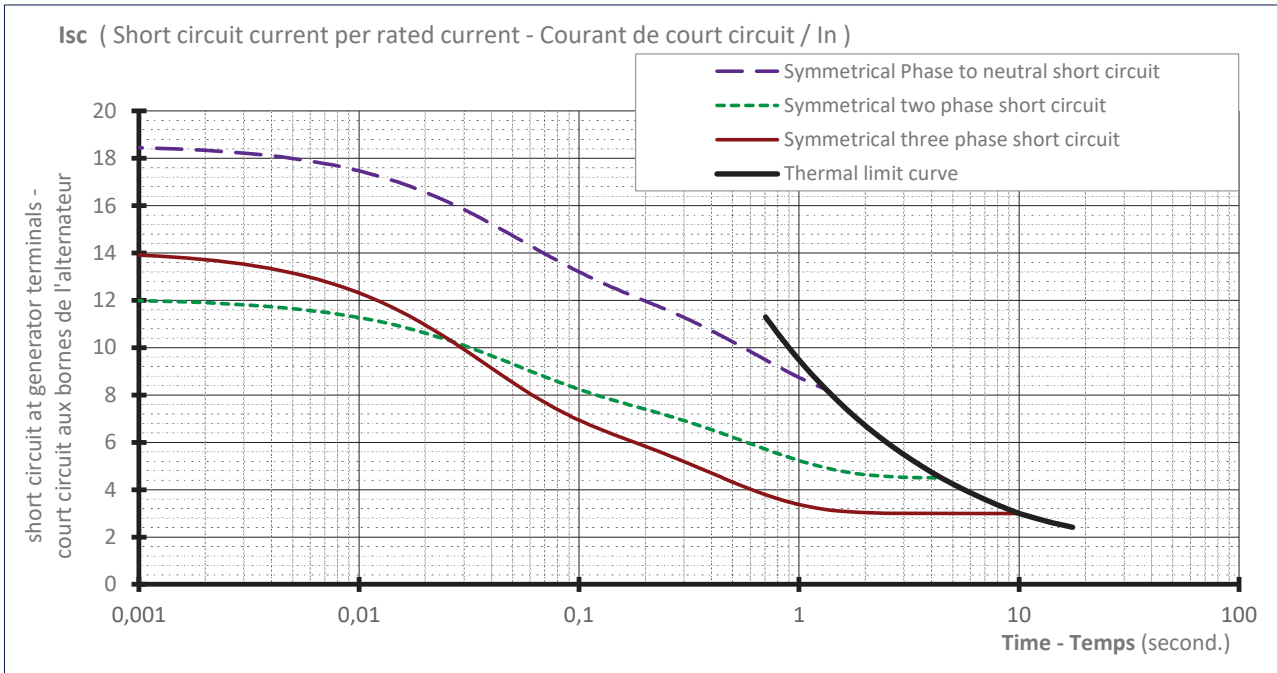
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

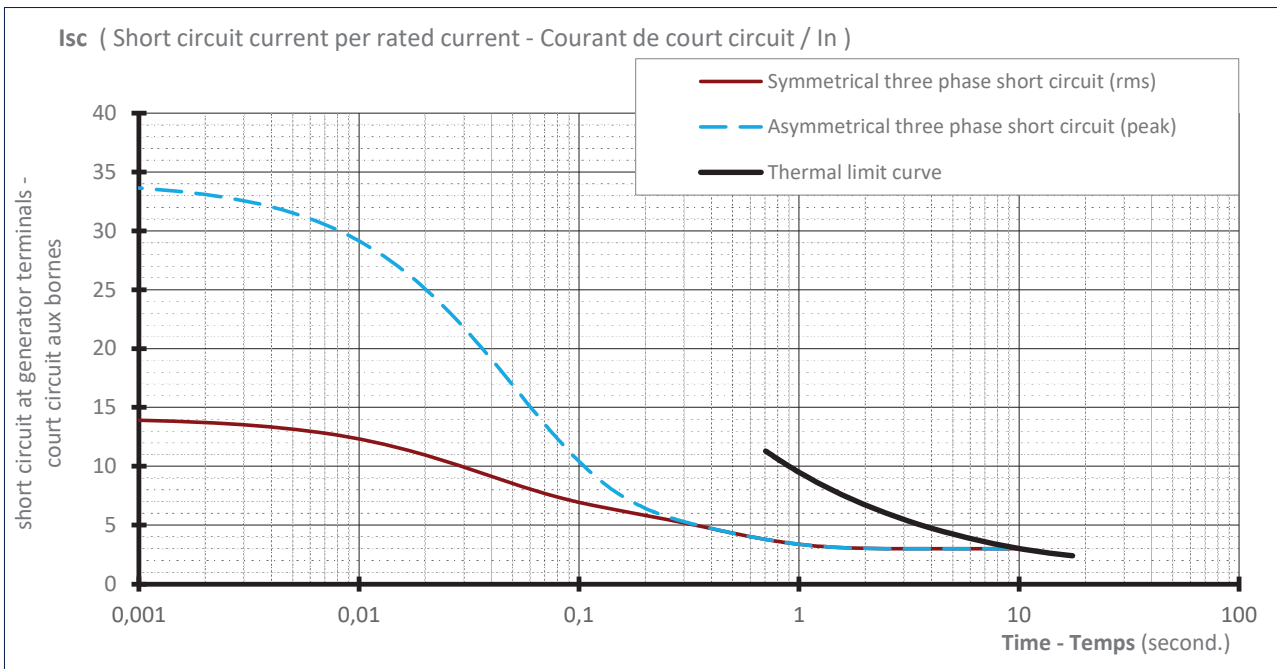
3000kVA - 400V - 50 Hz

Stator Current decrement curves

Symmetrical phase to neutral short-circuit	initial	79 912	A	18,5 x I_n	$I_n = 4330$ A
Symmetrical two phase short-circuit	max	51 903	A	12 x I_n	
Symmetrical three phase short-circuit	value	60 245	A	13,9 x I_n	
Thermal Limit					



