

Cummins Inc.

Columbus, Indiana 47201

Engine Data Sheet

Basic Engine Model: **QSK23-G3**

FR-50011

Curve Number: Date:

G-DRIVE QSK 1

Engine Critical Parts List: CPL: 8352

16Jan06

Displacement : 23.15 litre (1413 in 3) Bore: 170 mm (6.69 in.) Stroke: 170 mm (6.69 in.)

No. of Cylinders: 6 Aspiration: Turbocharged and Air to Air Aftercooled

Engine Speed	Standby Power		Prime	Power	Continuous Power		
RPM	kWm	kWm BHP		ВНР	kWm	ВНР	
1500	768 1030		701	701 940		720	
1800	895 1200		1200 809 1085		652	875	

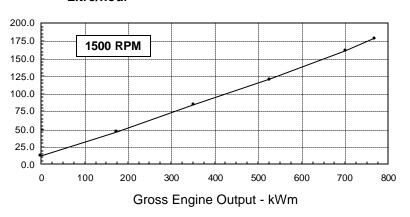
Emissions Certification (1800 RPM Only)

"For mobile applications in the U.S. and Canada, this rating may only be sold in accordance with the OEM TPEM provisions of 40 CFR 89.102. For stationary applications in the U.S. (except California), this rating may be sold through 2006 under the NSPS provisions of 40 CFR Part 60."

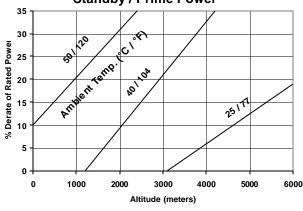
Engine Performance Data @ 1500 RPM

OUTPUT POWER			FUEL CONSUMPTION					
%	kWm	ВНР	kg/ lb/ kWm·h BHP·h		litre/ hour	U.S. Gal/ hour		
STAN	DBY PO	WER						
100	768	1030	0.197	0.323	178	46.9		
PRIME	PRIME POWER							
100	701	940	0.195	0.321	161	42.5		
75	526	705	0.196	0.322	121	32.0		
50	351	470	0.206	0.338	85	22.4		
25	175	235	0.223	0.370	46	12.2		
CONT	CONTINUOUS POWER							
100	537	720	0.198	0.326	125	33.1		

Litre/hour



Power Derate Curves @ 1500 RPM Standby / Prime Power



Continuous Power 35 30 Derate of Rated Power 25 20 ŝ b) 15 5 0 1000 2000 3000 4000 5000 6000 Altitude (meters)

Operation At Elevated Temperature And Altitude:

For sustained operation above these conditions, derate by an additional 3.4% per 300 m (1000 ft), and 20% per 10° C (18° F). Data Subject to Change Without Notice

CONVERSIONS: (litres = U.S. Gal x 3.785) (U.S.Gal = litres x 0.2642)

These guidelines have been formulated to ensure proper application of generator drive engines in A.C. generator set installations. STANDBY POWER RATINS: Applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility and standby rated for a maximum of an 80% average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby ratings should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency. PRIME POWER RATING: Applicable for supplying electric power in lieu of commercially purchased power. Prime Power applications must be in the form of one of the following two categories: UNLIMITED TIME RUNNING PRIME POW Fower applications must be in the form of one of the following two categories: <u>SNLIMITED 11 MIR RUNNING PRIME POWE</u>.

ER: Prime Power is available for an unlimited number of hours per year in a variable load application. Variable load should not exceed a 70% average of the Prime Power rating during any operating period of 250 hours. The total operating time at 100% Prime Power shall not exceed 500 hours per year. A 10% overload capability is availability in a variability is availability in a variable load application. It is intended for use in the 10% overload power shall not exceed 25 hours per year. LIMITED TIME RUNNING PRIME POWER: Limited Time Prime Power is available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating. The customers should be aware, however, that the life of any engine the reduced by this ceed the Prime Power rating. The customer should be aware, however, that the life of any engine will be reduced by this constant high load operation. Any operation exceeding 750 hours per year at the Prime Power rating should use the Continuous Power rating. CONTINUOUS POWER RATING: Applicable for supplying utility power at a constant 100% load for an unlimited number of hours per year. No overload capability is available for this rating.

