SLW_VHP_G595_L0.4 engine out - S&L Standard Lambda-1

VGF - P48GSI

S&L Energie-Projekte GmbH BH

Power Generation

ENGINE SPEED (rpm):	1500		
DISPLACEMENT (L):	48	COOLING SYSTEM:	JW, IC + OC
COMPRESSION RATIO:	8.6:1	INTERCOOLER WATER INLET (°C):	54.4
IGNITION SYSTEM:	CEC	JACKET WATER OUTLET (°C):	82.2
EXHAUST MANIFOLD:	Water Cooled	JACKET WATER CAPACITY (L):	220
COMBUSTION:	Rich Burn, Turbocharged	AUXILIARY WATER CAPACITY (L):	53
ENGINE DRY WEIGHT (kg):	6759	LUBE OIL CAPACITY (L):	428
AIR/FUEL RATIO SETTING:	0.35% CO	MAX. EXHAUST BACKPRESSURE (mm H2O):	381
ENGINE SOUND LEVEL (dBA)	98	MAX. AIR INLET RESTRICTION (mm H2O):	381
IGNITION TIMING:	23° BTDC	EXHAUST SOUND LEVEL (dBA)	112
FREQUENCY (Hz):	50	PHASE:	3
GENERATOR TYPE:	Synchronous	PHASE ROTATION:	T1-T2-T3
VOLTAGE:	400	GEN. ROTATING MASS MOMENT OF INERTIA (kg m2):	11.7

SITE CONDITIONS:

FUEL:	Erdgas H (Hamburg)	ALTITUDE (m):	75
FUEL PRESSURE RANGE (barG):	1.79 - 3.45	MAXIMUM INLET AIR TEMPERATURE (°C):	35
FUEL HHV (MJ/Nm3):	40.42	FUEL WKI:	93.3
FUEL LHV (MJ/Nm3):	36.54		

SITE SPECIFIC TECHNICAL DATA

POWER RATING	UNITS	110% OVERLOAD SITE DATA (See note 18)	MAX RATING AT 38 °C AIR TEMP	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE OF 35 °C		
				94%	70%	50%
CONTINUOUS ENGINE POWER	kWb	726	660	623	462	330
OVERLOAD	% 2/24 hr	Note 18	10	10	-	-
ELECTRICAL EFFICIENCY (LHV)	%	34.0	33.6	33.3	31.5	29.1
GENERATOR OUTPUT	kWe	693	630	595	441	315
GENERATOR kVA	kVA	866	788	744	551	394
GENERATOR CURRENT	Amps	1251	1139	1075	796	569
based on 95.45% generator efficiency at 0.8 PF, no auxiliary engine driven equipment						
FUEL CONSUMPTION						
FUEL CONSUMPTION (LHV)	kJ/kWh	10095	10237	10329	10908	11810
FUEL CONSUMPTION (HHV)	kJ/kWh	11167	11324	11426	12067	13065
FUEL FLOW *based on fuel analysis LHV*	Nm3/hr	201	185	176	138	107
HEAT REJECTION						
JACKET WATER (JW)	kW	643	605	581	483	403
LUBE OIL (OC)	kW	97	94	92	84	77
INTERCOOLER (IC)	kW	46	41	35	19	9
EXHAUST	kW	516	469	446	334	244
RADIATION	kW	47	45	46	44	41
EMISSIONS (ENGINE OUT):						
NOx (NO + NO2) *corr. To 5% O2*	mg/Nm3	5926	5926	5926	5926	5926
CO *corr. To 5% O2*	mg/Nm3	2963	2963	2963	2963	2963
THC *corr. To 5% O2*	mg/Nm3	556	556	556	556	556
NMHC *corr. To 5% O2*	mg/Nm3	93	93	93	93	93
NM,NEHC (VOC) *corr. To 5% O2*	mg/Nm3	8	8	8	8	8
CO2 *corr. To 5% O2*	g/Nm3	161	164	165	174	189
CO2e *corr. To 5% O2*	g/Nm3	174	176	178	187	201
CH2O *corr. To 5% O2*	mg/Nm3	18.52	18.52	18.52	18.52	18.52
CH4 *corr. To 5% O2*	mg/Nm3	463	463	463	463	463
AIR INTAKE / EXHAUST GAS						
INDUCTION AIR FLOW	Nm3/hr	2095	1931	1841	1440	1115
EXHAUST GAS MASS FLOW	kg/hr	2749	2534	2415	1890	1463
EXHAUST GAS FLOW *at exhaust temp, 100 kPa*	m3/hr	7040	6449	6125	4666	3483
EXHAUST TEMPERATURE	°C	580	574	571	549	520