Asymmetrical three phase short-circuit IP 144 343 A 33,3 x I_n



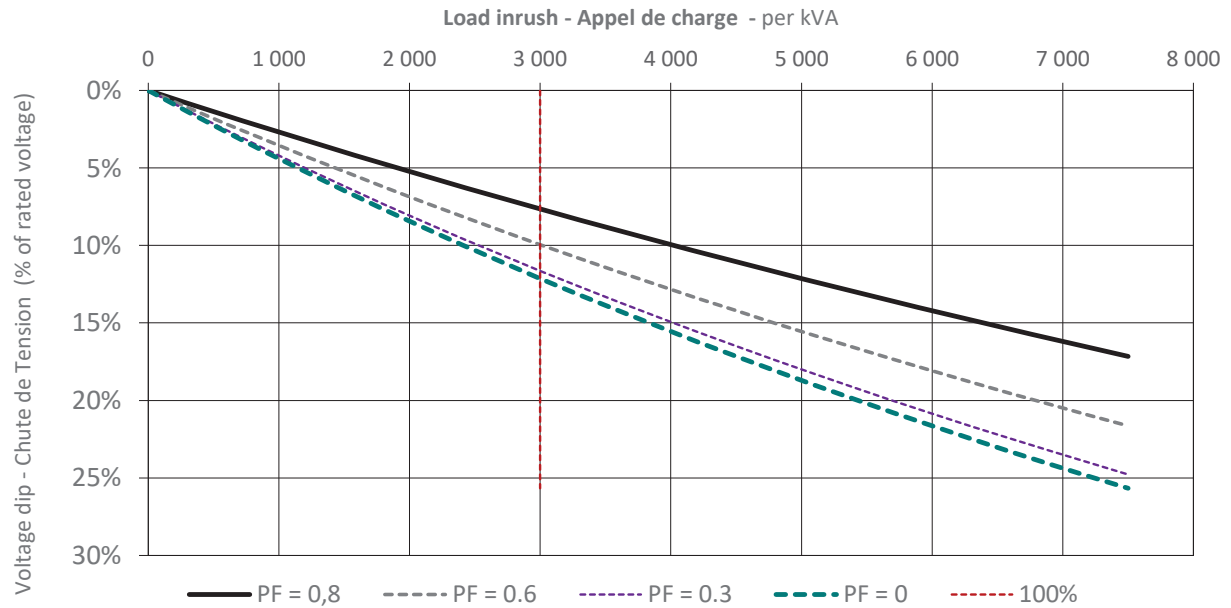
ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

