

# Preliminary

Model: C1540 N5CC  
 Frequency: 50 Hz  
 Fuel Type: Natural Gas MI 73 +  
 Emissions Performance NOx: 500 Mg/Nm<sup>3</sup>  
 LT Water Inlet Temperature: 40°C (104°F)  
 HT Water Outlet Temp: 90°C (194°F)

**Generator set data sheet**  
 1540kW continuous

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<b>Measured Sound Performance Data Sheet:</b>	
<b>Prototype Test Summary Data:</b>	
<b>Remote Radiator Cooling Outline:</b>	A042T047

<b>Fuel Consumption (ISO3046/1)</b>	See Note	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
Fuel Consumption (LHV) ISO3046/1, kW (MMBTU/hr)	2,3,6,11	3582 (12.23)	3254 (11.11)	2768 (9.45)	1953 (6.67)
Mechanical Efficiency ISO3046/1, percent	2,3,6	44.8%	44.4%	43.5%	41.1%
Electrical Efficiency ISO3046/1, percent	2,3,6,11	43.0%	42.6%	41.7%	39.4%

<b>Engine</b>	
Engine Manufacturer	Cummins
Engine Model	QSK60G
Configuration	V16
Displacement, L (cu.in)	60 (3661)
Aspiration	Turbocharged (1)
Gross Engine Power Output, kWm (hp)	1606 (2153)
BMEP, bar (psi)	21.2 (307.4)
Bore, mm (in)	159 (6.26)
Stroke, mm (in)	190 (7.48)
Rated Speed, rpm	1500
Piston Speed, m/s (ft/min)	9.5 (1870)
Compression Ratio	13.5:1
Lube Oil Capacity, L (qt)	380 (400)
Overspeed Limit, rpm	1875
Full Load Lubricating oil consumption, g/kWe-hr (g/hp-hr)	0.15 (0.11)

<b>Fuel</b>	
Gas supply pressure to engine inlet, bar (psi) <sup>6</sup>	0.20 (2.9)
Minimum Methane Index	73

<b>Starting System(s)</b>	
Electric starter voltage, volts	24
Minimum battery capacity @ 40 deg.C (104 deg.F), AH	720
Air Starter Pressure, barg (psig)	NA
Air Starter Flow Nm <sup>3</sup> /s (scfm)	NA

<b>Genset Dimensions (see note 1)</b>	
Genset Length, m (ft)	5.12 (16.8)
Genset Width, m (ft)	2.23 (7.30)
Genset Height, m (ft)	2.77 (9.08)
Genset Weight (wet), kg (lbs)	15450 (33,990)