Reference AEB 10.47 for determining Electrical Output

Data shown above represent gross engine performance capabilities obtained and corrected in accordance with ISO-3046 conditions of 100 kPa (29.53 in Hg) barometric pressure [110 m (361 ft) altitude], 25 °C (77 °F) air inlet temperature, and relative humidity of 30% with No. 2 diesel or a fuel corresponding to ASTM D2. Derates shown are based on 15 in H₂0 air intake restriction and 2 in Hg exhaust back pressure

The fuel consumption data is based on No. 2 diesel fuel weight at 0.85 kg/litre (7.1 lbs/U.S. gal). 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, optional equipment and driven components.

Data Status: Limited Production

Data Tolerance: ± 5%

Chief Engineer:

DK. Trueblood



Cummins Inc.

Columbus, Indiana 47201

Engine Data Sheet

Basic Engine Model: QSK23-G3

Engine Critical Parts List:

FR-50011

Curve Number:

16Jan06

QSK 2

G-DRIVE

CPL: 8352

Bore: 170 mm (6.69 in.) Stroke: 170 mm (6.69 in.)

No. of Cylinders: 6 Aspiration: Turbocharged and Air to Air Aftercooled

Engine Speed	Standby	/ Power	Prime	Power	Continuous Power		
RPM	kWm	ВНР	kWm	ВНР	kWm	ВНР	
1500	768	1030	701	701 940		720	
1800	895	1200	809	1085	652	875	

Emissions Certification (1800 RPM Only)

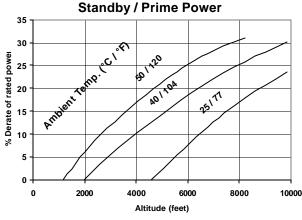
Displacement : 23.15 litre (1413 in 3)

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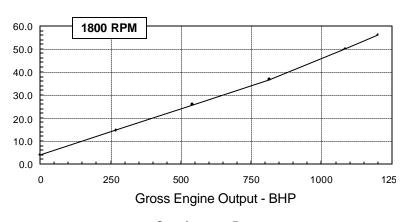
Engine Performance Data @ 1800 RPM

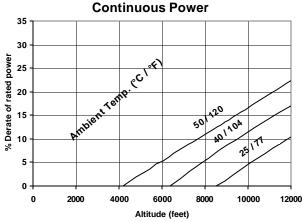
OUTPUT POWER			FUEL CONSUMPTION					
%	kWm	ВНР	kg/ lb/ kWm⋅h BHP⋅h					
STAN	DBY PO	WER						
100	895	1200	0.201 0.332		212	56.1		
PRIME POWER								
100	809	1085	0.199	0.326	189	49.8		
75	607	814	0.195	0.320	139	36.7		
50	405	543	0.204	0.336	97	25.7		
25	202	271	0.236 0.385		56	14.7		
CONT	INUOUS	POWE	R					
100	653	875	0.194	0.320	149	39.4		

Power Derate Curves @ 1800 RPM



U.S. Gallons / hour





Operation At Elevated Temperature And Altitude:

For sustained operation above these conditions, derate by an additional 5.0% per 300 m (1000 ft), and 7% per 10° C (18° F).

CONVERSIONS: (litres = U.S. Gal x 3.785) (U.S.Gal = litres x 0.2642)

These guidelines have been formulated to ensure proper application of generator drive engines in A.C. generator set installations. STANDBY POWER RATING: Applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility power is available. A Standby rated engine should be sized for a maximum of an 80% average load factor and 200 hours operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby ratings should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency. PRIME POWER RATING: Applicable for supplying electric power in lieu of commercially purchased power. Prime Power applications must be in the form of one of the following two categories: UNLIMITED TIME RUNNING PRIME POWER. Prime Power is available for an unlimited number of hours per year in a variable load application. It available load should not exceed a 70% average of the Prime Power rating during any operating period of 250 hours. The total operating time at 100% Prime Power shall not exceed 50 hours per year. A 10% overload capability is available for a period of in working application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating. The customer should be aware, however, that the life of any engine will be reduced by this constant high load operation. Any operation exceeding 750 hours per year at the Prime Power rating should use the Continuous Power rating. CONTINUOUS POWER RATING: Applicable for supplying utility power at a constant 100% load for an unlimited number of hours per

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Data Subject to Change Without Notice

The fuel consumption data is based on No. 2 diesel fuel weight at 0.85 kg/llite (7.1 lbs/U.S. gal). 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, optional equipment and driven components.