Date: 06-17-2024

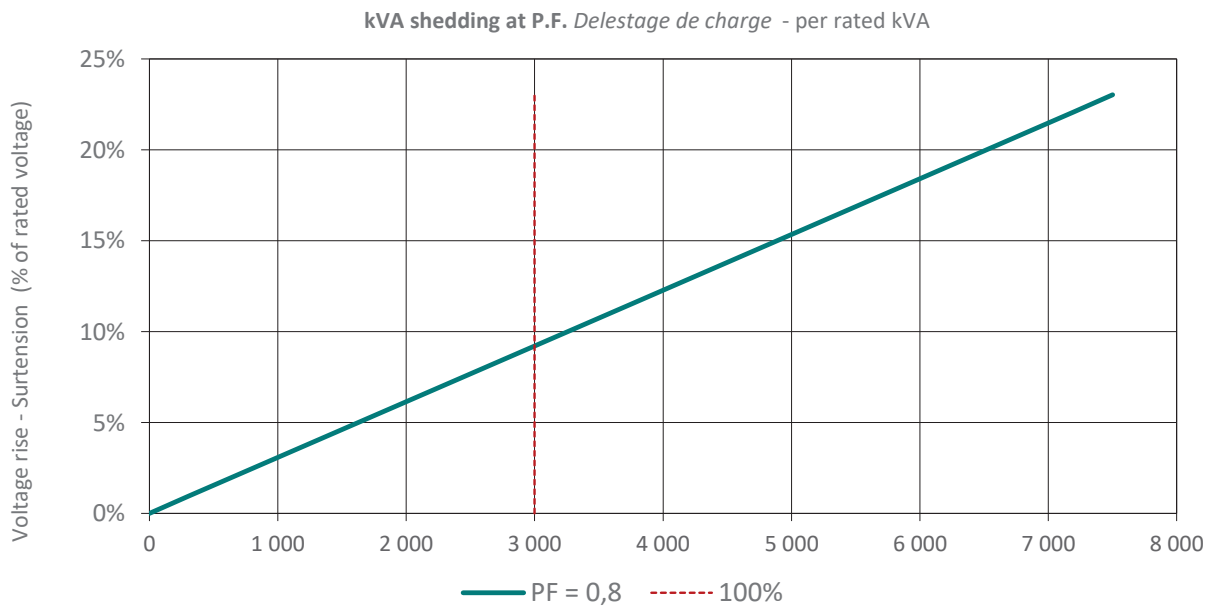
3000kVA - 400V - 50 Hz

Transient Voltage Variation

Transient voltage dip curve versus load impact



Transient voltage rise curve versus load rejection

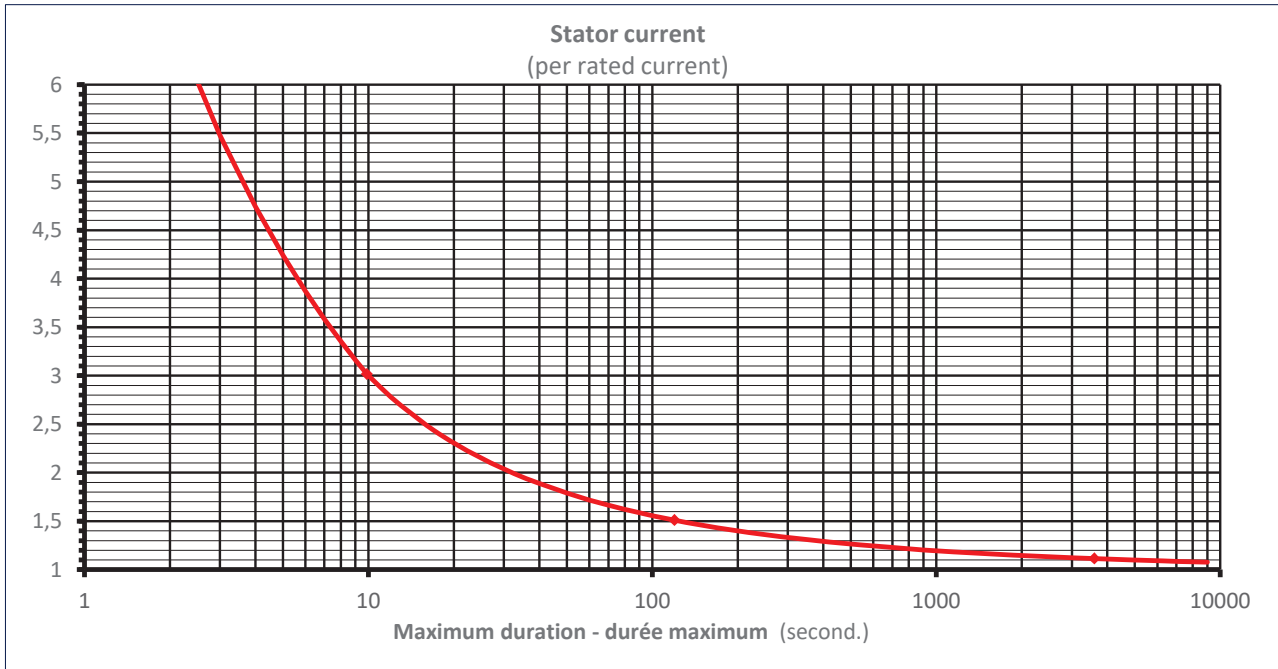


ALTERNATOR MAIN CURVES WHA 54.2 ZL17 / 4P

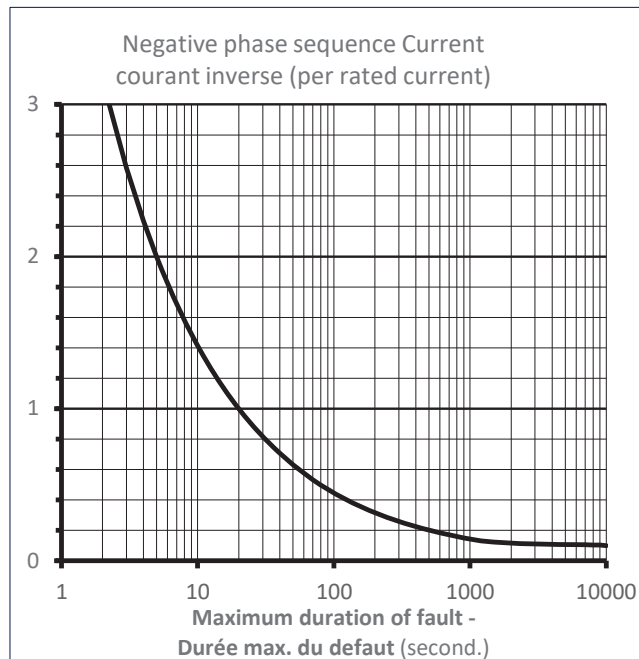
Date: 06-17-2024

3000kVA - 400V - 50 Hz

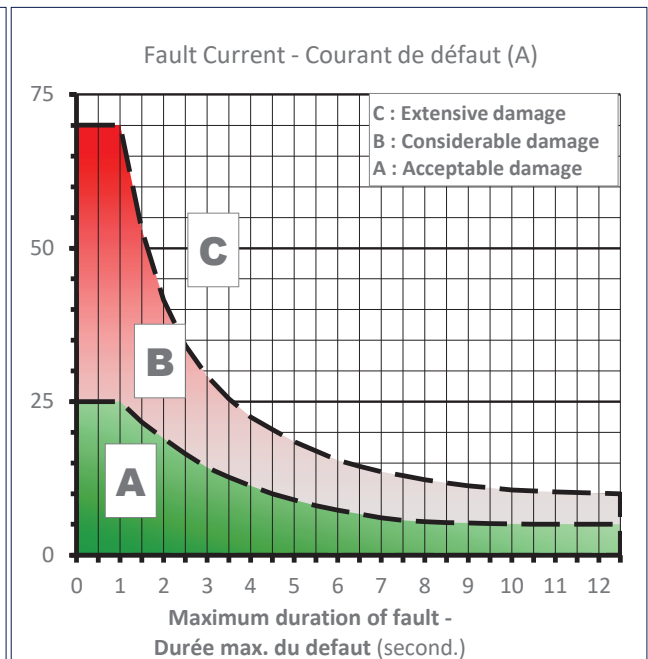
Thermal Damage Curve



Unbalance Load Curve



Stator Earth Fault Current





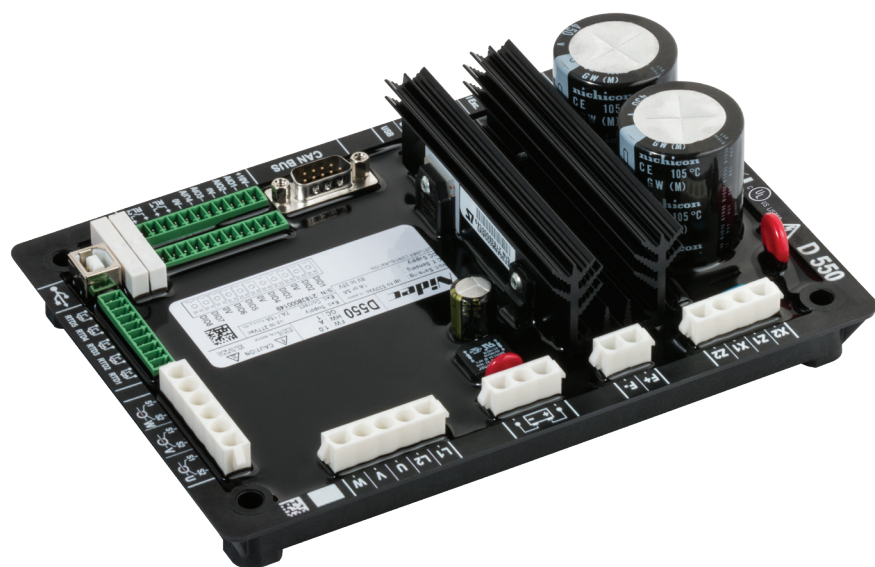
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APPENDIX 9.04

AVR Datasheet

D550 DIGITAL AVR

FOR ALTERNATORS WITH SHUNT, AREP OR PMG EXCITATION



The D550 is a digital automatic voltage regulator (AVR) for alternators with rated field current up to 8 A at 55°C.

It offers a vast array of regulation modes suitable for all power generation applications, including grid-connected configurations.

The D550 also integrates a visual interface through the EasyReg Advanced software, which allows the user to read the configuration values and parameters. It can also be configured directly via USB without external power supply.

The D550 also includes several protections and functions to keep the alternator running in full safe operation, in particular settings to comply with public network connection instructions (grid code).

The communication port is CANJ1939 compatible.

DATASHEET

KEY FEATURES