	See Notes	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
<b>Energy Data</b>					
Continuous Generator Electrical Output kWe @ 1.0 pf	9,11	1540	1386	1155	770
Total Heat Rejected in LT Circuit, kW (MMBTU/h)	4	127 (0.43)	111 (0.38)	91 (0.31)	66 (0.22)
Total Heat Rejected in HT Circuit, kW (MMBTU/h)	4	895 (3.06)	792 (2.70)	657 (2.24)	471 (1.61)
Unburnt, kW (MMBTU/h)	12	68 (0.23)	67 (0.23)	55 (0.19)	38 (0.13)
Heat Radiated to Ambient, kW (MMBTU/h)	12	252 (0.86)	228 (0.78)	193 (0.66)	134 (0.46)
Available Exhaust heat to 105C, kW (MMBTU/h)	4	651 (2.22)	660 (2.25)	553 (1.89)	427 (1.46)
<b>Intake Air Flow</b>					
Intake Air Flow Mass, kg/s (lb/hr)	3	2.13 (16870)	1.92 (15210)	1.58 (12510)	1.09 (8630)
Intake Air Flow Volume, m <sup>3</sup> /s @ 0°C (scfm)	3	1.65 (3690)	1.48 (3310)	1.22 (2720)	0.84 (1880)
Maximum Air Cleaner Restriction Below 35C, mmHG (in H <sub>2</sub> O)		11 (5.9)	NA	NA	NA
Maximum Air Cleaner Restriction Above 35C, mmHG (in H <sub>2</sub> O)		11 (5.9)	NA	NA	NA
<b>Exhaust Air Flow</b>					
Exhaust Gas Flow Mass, kg/s (lb/hr)	3	2.21 (17500)	1.98 (15680)	1.65 (13070)	1.13 (8950)
Exhaust Gas Flow Volume, m <sup>3</sup> /s (cfm)	3	4.05 (8570)	3.73 (7900)	3.20 (6780)	2.33 (4930)
Exhaust Temperature After Turbine, °C (°F)	2, 5	374 (706)	392 (738)	411 (773)	454 (849)
Max Exhaust System Back Pressure, mmHG (in H <sub>2</sub> O)	11,13	37.3 (20.0)	NA	NA	NA
Min Exhaust System Back Pressure, mmHG (in H <sub>2</sub> O)	11,13	NA	NA	NA	NA
<b>HT Cooling Circuit</b>					
HT Circuit Engine Coolant Volume, l (gal)		181 (48)	181 (48)	181 (48)	181 (48)
HT Coolant Flow @ Max Ext Restriction, m <sup>3</sup> /h (gal/min)		80 (353)	80 (353)	80 (353)	80 (353)
Maximum HT Engine Coolant Inlet Temp, °C (°F)	7	80 (175)	81 (178)	83 (181)	85 (185)
HT Coolant Outlet Temp, °C (°F)	7	90 (194)	90 (194)	90 (194)	90 (194)
Max Pressure Drop in External HT Circuit, bar (psig)		1.0 (15)	1.0 (15)	1.0 (15)	1.0 (15)
HT Circuit Maximum Pressure, bar (psig)		5.0 (73)	5.0 (73)	5.0 (73)	5.0 (73)
Minimum Static Head - Pump Inlet, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	0.5 (7)
<b>LT Cooling Circuit</b>					
LT Circuit Engine Coolant Volume, l (gal)		34 (9)	34 (9)	34 (9)	34 (9)
LT Coolant Flow @ Max Ext Restriction, m <sup>3</sup> /h (gal/min)		25 (109)	25 (109)	25 (109)	25 (109)
Maximum LT Engine Coolant Inlet Temp, °C (°F)	8	50 (122)	50 (122)	50 (122)	50 (122)
Nominal LT Coolant Inlet Temp, °C (°F)	8	40 (104)	40 (104)	40 (104)	40 (104)
Max Pressure Drop in External LT Circuit, bar (psig)		1.0 (15)	1.0 (15)	1.0 (15)	1.0 (15)
LT Circuit Maximum Pressure, bar (psig)		5.0 (73)	5.0 (73)	5.0 (73)	5.0 (73)
Minimum Static Head - Pump Inlet, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	0.5 (7)
<b>Emissions</b>					
NO <sub>x</sub> Emissions dry, ppm	14	166	166	181	185
NO <sub>x</sub> Emissions, mg/Nm <sup>3</sup> @5% O <sub>2</sub> (g/hp-h)	14	400 (0.80)	400 (0.80)	500 (0.90)	500 (0.90)
THC Emissions wet, ppm	12	1431	1500	1564	1595
THC Emissions, mg/Nm <sup>3</sup> @5% O <sub>2</sub> (g/hp-h)	12	1585 (3.00)	1643 (3.00)	1686 (3.00)	1663 (3.00)
NMHC Emissions wet, ppm	12	286	300	313	319
NMHC Exhaust Emissions, mg/Nm <sup>3</sup> (g/hp-h)	12	320 (0.6)	320 (0.6)	320 (0.6)	320 (0.6)
CO Emissions (dry), ppm	12	434	440	445	452
CO Emissions, mg/Nm <sup>3</sup> @5% O <sub>2</sub> (g/hp-h)	12	760 (1.40)	760 (1.40)	750 (1.40)	740 (1.50)
CO <sub>2</sub> Emissions (dry), percent	12	6.4	6.5	6.6	6.9
O <sub>2</sub> Emissions (dry), percent	12	9.5	9.4	9.2	8.7
Particulates PM <sub>10</sub> , g/hp-h	12	< 0.03	< 0.03	< 0.03	< 0.03