Data Status: Limited Production

Data Tolerance: ± 5%

Chief Engineer:

DK. Irueblood

Cummins Inc. Engine Data Sheet

ENGINE MODEL: QSK23-G3 CONFIGURATION NUMBER: D893001GX03 DATE: 16Jan06
PERFORMANCE CURVE: FR-50011

INSTALLATION DIAGRAM

• Fan to Flywheel : 3170553

<u>CPL NUMBER</u> • Engine Critical Parts List : 8352

74 - 103

(19 - 27)

Type	Inline 6-Cylinder	Diesel
Aspiration		nd Low Temperatur
	Aftercooled	
Bore x Stroke — mm x mm (in x in)	170 x 170 (6.69	x 6.69)
Displacement — litre (in²)	23.15 (1413)	
Compression Ratio	16.0:1	
Dry Weight		
Fan to Flywheel Engine — kg (lb)	2755	(6060)
Wet Weight		
Fan to Flywheel Engine — kg (lb)	2805	(6170)
Moment of Inertia of Rotating Components		
• with (SAE 0)	11.6	(270)
Center of Gravity from Front Face of Block	725	(28.5)
Center of Gravity Above Crankshaft Centerline	240	(9.5)
Maximum Static Loading at Rear Main Bearing — kg (lb)	990	(2160)
Ng (is)	333	(2.00)
ENGINE MOUNTING		
Maximum Bending Moment at Rear Face of Block — N • m (lb • ft)	3205	(2340)
EXHAUST SYSTEM		
Maximum Back Pressure— mm Hg (in Hg)	76.2	(3)
AIR INDUCTION SYSTEM Maximum Intake Air Restriction: • with Dirty Filter Element	635	(25)
• with Clean Filter Element	381	(15)
COOLING SYSTEM		
Coolant Capacity — Engine Only — litre (US gal)	46.5	(12.3)
Minimum Pressure Cap — kPa (psi)	69	(10)
la alias (Water Circuit Demains and		
<u>Jacket Water Circuit Requirements</u> Maximum Static Head of Coolant Above Engine Crank Centerline	18.3	(60)
Standard Thermostat (Modulating) Range	76.5-90	(170 - 194)
Maximum Top Tank Temperature for Standby . Prime Power	104 - 100	(220 - 212)
Maximum Coolant Friction Head External to the Engine - 1800 RPM — kPa (psi)	48	` , ,
-1500 RPM — kPa (psi)	46 34	(7) (5)
		· ,
Air-to-Air Core Requirements Mayirum Torra Dica Patrican Famina Air Intelsa and Intelsa Manifold 4500 / 4800 mag. 80 (%)	~	(00)
Maximum Temp. Rise Between Engine Air Intake and Intake Manifold —1500 / 1800 rpm — °C (°F)	33	(60)
Maximum Air Press. Drop from Turbo Air Outlet to Intake Manifold — 1500 / 1800 rpm — mm Hg (in Hg)	102	(4)
LUBRICATION SYSTEM		
Oil Pressure @ Idle Speed	145	(21)
@ Governed Speed — kPa (psi)	345 - 448	(50 - 65)
Maximum Oil Temperature	120	(248)
Oil Capacity with OP TBD Oil Pan : Low - High	66 - 95	(17 - 25)
Total System Canacity (Mith Combo Filters)	74 - 103	(10 - 27)