- **Regulation modes:**
 - Voltage regulation accuracy: $\pm 0.25\%$
 - Field current (manual mode)
 - Generator power factor
 - Grid power factor
 - Generator kVAR
- **Regulation features:**
 - Voltage equalization
 - Droop management
 - Cross current compensation
 - Soft start
 - Load Acceptance Module (L.A.M.) function to assist during heavy load application events
 - Negative field forcing
- **kW, kVAR, kVA and PF calculation**
- **Protections & Limitations:**
 - Under and over field current limitation
 - Loss of field sensing
 - Generator under/over voltage
 - Loss of sensing
 - V/Hz regulation mode
 - Diode fault monitor
- **Data logger** (option)
- **Synchronization monitoring**
- **Events log**

ELECTRICAL FEATURES

- **Generator voltage measurement:**
 - 3-phase, 2-phase
 - Range: 0-230-530 VAC
 - Consumption: < 2 VA
- **Grid voltage measurement:**
 - 2-phase
 - Range: 0-230-530 VAC
 - Consumption: < 2 VA
- **Generator current measurement:**
 - 1 or 3-phase
 - Secondary range: 1 or 5 A
 - Consumption: < 2 VA
- **AC supply input:**
 - PMG, AREP, SHUNT
 - Range: 50-277 VAC
- **Excitation:**
 - Rated field current (continuous):
 - 7 A at 70°C
 - 8 A at 55°C
 - Field forcing current (10s max):
 - 15 A at 70°C
 - Recommended field resistance:
 - > 4 ohms
- **Auxiliary supply: 8-35 VDC**
 - Consumption: < 1 A
- **Frequency range: 30-400 Hz**
- **Storage temperature range:**
 - 55°C +85°C
- **Operating temperature range:**
 - 40°C +70°C

