

ENGINE SPEED (rpm):	1800	RATING STRATEGY:	EMERGENCY
COMPRESSION RATIO:	9.7	PACKAGE TYPE:	WITHOUT RADIATOR
AFTERCOOLER TYPE:	SCAC	RATING LEVEL:	STANDBY
AFTERCOOLER - STAGE 2 INLET (°F):	130	FUEL:	NAT GAS
AFTERCOOLER - STAGE 1 INLET (°F):	198	FUEL SYSTEM:	CAT LOW PRESSURE
JACKET WATER OUTLET (°F):	210		WITH AIR FUEL RATIO CONTROL
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig): (See note 1)	0.5-5.0
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL METHANE NUMBER:	85
CONTROL SYSTEM:	ADEM4 W/ IM	FUEL LHV (Btu/scf):	905
EXHAUST MANIFOLD:	DRY	ALTITUDE CAPABILITY AT 77°F INLET AIR TEMP. (ft):	6325
COMBUSTION:	LOW EMISSION	POWER FACTOR:	0.8
		VOLTAGE(V):	440-4160

RATING	NOTES	LOAD	100%	75%	50%
GENSET POWER (WITHOUT FAN)	(2)(3)	ekW	1035	776	517
GENSET POWER (WITHOUT FAN)	(2)(3)	kVA	1294	970	646
ENGINE POWER (WITHOUT FAN)	(3)	bhp	1468	1100	738
GENERATOR EFFICIENCY	(2)	%	94.5	94.6	94.0
GENSET EFFICIENCY(@ 1.0 Power Factor) (ISO 3046/1)	(4)	%	36.9	35.5	32.9
THERMAL EFFICIENCY	(5)	%	48.6	49.7	51.5
TOTAL EFFICIENCY (@ 1.0 Power Factor)	(6)	%	85.5	85.2	84.4

ENGINE DATA						
GENSET FUEL CONSUMPTION (ISO 3046/1)	(7)	Btu/ekW-hr	9428	9782	10544	
GENSET FUEL CONSUMPTION (NOMINAL)	(7)	Btu/ekW-hr	9611	9972	10749	
ENGINE FUEL CONSUMPTION (NOMINAL)	(7)	Btu/bhp-hr	6773	7035	7535	
AIR FLOW (77°F, 14.7 psia) (WET)	(8)	ft3/min	3071	2422	1740	
AIR FLOW (WET)	(8)	lb/hr	13617	10739	7717	
FUEL FLOW (60°F, 14.7 psia)		scfm	183	143	102	
COMPRESSOR OUT PRESSURE		psi(abs)	43.9	35.5	26.4	
COMPRESSOR OUT TEMPERATURE		°F	326	282	211	
AFTERCOOLER AIR OUT TEMPERATURE		°F	136	135	133	
INLET MAN. PRESSURE	(9)	psi(abs)	40.1	31.6	22.5	
INLET MAN. TEMPERATURE (MEASURED IN PLENUM)	(10)	°F	136	135	133	
TIMING		°BTDC	32	32	32	
EXHAUST TEMPERATURE - ENGINE OUTLET	(11)	°F	954	952	958	
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia) (WET)	(12)	ft3/min	8721	6864	4954	
EXHAUST GAS MASS FLOW (WET)	(12)	lb/hr	14116	11128	7997	
MAX INLET RESTRICTION	(13)	in H2O	10.20	10.22	10.24	
MAX EXHAUST RESTRICTION	(13)	in H2O	19.80	19.77	19.74	

REGULATORY INFORMATION						
AGENCY TIER/STAGE REGULATION	LOCALITY		MAX LIMITS	YEAR IN	YEAR OUT	
EPA	S.I. STATIONARY NON-EMERGENCY - NATURAL GAS	U.S. (EXCL CALIF)	(14) g/bhp-hr - NOx: 1.0 CO: 2.0 VOC: 0.7	2011	----	