G-DRIVE

FUEL SYSTEM

102201012111		
Type Injection System	Cummir	ns HPI-PT
Maximum Restriction at Fuel Injection Pump — with Clean Fuel Filter — mm Hg (in Hg)	120	(4.0)
— with Dirty Fuel Filter — mm Hg (in Hg)	203	(8.0)
Maximum Allowable Head on Injector Return Line (Consisting of Friction Head and Static Head)	229	(9.0)
Maximum Inlet Temperature	70	(160)
Maximum Fuel Flow to Injection Pump — litre / hr (US gph)	684	(181)
Maximum Drain Flow — litre / hr (US gph)	662	(175)
ELECTRICAL SYSTEM		
Cranking Motor (Heavy Duty, Positive Engagement)volt		24
Battery Charging System, Negative Ground ampere		35
Maximum Allowable Resistance of Cranking Circuit — ohm	0.0	02
Minimum Recommended Battery Capacity		
Cold Soak @ 10 °C (50 °F) and Above0°F CCA	12	00
• Cold Soak @ 0 °C to 10 °C (32 °F to 50 °F)	12	80
• Cold Soak @ -18 °C to 0 °C (0 °F to 32 °F)	18	00
COLD START CAPABILITY		
Minimum Ambient Temperature for Cold Start with 1500 watt Coolant Heater to Rated Speed	-30	(-22)
Minimum Ambient Temperature for Unaided Cold Start to Idle Speed	0	(32)
Minimum Ambient Temperature for NFPA 110 Cold Start (90° F Minimum Coolant Temperature)	10	(50)
PERFORMANCE DATA	-	()
All data is based on: • Engine operating with fuel system, water pump, lubricating oil pump, air cleaner and exhaust		

• Engine operating with fuel system, water pump, lubricating oil pump, air cleaner and exhaust silencer; not included are battery charging alternator, fan, and optional driven components.

• Engine operating with fuel corresponding to grade No. 2-D per ASTM D975.

• ISO 3046, Part 1, Standard Reference Conditions of:

Barometric Pressure : 100 kPa (29.53 in Hg) Air Temperature : 25 °C (77 °F)

Altitude : 110 m (361 ft) Relative Humidity : 30%

Air Intake Restriction : 381 mm H_2O (15 in H_2O) Exhaust Restriction : 51 mm H_2 (2 in H_2O)

	STANDBY POWER			<u>ER</u>	PRIME POWER			
	6	0 hz	50) hz	6	0 hz	50) hz
Governed Engine Speed rpm	1	800	1:	500	1	1800	1	500
Engine Idle Speedrpm	750		750		750		750	
Gross Engine Power Output — kW _m (BHP)	895	(1200)	768	(1030)	809	(1085)	701	(940)
Brake Mean Effective Pressure — kPa (psi)	2600	(377)	2675	(388)	2350	(341)	2441	(354)
Piston Speed — m / s (ft / min)	10.3	(2010)	8.6	(1675)	10.3	(2010)	8.6	(1675)
Friction Horsepower — kW _m (HP)	93	(124)	72	(96)	93	(124)	72	(96)
Engine Jacket Water Flow at Stated Friction Head External to Engine:								
• 3 psi Friction Head litre / s (US gpm)	10.4	(165)	7.6	(120)	10.4	(165)	7.9	(126)
Maximum Friction Head litre / s (US gpm)	10.1	(160)	7.6	(120)	10.1	(160)	7.6	(120)
Engine Data								
Intake Air Flow— litre / s (cfm)	1132	(2398)	888	(1882)	1094	(2318)	815	(1720)
Exhaust Gas Temperature — °C (°F)	514	(957)	543	(1010)	467	(872)	532	(990)
Exhaust Gas Flow litre / s (cfm)	3056	(6475)	2463	(5218)	2773	(5875)	2259	(4786)
Air-to-Fuel Ratio— air : fuel	25.	5 : 1	23.	8:1	27.	.6 : 1	25	.3 : 1
Radiated Heat to Ambient — kW _m (BTU / min)	85	(4862)	71	(4058)	76	(4313)	65	(3682)
Heat Rejection to Jacket Water Coolant — kW _m (BTU / min)	269	(15305)	222	(12636)	235	(13358)	215	(12252)
Heat Rejection to Exhaust — kW _m (BTU / min)	656	(37334)	570	(32417)	569	(32392)	507	(28877)
Heat Rejection to Fuel*	9.1	(520)	6.8	(387)	9.1	(520)	6.8	(387)
Charge Air Cooler Heat Rejection	223	(12673)	146	(8329)	198	(11270)	122	(6944)
Turbo Compressor Outlet Temperature — °C (°F)	227	(440)	199	(390)	209	(408)	182	(360)
Turbo Compressor Outlet Pressure — kPa (psi)	283	(41)	248	(36)	269	(39)	214	(31)

^{*} This is the maximum heat rejection to fuel, which is at low load

N.A. - Not Available

N/A - Not Applicable to this Engine

TBD - To Be Determined

ENGINE MODEL: QSK23-G3
DATA SHEET: DS-50011-LP
DATE: 16Jan06
CURVE NO.: FR-50011