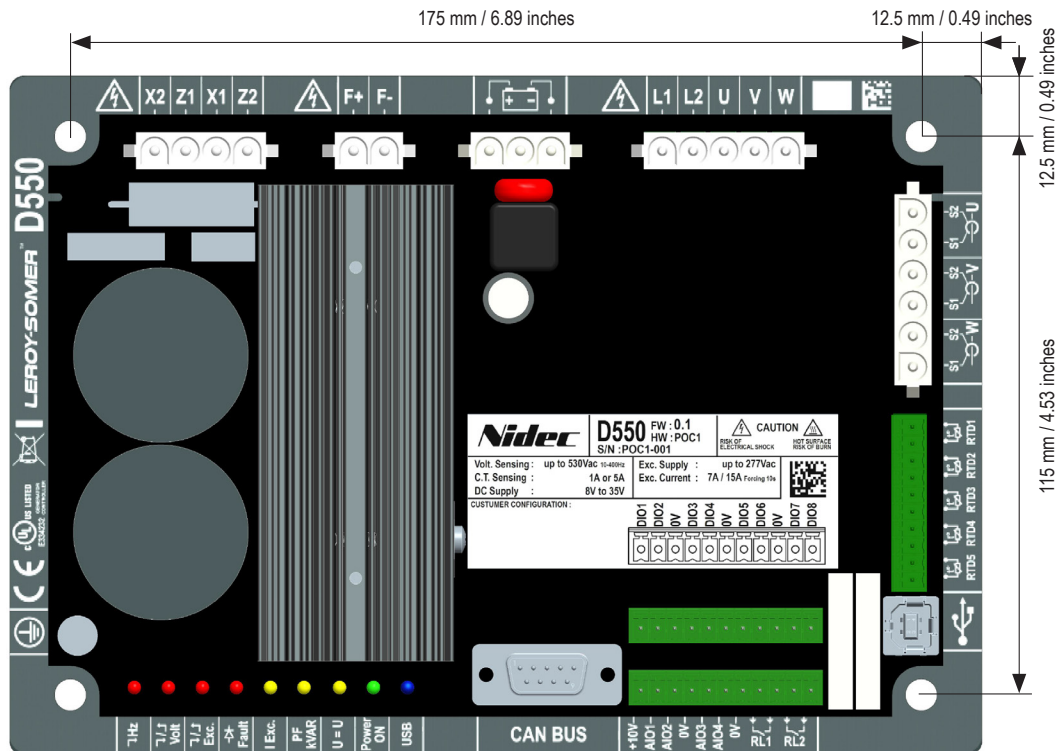
INPUTS / OUTPUTS

- **8 programmable digital inputs & outputs:**
 - Output specification: 150 mA - 30 VDC
- **4 programmable analog inputs & outputs:**
 - 4-20 mA / ± 10 V / 0-10 V / potentiometer (1 k Ω)
- **2 relay outputs:**
 - Specifications: 125 VAC - 5 A
- **5 temperature sensings:**
 - Type: Pt100/CTP
 - Programmable threshold

COMMUNICATION AND SETTINGS

- Software configuration (PC tool)
- USB port (self powered)
- CAN J1939 and Proprietary (Nidec Leroy-Somer protocol)

DIMENSIONS





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APPENDIX 9.05

Controller Datasheet

DSE8620 MKII

SYNCHRONISING AUTO MAINS (UTILITY) FAILURE LOAD SHARE CONTROL MODULE



Module can be configured to function as a DSE8610 MKII Synchronising and Load Sharing Control Module

Refer to DSE8610 MKII Data Sheet for product features.

KEY FEATURES

- Comprehensive synchronising & loadsharing capabilities
- Built in governor and AVR control
- Base load (kW export) control
- Positive & negative kVAr export control
- Mains (Utility) decoupling protection
- Mains (Utility) failure detection
- Mains (Utility) power (kW, kV Ar, kV A & pf) monitoring
- Mains (Utility) de-coupling protection
- Mains (Utility) kW export protection
- Peak lopping & shaving functionality
- 4-Line back-lit LCD text display
- Multiple Display Languages
- Five key menu navigation
- LCD alarm indication
- Heated display option available
- Customisable power-up text and images
- DSENet® expansion compatibility
- Data logging & trending facility
- Internal PLC editor
- Protections disable feature
- Fully configurable via PC using USB, RS232, RS485 & Ethernet communication
- Front panel configuration with PIN protection
- Power save mode
- 3 phase generator sensing and protection
- Generator current and power monitoring (kW, kvar, kVA, pf)
- kW and kvar overload alarms
- Reverse power alarms
- Over current protection
- Unbalanced load protection
- Independent earth fault protection
- Breaker control via fascia buttons
- Fuel and start outputs configurable when using CAN
- 8 configurable DC outputs
- 2 configurable volt-free relay outputs
- 4 configurable analogue/digital inputs
- Built in sensors to support 0 V to 10 V & 4 mA to 20 mA
- 12 configurable digital inputs
- Configurable 5 stage dummy load and load shedding outputs
- CAN, MPU and alternator frequency speed sensing in one variant
- Real time clock
- Manual and automatic fuel pump control
- Engine run-time scheduler
- Fuel usage monitor and low fuel level alarms
- Simultaneous use of all communication ports
- Remote SCADA monitoring via various DSE software applications
- MODBUS RTU & TCP support with configurable MODBUS pages for integration into building management systems (BMS)
- 3 configurable maintenance alarms
- Compatible with a wide range of CAN engines, including tier 4 engine support
- Uses DSE Configuration Suite PC Software for simplified configuration

