

ENGINE SPEED:	1800	FUEL:	LOW ENERGY
COMPRESSION RATIO:	10.5:1	FUEL SYSTEM:	LPG IMPCO
JACKET WATER - MAX. OUTLET (°F):	210		
COOLING SYSTEM:	JW+OC	FUEL PRESS. RANGE (PSIG):	1.5 - 5.0
IGNITION SYSTEM:	MAG	THC:FREE INERT RATIO	1.9
EXHAUST MANIFOLD:	WC	RATED ALTITUDE (FT):	500
COMBUSTION:	STANDARD	AT AIR TO TURBO. TEMP. (°F):	77
		EXHAUST O2 EMISSION LEVEL:	2.0 %O2
		FUEL LHV (BTU/SCF):	593
		APPLICATION:	60 Hz GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	BHP	110	82	55
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	75	57	38
<b>ENGINE EFFICIENCY</b>	<b>(ISO 3046/1)</b>	<b>(3)</b>	<b>%</b>	<b>28.7</b>	<b>26.4</b>	<b>22.1</b>
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	28.7	26.4	22.1
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	59.7	61.9	66.1
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	88.3	88.3	88.2

ENGINE DATA						
<b>FUEL CONSUMPTION</b>	<b>(ISO 3046/1)</b>	<b>(6)</b>	<b>BTU/bhp-hr</b>	<b>8880</b>	<b>9643</b>	<b>11525</b>
FUEL CONSUMPTION	(NOMINAL)	(6)	BTU/bhp-hr	8880	9643	11525
AIR FLOW (77 °F, 14.7 psi)		(7)	SCFM	188	154	125
AIR FLOW		(7)	lb/hr	834	682	554
INLET MAN. PRESSURE		(8)	in. HG (abs)	24.4	21	17.9
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°F	90	94	98
TIMING		(10)	°BTDC	30	30	30
EXHAUST STACK TEMPERATURE		(11)	°F	1077	1057	1038
EXHAUST GAS FLOW (@ stack temp.)		(12)	CFM	601	485	388
EXHAUST MASS FLOW		(12)	lb/hr	944	771	625

EMISSIONS DATA						
NOx (as NO2)		(13)	g/bhp-hr	17.25	17.58	17.87
CO		(14)	g/bhp-hr	3.2	3.22	3.25
THC (molecular weight of 15.84)		(14)	g/bhp-hr	1.93	2.24	2.53
NMHC (molecular weight of 15.84)		(14)	g/bhp-hr	0.29	0.34	0.38
EXHAUST O2		(15)	% DRY	2.0	2.0	2.5
LAMBDA				1.06	1.06	1.09

HEAT BALANCE DATA						
LHV INPUT		(16)	BTU/min	16275	13255	10561
HEAT REJECTION TO JACKET (JW)		(17) (21)	BTU/min	5620	4887	4303
HEAT REJECTION TO ATMOSPHERE		(18)	BTU/min	651	530	422
HEAT REJECTION TO LUBE OIL (OC)		(19) (21)	BTU/min	889	773	680
HEAT REJECTION TO EXHAUST (LHV to 77°F)		(20)	BTU/min	4452	3567	2824
HEAT REJECTION TO EXHAUST (LHV to 350°F)		(20)	BTU/min	3204	2543	2000

### CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1STD. REF. CONDITIONS OF 77°F, 29.6 IN HG BAROMETRIC PRESSURE, 500 FT ALTITUDE). NO OVERLOAD PERMITTED AT RATING SHOWN. CONSULT ALTITUDE CHARTS FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE.

EMISSION LEVELS ARE BASED ON THE ENGINE OPERATING AT STEADY STATE CONDITIONS. EMISSION TOLERANCES SPECIFIED ARE DEPENDANT UPON FUEL QUALITY. METHANE NUMBER CANNOT VARY MORE THAN ± 3. PUBLISHED PART LOAD DATA MAY REQUIRE ENGINE ADJUSTMENT.

ENGINE RATING IS WITH 1 ENGINE DRIVEN JACKET WATER PUMP.

FOR NOTES INFORMATION CONSULT PAGE THREE.

### FUEL USAGE GUIDE

THC:FREE INERT RATIO	<1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	>2.0
IGNITION TIMING	-	-	30	30	30	30	30	30	30	30	30	30
DERATION FACTOR	0	0	0.78	0.82	0.86	0.90	0.93	0.95	0.97	0.99	1.00	1.00

### ALTITUDE DERATION FACTORS

AIR TO TURBO (°F)	130	0.93	0.89	0.86	0.83	0.80	0.77	0.74	0.71	0.68	0.65	0.63	0.60	0.58
	120	0.94	0.91	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.64	0.61	0.59
	110	0.96	0.92	0.89	0.86	0.82	0.79	0.76	0.73	0.70	0.68	0.65	0.62	0.60
	100	0.98	0.94	0.91	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.63	0.61
	90	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.65	0.62
	80	1.00	0.98	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.69	0.66	0.63
	70	1.00	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.64
	60	1.00	1.00	0.98	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.68	0.66
	50	1.00	1.00	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67
		0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
	ALTITUDE (FEET ABOVE SEA LEVEL)													