ENERGY BALANCE DATA						
LHV INPUT	(15)	Btu/min	165751	128985	92691	
HEAT REJECTION TO JACKET WATER (JW)	(16)(24)	Btu/min	24072	20233	17250	
HEAT REJECTION TO ATMOSPHERE (INCLUDES GENERATOR)	(17)	Btu/min	8821	6712	5340	
HEAT REJECTION TO LUBE OIL (OC)	(18)(24)	Btu/min	4650	4137	3514	
HEAT REJECTION TO EXHAUST (LHV TO 77°F)	(19)(20)	Btu/min	57000	44994	32750	
HEAT REJECTION TO EXHAUST (LHV TO 248°F)	(19)	Btu/min	44757	35164	25497	
HEAT REJECTION TO A/C - STAGE 1 (1AC)	(21)(24)	Btu/min	6004	3489	456	
HEAT REJECTION TO A/C - STAGE 2 (2AC)	(22)(25)	Btu/min	5387	4315	2986	
PUMP POWER	(23)	Btu/min	971	971	971	

**CONDITIONS AND DEFINITIONS**

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 14.50 PSI barometric pressure.) No overload permitted at rating shown. Consult the altitude deration factor chart for applications that exceed the rated altitude or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

**FUEL USAGE GUIDE**

METHANE NUMBER	<70	70	75	80	85	100
DERATION FACTOR	0	1	1	1	1	1

**ALTITUDE DERATION FACTORS AT RATED SPEED**

INLET AIR TEMP °F	130	1	1	1	1	1	0.97	0.93	0.89	0.85	0.81	0.77	0.73	0.67
	120	1	1	1	1	1	0.99	0.95	0.91	0.87	0.82	0.78	0.74	0.68
	110	1	1	1	1	1	1	0.98	0.93	0.89	0.84	0.80	0.75	0.69
	100	1	1	1	1	1	1	1	0.95	0.90	0.85	0.81	0.76	0.70
	90	1	1	1	1	1	1	1	0.96	0.91	0.86	0.82	0.77	0.71
	80	1	1	1	1	1	1	1	0.97	0.92	0.87	0.83	0.78	0.72
	70	1	1	1	1	1	1	1	0.98	0.93	0.88	0.83	0.79	0.73
	60	1	1	1	1	1	1	1	0.99	0.94	0.89	0.84	0.79	0.74
	50	1	1	1	1	1	1	1	1	0.95	0.90	0.85	0.80	0.75
			0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000

ALTITUDE (FEET ABOVE SEA LEVEL)

**AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)**

INLET AIR TEMP °F	130	1.37	1.43	1.48	1.54	1.60	1.66	1.72	1.74	1.74	1.74	1.74	1.74	1.74
	120	1.30	1.36	1.41	1.47	1.53	1.59	1.65	1.67	1.67	1.67	1.67	1.67	1.67
	110	1.22	1.28	1.33	1.39	1.44	1.50	1.56	1.58	1.58	1.58	1.58	1.58	1.58
	100	1.15	1.20	1.26	1.31	1.37	1.42	1.48	1.50	1.50	1.50	1.50	1.50	1.50
	90	1.07	1.12	1.18	1.23	1.28	1.34	1.40	1.41	1.41	1.41	1.41	1.41	1.41
	80	1	1.05	1.10	1.15	1.21	1.26	1.32	1.34	1.34	1.34	1.34	1.34	1.34
	70	1	1	1.02	1.07	1.13	1.18	1.23	1.25	1.25	1.25	1.25	1.25	1.25
	60	1	1	1	1	1.05	1.10	1.15	1.17	1.17	1.17	1.17	1.17	1.17
	50	1	1	1	1	1	1.02	1.07	1.09	1.09	1.09	1.09	1.09	1.09
			0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000

ALTITUDE (FEET ABOVE SEA LEVEL)

**FUEL USAGE GUIDE:**

This table shows the derate factor required for a given fuel. Note that deration occurs as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar methane number calculation.

**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. The derate factors shown do not account for the external cooling system capacity. The derate factors provided assume the external cooling system can maintain the specified cooling water temperatures at site conditions.

**ACTUAL ENGINE RATING:**

To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/ Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).

- 1) Fuel Usage Guide Deration
- 2)  $1 - ((1 - \text{Altitude / Temperature Deration}) + (1 - \text{RPC}))$

**AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):**

To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See notes (24) and (25) for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

**INLET AND EXHAUST RESTRICTIONS FOR ALTITUDE CAPABILITY:**

The altitude derate chart is based on the maximum inlet and exhaust restrictions provided on page 1. Contact factory for restrictions over the specified values. Heavy Derates for higher restrictions will apply.