## Genset De-rating

### Altitude and Temperature Derate Multiplication Factor

Barometer		Altitude		Table A *																
In Hg	mbar	Feet	Meters	Derate Multiplier with Grid Parallel Operation																
20.7	701	9843	3000	0.78	0.77	0.74	0.69	0.65	-	-	-	-	-	-	-	-	-	-	-	-
21.4	723	9022	2750	0.81	0.79	0.76	0.72	0.67	-	-	-	-	-	-	-	-	-	-	-	-
22.1	747	8202	2500	0.84	0.82	0.79	0.74	0.69	0.65	-	-	-	-	-	-	-	-	-	-	-
22.8	771	7382	2250	0.87	0.85	0.82	0.77	0.72	0.67	-	-	-	-	-	-	-	-	-	-	-
23.5	795	6562	2000	0.90	0.88	0.85	0.80	0.75	0.70	0.65	-	-	-	-	-	-	-	-	-	-
24.3	820	5741	1750	0.93	0.91	0.88	0.82	0.77	0.72	0.68	-	-	-	-	-	-	-	-	-	-
25.0	846	4921	1500	0.96	0.94	0.91	0.85	0.79	0.74	0.70	-	-	-	-	-	-	-	-	-	-
25.8	872	4101	1250	0.99	0.97	0.93	0.88	0.82	0.77	0.72	0.67	-	-	-	-	-	-	-	-	-
26.6	899	3281	1000	1.00	1.00	0.96	0.90	0.84	0.79	0.74	0.68	-	-	-	-	-	-	-	-	-
27.4	926	2461	750	1.00	1.00	0.99	0.94	0.88	0.82	0.77	0.72	-	-	-	-	-	-	-	-	-
28.3	954	1640	500	1.00	1.00	1.00	0.97	0.91	0.84	0.79	0.74	-	-	-	-	-	-	-	-	-
29.1	983	820	250	1.00	1.00	1.00	0.99	0.94	0.88	0.82	0.76	-	-	-	-	-	-	-	-	-
29.5	995	492	150	1.00	1.00	1.00	1.00	0.95	0.89	0.83	0.77	-	-	-	-	-	-	-	-	-
30.0	1012	0	0	1.00	1.00	1.00	1.00	0.96	0.90	0.85	0.79	0.75	-	-	-	-	-	-	-	-
			°C	20	25	30	35	40	45	50	55	60	-	-	-	-	-	-	-	-
			°F	68	77	86	95	104	113	122	131	140	-	-	-	-	-	-	-	-
			Air Filter Inlet Temperature																	

\* Based on SAE standard ambient pressure vs. altitude. Assumes LT return temperature is 10C above air filter inlet.

### Temperature & Altitude Derate

1. Determine derate multiplier vs. temperature and altitude in Table A depending upon your operating condition.
2. Assumes the LT return temperature is 10 deg C above the air filter inlet with a maximum LT temperature of 40 deg C.
3. If the LT temperature exceeds 40 deg C, consult factory for recommendations.
4. Altitude is based upon SAE standard ambient pressure vs. altitude. For low barometric conditions add 150m (500 ft) to site altitude.