HEAT EXCHANGER SIZING[12]			
TOTAL JACKET WATER CIRCUIT (JW)	kW	729	686
TOTAL AUXILIARY WATER CIRCUIT (IC + OC)	kW	162	152

COOLING SYSTEM WITH ENGINE MOUNTED WATER PUMPS		
JACKET WATER PUMP MIN. DESIGN FLOW	L/min	1052
JACKET WATER PUMP MAX. EXTERNAL RESTRICTION	barG	1.05
AUX WATER PUMP MIN. DESIGN FLOW	L/min	269
AUX WATER PUMP MAX. EXTERNAL RESTRICTION	barG	0.44

All data provided per the condtions listed in the notes section on page three.

Data Generated by EngCalc Program Version 4.0 INNIO Waukesha Gas Engines, Inc.

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FUEL COMPOSITION

HYDROCARBONS:		Mole or Volume %
Methane	CH4	94.46
Ethane	C2H6	3.447
Propane	C3H8	0.349
Iso-Butane	I-C4H10	0.064
Normal Butane	N-C4H10	0.049
Iso-Pentane	I-C5H12	0.013
Normal Pentane	N-C5H12	0.01
Hexane	C6H14	0
Heptane	C7H16	0
Ethene	C2H4	0
Propene	C3H6	0
	SUM HYDROCARBONS	98.392
NON-HYDROCARBONS:		
Nitrogen	N2	0.8
Oxygen	O2	0
Helium	He	0
Carbon Dioxide	CO2	0.804
Carbon Monoxide	CO	0
Hydrogen	H2	0
Water Vapor	H2O	0
	TOTAL FUEL	99.996

FUEL:	Erdgas H (Hamburg)
FUEL PRESSURE RANGE (barG):	1.79 - 3.45
FUEL WKI:	93.3
FUEL SLHV (BTU/ft3):	912.99
FUEL SLHV (MJ/Nm3):	35.90
FUEL LHV (BTU/ft3):	929.16
FUEL LHV (MJ/Nm3):	36.54
FUEL HHV (BTU/ft3):	1027.83
FUEL HHV (MJ/Nm3):	40.42
FUEL DENSITY (SG):	0.59

Standard Conditions per ASTM D3588-91 [60°F and 14.696psia] and ISO 6976:1996-02-01[25, V(0;101.325)].
Based on the fuel composition, supply pressure and temperature, liquid hydrocarbons may be present in the fuel. No liquid hydrocarbons are allowed in the fuel. The fuel must not contain any liquid water. Waukesha recommends both of the following:
1) Dew point of the fuel gas to be at least 20°F (11°C) below the measured temperature of the gas at the inlet of the engine fuel regulator.
2) A fuel filter separator to be used on all fuels except commercial quality natural gas.
Refer to the 'Fuel and Lubrication' section of 'Technical Data' or contact the Waukesha Application Engineering Department for additional information on fuels, or LHV and WKI* calculations.
* Trademark of INNIO Waukesha Gas Engines Inc.

FUEL CONTAMINANTS

Total Sulfur Compounds	0	% volume
Total Halogen as Cloride	0	% volume
Total Ammonia	0	% volume
Siloxanes		
Tetramethyl silane	0	% volume
Trimethyl silanol	0	% volume
Hexamethyldisiloxane (L2)	0	% volume
Hexamethylcyclotrisiloxane (D3)	0	% volume
Octamethyltrisiloxane (L3)	0	% volume
Octamethylcyclotetrasiloxane (D4)	0	% volume
Decamethyltetrasiloxane (L4)	0	% volume
Decamethylcyclopentasiloxane (D5)	0	% volume
Dodecamethylpentasiloxane (L5)	0	% volume
Dodecamethylcyclohexasiloxane (D6)	0	% volume
Others	0	% volume

Total Sulfur Compounds	0 µg/BTU
Total Halogen as Clorid	0 µg/BTU
Total Ammonia	0 µg/BTU
Total Siloxanes (as Si)	0 µg/BTU

Calculated fuel contaminant analysis will depend on the entered fuel composition and selected engine model.

No water or hydrocarbon condensates are allowed in the engine. Requires liquids removal.