### FREE FIELD MECHANICAL & EXHAUST NOISE

100% Load Data			dB(A)		(dB)							
Free Field Mechanical	DISTANCE FROM THE ENGINE (FEET)	3.2	91.7	72.4	82.4	83.4	84.9	86.9	86.4	81.9	77.9	
		22.9	81.7	65.6	76.1	74.1	72.6	78.1	76.1	70.6	65.6	
		49.2	75.7	59.6	70.1	68.1	66.6	72.1	70.1	64.6	59.6	
Free Field Exhaust	DISTANCE FROM THE ENGINE (FEET)	4.9	110.4	109.0	111.0	109.0	101.0	104.0	104.5	102.0	99.0	
		22.9	97.0	95.5	98.0	91.0	86.5	89.0	90.5	91.5	87.5	
		49.2	90.4	90.2	93.2	87.7	80.7	82.7	83.2	84.7	79.7	
			Overall SPL	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Octave Band Center Frequency (OBCF)												

#### FUEL USAGE GUIDE:

This table shows the derate factor required for a given fuel. Note that deration occurs as the THC:Free Inert ratio decreases.

This Fuel Usage Guide is intended for digester/biogas applications only. Standard rating is based on digester fuel with 130 MN and 1.9:1 THC:Free Inert Ratio.

#### ALTITUDE DERATION FACTORS:

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site.

#### ACTUAL ENGINE RATING:

To determine the actual rating of the engine at site conditions, one must consider limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature and RPC (reference Caterpillar Methane Program) are added together to establish air system limitations.

Determine the actual site power available with the following equation:

$$\text{Spec Sheet Power} * (1 - ((1 - \text{FUG deration}) + (1 - \text{Altitude Deration Factor})))$$

Note: Spec sheet rating is based on digester fuel with 130 MN, 96 RPC and 1.9:1 THC:Free Inert ratio.

#### SOUND DATA:

Data determined by methods similar to ISO Standard DIS-8528-10. Accuracy Grade 3. SPL = Sound Pressure Level.

**NOTES**

- 1 ENGINE RATING IS WITH 1 ENGINE DRIVEN JACKET WATER PUMP. TOLERANCE IS  $\pm 3\%$  OF FULL LOAD.
- 2 GENERATOR POWER DETERMINED WITH AN ASSUMED GENERATOR EFFICIENCY OF 92% AND POWER FACTOR OF 0.8 [GENERATOR POWER = ENGINE POWER  $\times$  GENERATOR EFFICIENCY].
- 3 ISO 3046/1 ENGINE EFFICIENCY TOLERANCE IS (+)0, (-)5% OF FULL LOAD % EFFICIENCY VALUE. NOMINAL ENGINE EFFICIENCY TOLERANCE IS  $\pm 5\%$  OF FULL LOAD % EFFICIENCY VALUE.
- 4 THERMAL EFFICIENCY: JACKET HEAT + LUBE OIL HEAT + EXH. HEAT TO 350°F.
- 5 TOTAL EFFICIENCY = ENGINE EFF. + THERMAL EFF. TOLERANCE IS  $\pm 10\%$  OF FULL LOAD DATA.
- 6 ISO 3046/1 FUEL CONSUMPTION TOLERANCE IS (+)5, (-)0% OF FULL LOAD DATA. NOMINAL FUEL CONSUMPTION TOLERANCE IS  $\pm 5\%$  OF FULL LOAD DATA.
- 7 UNDRIED AIR. FLOW TOLERANCE IS  $\pm 5\%$
- 8 INLET MANIFOLD PRESSURE TOLERANCE IS  $\pm 5\%$
- 9 INLET MANIFOLD TEMPERATURE TOLERANCE IS  $\pm 9^\circ\text{F}$ .
- 10 TIMING INDICATED IS FOR USE WITH THE MINIMUM FUEL METHANE NUMBER SPECIFIED. CONSULT THE APPROPRIATE FUEL USAGE GUIDE FOR TIMING AT OTHER METHANE NUMBERS.
- 11 EXHAUST STACK TEMPERATURE TOLERANCE IS (+)63°F, (-)54°F.
- 12 WET EXHAUST. FLOW TOLERANCE IS  $\pm 6\%$
- 13 NOX VALUES ARE "NOT TO EXCEED".
- 14 CO, CO<sub>2</sub>, THC, and NMHC VALUES ARE "NOT TO EXCEED".
- 15 O<sub>2</sub>% TOLERANCE IS  $\pm 0.5$ .
- 16 LHV INPUT TOLERANCE IS  $\pm 5\%$ .
- 17 HEAT REJECTION TO JACKET TOLERANCE IS  $\pm 10\%$  OF FULL LOAD DATA, BASED ON TREATED WATER.
- 18 HEAT REJECTION TO ATMOSPHERE TOLERANCE IS  $\pm 50\%$  OF FULL LOAD DATA, BASED ON TREATED WATER.
- 19 HEAT REJECTION OF LUBE OIL TOLERANCE IS  $\pm 20\%$  OF FULL LOAD DATA, BASED ON TREATED WATER.
- 20 HEAT REJECTION TO EXHAUST TOLERANCE IS  $\pm 10\%$  OF FULL LOAD DATA, BASED ON TREATED WATER.

**SITE SPECIFIC COOLING SYSTEM SIZING EQUATIONS (WITH TOLERANCES)**

- 21 TOTAL JACKET CIRCUIT (JW+OC) = (JW  $\times$  1.1) + (OC  $\times$  1.2).