KEY BENEFITS

- Can be configured for use as a DSE8610 MKII
- 132 x 64 pixel ratio display for clarity
- Real-time clock provides accurate event logging
- Ethernet communication, provides built in advanced remote monitoring.
- Can be integrated into building management systems (BMS) and programmable logic control (PLC)
- Increased input and output expansion capability via DSENet®
- Licence-free PC software
- IP65 rating (with supplied gasket) offers increased resistance to water ingress
- Extended internal PLC editor allows user configurable functions to meet specific application requirements.

EXPANSION DEVICES

- DSE124 CAN/MSC Extender
- DSE2130 Input Expansion Module
- DSE2131 Ratio-metric Input Expansion Module
- DSE2133 RTD & Thermo-couple Expansion Module
- DSE2152 Ratio-metric Output Expansion Module
- DSE2157 Output Expansion Module
- DSE2548 LED Expansion

SPECIFICATIONS

DC SUPPLY

CONTINUOUS VOLTAGE RATING
5 V to 35 V Continuous

CRANKING DROPOUTS

Able to survive 0 V for 100 mS, providing supply was at least 10 V before dropout and supply recovers to 5 V. This is achieved without the need for internal batteries. LEDs and backlight will not be maintained during cranking.

MAXIMUM OPERATING CURRENT

530 mA at 12 V, 280 mA at 24 V

MAXIMUM STANDBY CURRENT

320 mA at 12 V, 160 mA at 24 V

CHARGE FAIL/EXCITATION RANGE

0 V to 35 V

GENERATOR & MAINS (UTILITY)

VOLTAGE RANGE

15 V to 415 V AC (Ph to N)
26 V to 719 V AC (Ph to Ph)

FREQUENCY RANGE

3.5 Hz to 75 Hz

MAGNETIC PICKUP

VOLTAGE RANGE

+/- 0.5 V to 70 V

FREQUENCY RANGE

10,000 Hz (max)

INPUTS

DIGITAL INPUTS A TO L

Negative switching

ANALOGUE INPUTS A TO D

Configurable as:
Negative switching digital input
0 V to 10 V sensor
4 mA to 20 mA sensor
0 Ω to 480 Ω sensor

OUTPUTS

OUTPUT A & B (FUEL & START)

15 A DC at supply voltage

OUTPUTS C & D

8 A AC at 250 V AC (Volt-free)

AUXILIARY OUTPUTS E TO L

2 A DC at supply voltage

BUILT IN AVR GOVERNOR CONTROL

MINIMUM LOAD IMPEDANCE

500 Ω
Fully isolated

GAIN VOLTAGE

0 V to 10 V DC
Fully isolated

OFFSET VOLTAGE

0 V to 10 V DC
Fully isolated

DIMENSIONS

OVERALL

245 mm x 184 mm x 51 mm
9.6" x 7.2" x 2.0"

PANEL CUT-OUT

220 mm x 160 mm
8.7" x 6.3"

MAXIMUM PANEL THICKNESS

8 mm
0.3"

STORAGE TEMPERATURE RANGE

-40 °C to +85 °C
-40 °F to +185 °F

OPERATING TEMPERATURE RANGE

-30 °C to +70 °C
-40 °F to +185 °F

HEATED DISPLAY VARIANT

-40 °C to +70 °C
-40 °F to +158 °F

RELATED MATERIALS

TITLE

DSE8620 MKII Installation Instructions

DSE8620 MKII Operator Manual

DSE8620 MKII PC Configuration Suite Manual

DSE8610 MKII Data Sheet

PART NO.

053-183

057-254

057-238

055-204

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DSE8620 MKII

SYNCHRONISING AUTO MAINS (UTILITY) FAILURE LOAD SHARE CONTROL MODULE

The DSE8620 MKII is an easy to use Synchronising Auto Mains (Utility) Failure Control Module suitable for paralleling single gensets (diesel or gas) with the mains (utility) supply. The controller can be configured for use as a DSE8610 MKII Auto Start Control Module. When converted for use as a DSE8610 MKII the unit provides generator to generator load share.

Designed to synchronise a single genset with a single mains (utility) supply the DSE8620 MKII will automatically control the change over from mains (utility) to generator supply or run the generator in synchronisation with the mains (utility) to provide no break, peak lopping and peak shaving power solutions.

System alarms are annunciated on the LCD screen (multiple language options available), illuminated LED and audible sounder.

Comprehensive communications are also available via RS232, RS485 and Ethernet for remote PC control and monitoring and integration into building management systems

The event log will record 250 events to facilitate easy maintenance, and an extensive number of fixed and flexible monitoring, metering and protection features are included.

Designed to offer increased built in support for active sensors for 0 V to 10 V & 4 mA to 20 mA. Comprehensive communication and system expansion options are available.