NOTES

1. All data is based on engines with standard configurations unless noted otherwise.
2. Power rating is adjusted for fuel, site altitude, and site air inlet temperature, in accordance with ISO 3046/1 with tolerance of ± 3%.
3. Fuel consumption is presented in accordance with ISO 3046/1 with a tolerance of -0 / +5% at maximum rating. Fuel flow calculation based on fuel LHV and fuel consumption with a tolerance of -0/+5 %. For sizing piping and fuel equipment, it is recommended to include the 5% tolerance.
4. Heat rejection tolerances are ± 30% for radiation, and ± 8% for jacket water, lube oil, intercooler, and exhaust energy.
5. Emission levels for engines with Waukesha supplied 3-way catalyst are given at catalyst outlet flange. For all other engine models, emission levels are given at engine exhaust outlet flange prior to any after treatment. Values are based on a new engine operating at indicated site conditions, and adjusted to the specified timing and air/fuel ratio at rated load. Catalyst out emission levels represent emission levels the catalyst is sized to achieve. Manual adjustment may be necessary to achieve compliance as catalyst/engine age. Catalyst-out emission levels are valid for the duration of the engine warranty. Emissions are at an absolute humidity of 75 grains H2O/lb (10.71 g H2O/kg) of dry air. Emission levels may vary subject to instrumentation, measurement, ambient conditions, fuel quality, and engine variation. Engine may require adjustment on-site to meet emission values, which may affect engine performance and heat output. NOx, CO, THC, and NMHC emission levels are listed as a not to exceed limit, all other emission levels are estimated. CO2 emissions based on EPA Federal Register/Vol. 74, No. 209/Friday, October 30, 2009 Rules and Regulations 56398, 56399 (3) Tier 3
6. Air flow is based on undried air with a tolerance of ± 7%.
7. Exhaust temperature given at engine exhaust outlet flange with a tolerance of ± 50°F (28°C).
8. Exhaust gas mass flow value is based on a "wet basis" with a tolerance of ± 7%.
9. Inlet air restrictions based on full rated engine load. Exhaust backpressure based on 160 PSI BMEP and 1800 RPM. Refer to the engine specification section of Waukesha's standard technical data for more information.
10. Cooling circuit capacity, lube oil capacity, and engine dry weight values are typical.
11. Fuel must conform to Waukesha's "Gaseous Fuel Specification" S7884-7 or most current version. Fuel may require treatment to meet current fuel specification.
12. Heat exchanger sizing values given as the maximum heat rejection of the circuit, with applied tolerances and an additional 5% reserve factor.
13. Fuel volume flow calculation in english units is based on 100% relative humidity of the fuel gas at standard conditions of 60°F and 14.696 psia (29.92 inches of mercury; 101.325 kPa).
14. Fuel volume flow calculation in metric units is based on 100% relative humidity of the fuel gas at a combustion temperature of 25°C and metering conditions of 0°C and 101.325 kPa (14.696 psia; 29.92 inches of mercury). This is expressed as [25, V(0;101.325)].
15. Engine sound data taken with the microphone at 1 m (3.3 ft) from the side of the engine at the approximate front-to-back centerline. Microphone height was at intake manifold level. Engine sound pressure data may be different at front, back and opposite side locations. Exhaust sound data taken with microphone 1 meter (3.3 ft) away and 1 meter (3.3 ft) to the side of the exhaust outlet.
16. Due to variation between test conditions and final site conditions, such as exhaust configuration and background sound level, sound pressure levels under site conditions may be different than those tabulated above.
17. Cooling system design flow is based on minimum allowable cooling system flow. Cooling system maximum external restriction is defined as the allowable restriction at the minimum cooling system flow.
18. Continuous Power Rating: The highest load and speed that can be applied 24 hours per day, seven days per week, 365 days per year except for normal maintenance at indicated ambient reference conditions and fuel. It is permissible to operate the engine at the indicated overload power, for two hours in every 24 hour period.
19. emPact emission compliance available for entire range of operable fuels; however, fuel system and/or O2 set point may need to be adjusted in order to maintain compliance.
20. In cold ambient temperatures, heating of the engine jacket water, lube oil and combustion air may be required. See Waukesha Technical Data.
21. Available Turndown Speed Range refers to the constant torque speed range available. Reduced power may be available at speeds outside of this range. Contact application engineering.

SPECIAL REQUIREMENTS