**NOTES:**

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.
2. Generator efficiencies, power factor, and voltage are based on standard generator. [Genset Power (ekW) is calculated as: Engine Power (bkW) x Generator Efficiency], [Genset Power (kVA) is calculated as: Engine Power (bkW) x Generator Efficiency / Power Factor]
3. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load.
4. Genset Efficiency published in accordance with ISO 3046/1, based on a 1.0 power factor.
5. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 248°F with engine operation at ISO 3046/1 Genset Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.
6. Total efficiency is calculated as: Genset Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.
7. ISO 3046/1 Genset fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal genset and engine fuel consumption tolerance is ± 3.0% of full load data at the specified power factor.
8. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.
9. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
10. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
11. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
12. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
13. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.
14. Gaseous emissions data measurements are consistent with those described in EPA 40 CFR PART 60 SUBPART JJJJ and ISO 8178 for measuring VOC, CO, and NOx. Gaseous emissions values are weighted cycle averages and are in compliance with the stationary regulations.
15. LHV rate tolerance is ± 3.0%.
16. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
17. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
18. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
19. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
20. Heat rejection to exhaust (LHV to 77°F) value shown includes unburned fuel and is not intended to be used for sizing or recovery calculations.
21. Heat rejection to A/C - Stage 1 based on treated water. Tolerance is ±5% of full load data.
22. Heat rejection to A/C - Stage 2 based on treated water. Tolerance is ±5% of full load data.
23. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
24. Total Jacket Water Circuit heat rejection is calculated as:  $(\text{JW} \times 1.1) + (\text{OC} \times 1.2) + (1\text{AC} \times 1.05) + [0.78 \times (1\text{AC} + 2\text{AC}) \times (\text{ACHRF} - 1) \times 1.05]$ . Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
25. Total Second Stage Aftercooler Circuit heat rejection is calculated as:  $(2\text{AC} \times 1.05) + [(1\text{AC} + 2\text{AC}) \times 0.22 \times (\text{ACHRF} - 1) \times 1.05]$ . Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

**FREE FIELD MECHANICAL & EXHAUST NOISE**
**MECHANICAL: Sound Power (1/3 Octave Frequencies)**

Gen Power Without Fan	Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1035	100	1468	125.5	108.0	109.6	114.9	111.5	108.8	113.4	112.6	112.7	111.8	110.2
776	75	1100	122.9	107.6	109.3	113.7	110.7	108.2	113.1	111.5	111.9	111.4	109.6
517	50	738	121.9	106.9	108.0	113.4	108.9	107.9	112.9	111.8	111.0	110.5	109.3

**MECHANICAL: Sound Power (1/3 Octave Frequencies)**

Gen Power Without Fan	Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1035	100	1468	110.5	109.7	109.7	108.2	109.5	107.7	106.3	105.5	118.4	119.0	106.1
776	75	1100	109.8	108.9	108.4	106.7	107.5	106.4	104.8	106.5	111.5	103.1	100.7
517	50	738	109.5	108.4	107.6	105.7	105.9	104.5	105.3	106.5	100.2	98.5	97.5

**EXHAUST: Sound Power (1/3 Octave Frequencies)**

Gen Power Without Fan	Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1035	100	1468	129.7	115.0	123.2	117.2	119.3	119.7	123.3	121.5	113.6	114.3	115.0
776	75	1100	128.5	113.7	121.5	115.1	117.7	120.1	121.9	120.1	113.0	113.6	114.1
517	50	738	126.6	113.4	120.7	113.3	114.3	117.2	119.3	118.8	112.3	111.9	111.5

**EXHAUST: Sound Power (1/3 Octave Frequencies)**

Gen Power Without Fan	Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1035	100	1468	111.2	106.4	106.1	102.8	101.6	102.0	98.3	94.4	100.2	102.0	88.9
776	75	1100	110.5	105.8	104.5	99.8	98.9	99.1	96.1	93.0	96.5	87.9	83.4
517	50	738	108.5	104.6	102.5	96.4	95.6	95.6	93.9	92.3	87.5	84.8	80.2

**SOUND PARAMETER DEFINITION:**

Sound Power Level Data

Sound power is defined as the total sound energy emanating from a source irrespective of direction or distance. Sound power level data is presented under two index headings:

Sound power level -- Mechanical

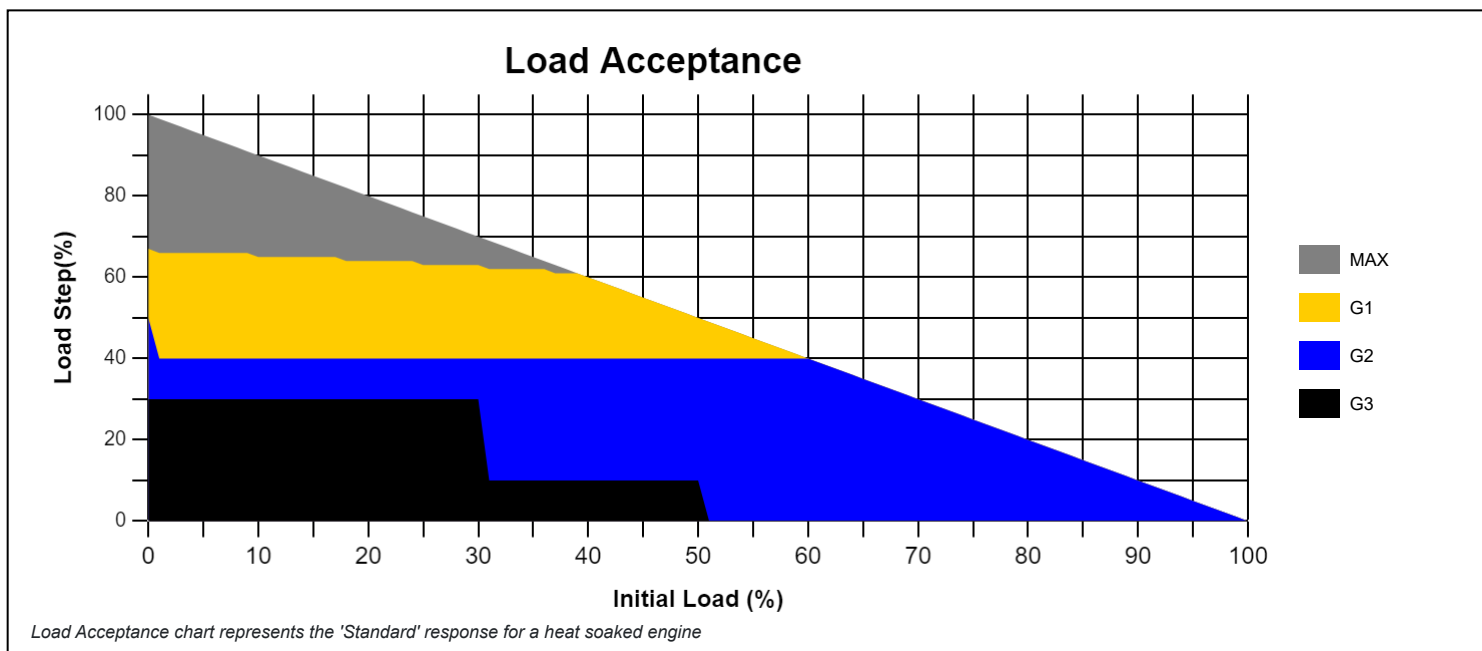
Sound power level -- Exhaust

Mechanical: Sound power level data is calculated in accordance with ISO 3747. The data is recorded with the exhaust sound source isolated.

Exhaust: Sound power level data is calculated in accordance with ISO 6798 Annex A. Exhaust data is post-catalyst on gas engine ratings labeled as "Integrated Catalyist".

Measurements made in accordance with ISO 3747 and ISO 6798 for mechanical and exhaust sound level only. Frequency bands outside the displayed ranges are not measured, due to physical test, and environmental conditions that affect the accuracy of the measurement. No cooling system noise is included unless specifically indicated. Sound level data is indicative of noise levels recorded on one engine sample in a survey grade 3 environment.

How an engine is packaged, installed and the site acoustical environment will affect the site specific sound levels. For site specific sound level guarantees, sound data collection needs to be done on-site or under similar conditions.