Using the DSE PC Configuration Suite Software allows easy alteration of the operational sequences, timers and alarms. With all communication ports capable of being active at the same time, the DSE8620 MKII is ideal for a

wide variety of demanding load share applications.

KEY LOAD SHARE FEATURES:

- Peak lopping/sharing (with appropriate DSE mains (utility) controller
- Manual voltage/frequency adjustment
- R.O.C.O.F. and vector shift protection
- Mains (Utility) decoupling
- Mains (Utility) decoupling test mode
- Direct governor and AVR control
- Volts and frequency matching
- kW and kvar load sharing

ENVIRONMENTAL TESTING STANDARDS

ELECTRO MAGNETIC COMPATIBILITY

BS EN 61000-6-2
EMC Generic Immunity Standard for the Industrial Environment
BS EN 61000-6-4
EMC Generic Emission Standard for the Industrial Environment

ELECTRICAL SAFETY

BS EN 60950
Safety of Information Technology Equipment, including Electrical Business Equipment

TEMPERATURE

BS EN 60068-2-1
Ab/Ae Cold Test -30 °C
BS EN 60068-2-2
Bb/Be Dry Heat +70 °C

VIBRATION

BS EN 60068-2-6
Ten sweeps in each of three major axes
5 Hz to 8 Hz at +/-7.5 mm, 8 Hz to 500 Hz at 2 gn

HUMIDITY

BS EN 60068-2-30
Db Damp Heat Cyclic 20/55 °C at 95% RH
48 Hours
BS EN 60068-2-78
Cab Damp Heat Static 40 °C at 93% RH
48 Hours

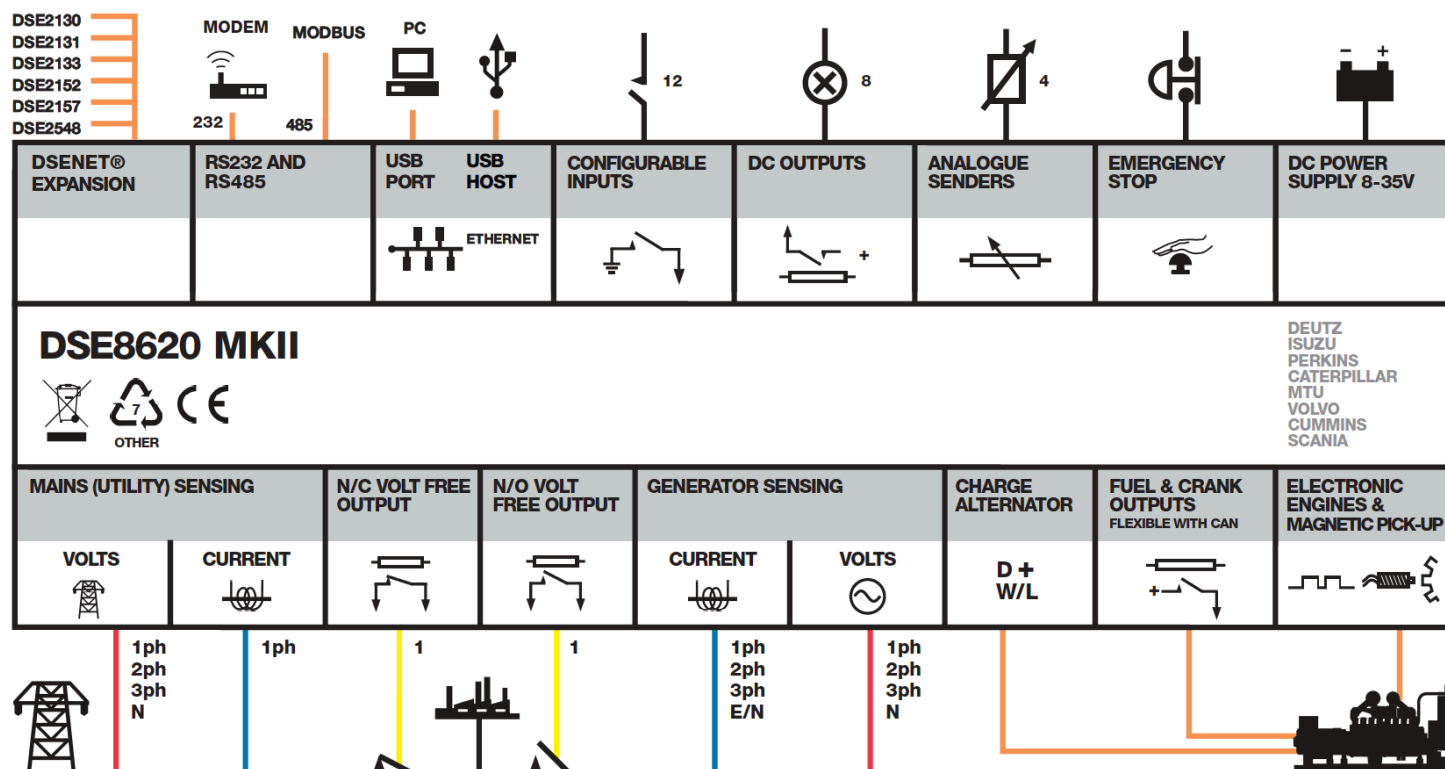
SHOCK

BS EN 60068-2-27
Three shocks in each of three major axes
15 gn in 11 ms

DEGREES OF PROTECTION PROVIDED BY ENCLOSURES

BS EN 60529
IP65 - Front of module when installed into the control panel with the supplied sealing gasket.