### Heat Rejection Factor (altitude and ambient) for HT and LT Circuits

Barometer		Altitude		Table B																
In Hg	mbar	Feet	Meters	Multiplier for HT & LT Heat Rejection vs Alt & Temp.																
20.7	701	9843	3000	1.11	1.13	1.14	1.15	1.17	1.18	1.19	-	-	-	-	-	-	-	-	-	-
21.4	723	9022	2750	1.10	1.12	1.13	1.14	1.15	1.17	1.18	-	-	-	-	-	-	-	-	-	-
22.1	747	8202	2500	1.09	1.10	1.12	1.13	1.14	1.16	1.17	-	-	-	-	-	-	-	-	-	-
22.8	771	7382	2250	1.08	1.09	1.11	1.12	1.13	1.14	1.16	-	-	-	-	-	-	-	-	-	-
23.5	795	6562	2000	1.07	1.08	1.09	1.11	1.12	1.13	1.15	-	-	-	-	-	-	-	-	-	-
24.3	820	5741	1750	1.06	1.07	1.08	1.10	1.11	1.12	1.14	-	-	-	-	-	-	-	-	-	-
25.0	846	4921	1500	1.05	1.06	1.07	1.09	1.10	1.11	1.12	-	-	-	-	-	-	-	-	-	-
25.8	872	4101	1250	1.04	1.05	1.06	1.07	1.09	1.10	1.11	-	-	-	-	-	-	-	-	-	-
26.6	899	3281	1000	1.02	1.04	1.05	1.06	1.08	1.09	1.10	-	-	-	-	-	-	-	-	-	-
27.4	926	2461	750	1.01	1.03	1.04	1.05	1.07	1.08	1.09	-	-	-	-	-	-	-	-	-	-
28.3	954	1640	500	1.00	1.02	1.03	1.04	1.05	1.07	1.08	-	-	-	-	-	-	-	-	-	-
29.1	983	820	250	0.99	1.00	1.02	1.03	1.04	1.06	1.07	-	-	-	-	-	-	-	-	-	-
29.5	995	492	150	0.99	1.00	1.01	1.03	1.04	1.05	1.06	-	-	-	-	-	-	-	-	-	-
30.0	1012	0	0	0.98	0.99	1.01	1.02	1.03	1.05	1.06	-	-	-	-	-	-	-	-	-	-
			°C	20	25	30	35	40	45	50	55	60	-	-	-	-	-	-	-	-
			°F	68	77	86	95	104	113	122	131	140	-	-	-	-	-	-	-	-
			Air Filter Inlet Temperature																	

### LT & HT Circuit Heat Rejection Calculation

1. Determine derate multiplier vs. temperature derate per above.
2. Using the multiplier from #1 above as the percent load factor determine the Heat rejection from the previous page.
3. From Table B find the HT and LT circuit multiplier.
4. Multiply the result of step 2 by the result of step 3 to obtain the heat rejection at your altitude and temperature.

### Methane Number Capability

Load (Percent of Rated)			
100%	90%	75%	50%
73	70	64	60

## Alternator Data

Voltage Range	Connection Configuration	Temp Rise Degrees C	Duty <sup>10</sup> Cycle	Single Phase Factor	Alternator Data Sheet	Feature Code
380-440	Wye, 3 Phase	80	C	N/A		
380-440	Wye, 3 Phase	105	C	N/A		
3300	Wye, 3 Phase	80	C	N/A		
3300	Wye, 3 Phase	105	C	N/A		
6300-6600	Wye, 3 Phase	80	C	N/A		
6300-6600	Wye, 3 Phase	105	C	N/A		
10000	Wye, 3 Phase	80	C	N/A		
10000	Wye, 3 Phase	105	C	N/A		
10500-11000	Wye, 3 Phase	80	C	N/A		
10500-11000	Wye, 3 Phase	105	C	N/A		
13200	Wye, 3 Phase	80	C	N/A		
13200	Wye, 3 Phase	105	C	N/A		

## Continuous Rating Definition

Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271, and BS5514).

## Notes

- 1) Weights and set dimensions represent a generator set with its standard features only. See outline drawing for other configurations.
- 2) At ISO3046 reference conditions, altitude 1013 mbar (30in Hg), air inlet temperature 25 °C (77°F)
- 3) According to ISO 3046/I with fuel consumption tolerance of +5% -0%
- 4) Production variation/tolerance ±10%.
- 5) With air intake at 25 °C (77°F). Tolerance ± 10°C.
- 6) Tested using pipeline natural gas with LHV of 33.44mJ/Nm3 (905BTU/ft3)
- 7) Outlet temperature controlled by thermostat. Inlet temperature for reference only.
- 8) Inlet temperature controlled by thermostat, outlet temperature for reference only.
- 9) With on engine coolant pumps
- 10) Standby (S), Prime (P), Continuous ( C)
- 11) At electrical output of 1.0 Power Factor
- 12) Tolerance +/- 15%
- 13) Exhaust system back pressure is at rated load and will decrease at lower loads.
- 14) Tolerance ±10% for 500mg, ±14% for 350mg & ±20% for 250mg
- 15) NA = Not Applicable