Transient Load Acceptance					
Load Step	Frequency Deviation +/- (%)	Voltage Deviation +/- (%)	Recovery Time (sec)	Classification as Defined by ISO 8528 - 5	Notes
100	+1/-23	+2/-53	6.5/12.5		(5)
75	+1/-21	+1/-43	7.7/7.6		(5)
50	+1/-12	+4/-23	3.8/5.4	G1	(2)/(5)
40	+2/-11	+1/-20	3.6	G2	(3)
30	+2/-8	+1/-15	2.7/3	G2	(3)/(5)
25	+2/-6	+1/-11	2.5/3	G2	(3)/(5)
20	+2/-5	+1/-8	2.4/3.4	G2	(3)/(5)
15	+2/-4	+1/-6	2.4	G2	(3)
10	+2/-3	+1/-4	2.6	G2	(3)
-10	+3/-3	+1/-3	2/3.5		(5)
-20	+4/-3	+2/-4	3.8		
-50	+6/-4	+10/-3	3.4		
-75	+9/-16	+18/-23	5		
Breaker Open	+11/-1	+24/-2	2.8		(1)
Recovery Specification	+1.75/-1.75	+5/-5			
Steady State Specification	+0.5/-0.5	+0.25/-0.25			(6)

**Transient Information**

The transient load steps listed above are stated as a percentage of the engine's full rated load as indicated in the appropriate performance technical data sheet. Site ambient conditions, fuel quality, inlet/exhaust restriction and emissions settings will all affect engine response to load change. Engines that are not operating at the standard conditions stated in the Technical data sheet should be set up according to the guidelines included in the technical data; applying timing changes and/or engine derates as needed. Adherence to the engine settings guidelines will allow the engines to retain the transient performance stated in the tables above as a percentage of the site derated power (where appropriate). Fuel supply pressure and stability is critical to transient performance. Proper installation requires that all fuel train components (including filters, shut off valves, and regulators) be sized to ensure adequate fuel be delivered to the engine. The following are fuel pressure requirements to be measured at the engine mounted fuel control valve.

- a. Steady State Fuel Pressure Stability +/- .15 psi/sec
- b. Transient fuel Pressure Stability +/- .15 psi/sec Transient response is dependent on stable inlet manifold air temperature. For SCAC equipped engines, inlet water temperature to the SCAC must be maintained within +/- 1 °C during all engine-operating cycles. The Air Fuel Ratio control system may require up to 30 seconds after a load step has been performed for NOx emission to return to nominal setting. If the stabilization time between load steps is not met, then the transient performance listed in this document may not be met. Differences in generator inertia may change the transient response of engine. Engine governor gains and voltage regulator settings may need to be tuned for site conditions. The time needed to start and stabilize at rated engine speed is a minimum of 30 seconds after a successful crank cycle. Engines must be maintained in accordance with the guidelines set forth in the applicable service manuals for each engine. Wear of components outside of the specified tolerances will affect the transient capability of the engine. The Air Fuel Ratio control system requires up to 180 seconds to converge after a load step has been performed for NOx to return to nominal setting. If the stabilization time is not met between load steps the transient performance listed in the document may not be met. Differences in generator inertia may change the transient response of engine. Engine Governor gains and Voltage regulator settings may need to be tuned for site conditions. Engines must be maintained in accordance with the guidelines set forth in the applicable service manuals for each engine. Wear of components outside of the specified tolerances will affect the transient capability of the engine.

**NOTES:**

1. For unloading the engine to 0% load from a loaded condition no external input is needed. The engine control algorithm employs a load sensing strategy to determine a load drop. In the event that the local generator breaker opens the strategy provides control to the engine that resets all control inputs to the rated idle condition. This prevents engine over speeding and will allow the engine to remain running unloaded at the rated synchronous speed.
2. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G1 transient performance as defined by ISO 8528 - 5 with exceptions.
3. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G2 transient performance as defined by ISO 8528 - 5 with exceptions.
4. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G3 transient performance as defined by ISO 8528 - 5 with exceptions.
5. Air flow is critical for turbocharged engines during transients. As the exhaust temperature increases, the air flow or turbo response increases to enhance the genset transient response. Therefore, the recovery time for an engine's "First" load step after start up may differ from the "Standard" response for a heat soaked engine. If different, the load step recovery times are illustrated as Standard/First. If shown, '-' indicates engine is not capable of the specified initial load step.
6. Steady state voltage and frequency stability specified at +/-2 sigma or better.