COMPREHENSIVE FEATURE LIST TO SUIT A WIDE VARIETY OF LOAD SHARE APPLICATIONS





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APPENDIX 9.06

UTI Letter

15 November 2023

Paul Randall
Powergen Business Advisor
Weichai Singapore Pte. Ltd.
237 Pandan Loop, #05-11 Westech Building
Singapore 128424
Singapore

Dear Paul Randall,

The *Tier Standard: Topology* requires that Tier III and Tier IV engine generator systems are capable of supporting the design load for unlimited hours.

2.5.2 Engine generators for Tier III and Tier IV sites shall not have a limitation on consecutive hours of operation when loaded to 'N' demand. Engine generators that have a limit on consecutive hours of operation at 'N' demand are appropriate for Tier I or Tier II.

Since this clarification to the Tier Standard, engine-generator manufacturers have been providing letters attesting to the continuous capacity of select engine-generator models.

Weichai Singapore Pte. Ltd. has introduced their Data Center Rated (DCR) engine-generator rating, defined as the maximum power that the generator is capable of delivering continuously to a constant or varying electrical load for unlimited hours in a data center application.

Considering this definition and the review of documentation provided by Weichai, I am pleased to inform you that Uptime Institute considers the Weichai Singapore Pte. Ltd. rating as acceptable for a Tier III or Tier IV objective for the units shown in Table 1 and Table 2 at the baseline conditions of 45°C and an elevation of 800 meters (m) above sea level when certain project conditions exist. Specifically, Weichai will provide project-specific letters confirming the constant load unlimited runtime of the unit with a preapproved letter template and preapproved signers, as identified by Weichai Singapore Pte. Ltd. Additionally, as part of a Tier Certification of Constructed Facility review, the unit installed must contain a nameplate with the DCR rating; if not, an additional letter would be required to verify the constant load unlimited runtime capacity of the unit with reference to the serial numbers of the units installed on site. In addition, ambient temperatures and other site factors also need to be accounted for on an individual basis.

If there are questions on this matter, please bring them to my attention.



Christopher Brown
Chief Technical Officer

Enclosure: Table 1. WPG B Series DCR Non-Environmental Protection Agency (EPA) 2 Engine-Generator Models and Table 2. WPG B Series DCR EPA 2 Engine-Generator Models

Weichai Singapore Pte. Ltd. Data Center Rated							
Model Number		DC Rating (kilowatts [kW])	Voltage (V)	Engine		Alternator	
				Manufacturer	Model	Manufacturer	Model
Non-EPA 2 Engine-Generator Models	WPG2500B7	2,000	415/240	Baudouin	20M33G2500 /5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2500B7	2,000	400/230	Baudouin	20M33G2500 /5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2750B7	2,200	415/240	Baudouin	12M55G2750 /5	Weichai or Baudouin	WHA 54 M90
	WPG2750B7	2,200	400/230	Baudouin	12M55G2750 /5	Weichai or Baudouin	WHA 53.2 L14
	WPG3000B7	2,400	415/240	Baudouin	12M55G3000 /5	Weichai or Baudouin	WHA 54 M90
	WPG3000B7	2,400	400/230	Baudouin	12M55G3000 /5	Weichai or Baudouin	WHA 54.2 ZL17
	WPG3750B7	3,000	415/240	Baudouin	16M55G3750 /5	Weichai or Baudouin	WHA 54.2 ZL18
	WPG3750B7	3,000	400/230	Baudouin	16M55G3750 /5	Weichai or Baudouin	WHA 54.2 ZL17

Table 1. WPG B Series Data Center Rated Non-EPA 2 Engine-Generator Models

Weichai Singapore Pte. Ltd. Data Center Rated							
Model Number		DC Rating (kilowatts [kW])	Voltage (V)	Engine		Alternator	
				Manufacturer	Model	Manufacturer	Model
EPA 2 Engine-Generator Models	WPG2500B7	2,000	415/240	Baudouin	20M33G4D2/5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2500B7	2,000	400/230	Baudouin	20M33G4D2/5	Weichai or Baudouin	WHA 52.3 UL16
	WPG2750B7	2,200	415/240	Baudouin	12M55G8D2/5	Weichai or Baudouin	WHA 54 M90
	WPG2750B7	2,200	400/230	Baudouin	12M55G8D2/5	Weichai or Baudouin	WHA 53.2 L14
	WPG3000B7	2,400	415/240	Baudouin	12M55G10D2/5	Weichai or Baudouin	WHA 54 M90
	WPG3000B7	2,400	400/230	Baudouin	12M55G10D2/5	Weichai or Baudouin	WHA 54.2 ZL17
	WPG3750B7	3,000	415/240	Baudouin	16M55G6D2/5	Weichai or Baudouin	WHA 54.2 ZL18
	WPG3750B7	3,000	400/230	Baudouin	16M55G6D2/5	Weichai or Baudouin	WHA 54.2 ZL17

Table 2. WPG B Series Data Center Rated EPA 2 Engine-Generator Models