PERFORMANCE DATA [RRA16670]

SEPTEMBER 12, 2023

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Help

Perf No: DM7687 **Change Level:** 08

General | Heat Rejection | Emissions | Regulatory | Altitude Derate | Cross Reference | Perf Param Ref

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SALES MODEL:	C13	**COMBUSTION:**	DIRECT INJECTION
BRAND:	CAT	**ENGINE SPEED (RPM):**	2,100
MACHINE SALES MODEL:		**PEAK TORQUE SPEED (RPM):**	1,400
ENGINE POWER (BKW):	328.0	**TORQUE RISE (%):**	35
PEAK TORQUE (NM):	2,010.0	**ASPIRATION:**	TA
COMPRESSION RATIO:	17.3	**AFTERCOOLER TYPE:**	ATAAC
RATING LEVEL:	INDUSTRIAL C - INTERMITTENT	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
PUMP QUANTITY:	1	**INLET MANIFOLD AIR TEMP (C):**	49
FUEL TYPE:	DIESEL	**JACKET WATER TEMP (C):**	89
MANIFOLD TYPE:	DRY	**TURBO CONFIGURATION:**	SINGLE
GOVERNOR TYPE:	ELEC	**TURBO QUANTITY:**	1
INJECTOR TYPE:	EUI	**TURBOCHARGER MODEL:**	GTA4502BS 1.33 A/R
REF EXH STACK DIAMETER (MM):	127	**CERTIFICATION YEAR:**	2005
MAX OPERATING ALTITUDE (M):	716	**PISTON SPD @ RATED ENG SPD (M/SEC):**	11.0

INDUSTRY	SUB INDUSTRY	APPLICATION
INDUSTRIAL	GENERAL INDUSTRIAL	INDUSTRIAL
INDUSTRIAL	MATERIAL HANDLING	INDUSTRIAL
INDUSTRIAL	CONSTRUCTION	INDUSTRIAL
INDUSTRIAL	MINING	INDUSTRIAL
INDUSTRIAL	AGRICULTURE	INDUSTRIAL
OIL AND GAS	WELL SERVICING	INDUSTRIAL
OIL AND GAS	LAND PRODUCTION	INDUSTRIAL
INDUSTRIAL	FORESTRY	INDUSTRIAL

General Performance Data Top

ENGINE SPEED	ENGINE POWER	ENGINE TORQUE	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	ISO BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	ISO VOL FUEL CONSUMPTN (VFC)
RPM	BKW	NM	KPA	G/BKW-HR	G/BKW-HR	L/HR	L/HR
2,100	328	1,492	1,500	217.8	215.8	84.8	84.0
2,000	328	1,567	1,575	215.9	213.8	83.9	83.1
1,900	328	1,650	1,658	213.0	211.0	82.5	81.7
1,800	328	1,741	1,750	210.4	208.4	81.6	80.9
1,700	325	1,824	1,833	210.9	208.9	81.0	80.2
1,600	318	1,896	1,906	207.8	205.8	78.2	77.5
1,500	308	1,961	1,971	205.5	203.6	75.2	74.5
1,400	295	2,011	2,022	204.2	202.3	71.6	70.9
1,300	270	1,986	1,996	203.6	201.6	65.3	64.6
1,200	244	1,940	1,950	200.6	198.7	58.2	57.6
1,100	206	1,791	1,800	202.4	200.5	49.9	49.4
1,000	172	1,642	1,650	196.1	194.2	40.1	39.8
900	136	1,448	1,456	206.3	204.3	32.7	32.4
700	87.5	1,194	1,200	222.1	220.0	23.2	23.0

ENGINE SPEED	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
RPM	BKW	KPA	DEG C	DEG C	KPA	DEG C	KPA	DEG C
2,100	328	161.7	49.3	632.4	146.4	496.2	174	161.9

ENGINE SPEED	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
2,000	328	161.6	44.4	614.0	139.4	445.5	173	154.0
1,900	328	165.2	45.7	626.6	133.3	480.5	176	157.8
1,800	328	169.3	45.9	638.3	128.9	506.8	179	161.1
1,700	325	172.2	46.0	647.5	122.9	522.5	181	161.9
1,600	318	171.0	44.9	649.6	115.5	525.5	179	161.4
1,500	308	172.6	42.9	644.5	110.1	516.2	179	161.8
1,400	295	171.3	41.7	647.2	102.4	523.5	178	162.8
1,300	270	166.4	39.8	634.6	94.0	515.4	172	161.1
1,200	244	143.3	38.0	642.7	75.9	523.2	148	151.8
1,100	206	112.8	34.0	664.1	56.0	552.7	116	132.8
1,000	172	70.8	30.1	634.7	34.2	546.6	73	100.5
900	136	46.8	29.5	626.6	22.9	543.0	49	85.6
700	87.5	20.8	28.7	629.0	12.4	544.0	22	66.2

ENGINE SPEED	ENGINE POWER	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	ENGINE OUTLET WET EXH VOL FLOW RATE (0 DEG C AND 101 KPA)	ENGINE OUTLET DRY EXH VOL FLOW RATE (0 DEG C AND 101 KPA)
RPM	BKW	M3/MIN	M3/MIN	KG/HR	KG/HR	M3/MIN	M3/MIN
2,100	328	29.1	77.1	2,011.4	2,083.5	27.4	25.1
2,000	328	28.4	70.3	1,960.9	2,032.2	26.7	24.4
1,900	328	27.5	71.2	1,893.7	1,963.8	25.8	23.6
1,800	328	26.7	71.6	1,839.3	1,908.6	25.1	22.9
1,700	325	25.8	70.5	1,773.9	1,842.8	24.2	22.1
1,600	318	24.3	66.6	1,667.9	1,734.4	22.8	20.7
1,500	308	23.1	62.5	1,580.6	1,644.6	21.6	19.6
1,400	295	21.6	59.0	1,479.4	1,540.2	20.2	18.4
1,300	270	20.0	53.8	1,363.3	1,418.9	18.6	16.9
1,200	244	17.0	46.2	1,157.1	1,206.5	15.9	14.3
1,100	206	13.7	38.7	931.7	974.1	12.8	11.5
1,000	172	9.9	27.8	670.7	704.8	9.3	8.2
900	136	7.7	21.6	522.6	550.4	7.2	6.4
700	87.5	4.8	13.4	321.6	341.4	4.5	3.9

Heat Rejection Data Top

ENGINE SPEED	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXH RECOVERY TO 177C	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
RPM	BKW	KW	KW	KW	KW	KW	KW	KW	KW	KW
2,100	328	125	42.4	347	197	45.3	63.3	328	850	905
2,000	328	122	80.1	307	161	44.9	60.0	328	842	897
1,900	328	120	58.8	319	177	44.2	59.3	328	831	885
1,800	328	118	42.1	327	187	43.7	59.2	328	821	874
1,700	325	121	37.3	326	190	43.3	57.5	325	814	867
1,600	318	115	37.8	310	181	41.8	54.3	318	784	836
1,500	308	111	39.8	290	167	40.1	52.5	308	752	801
1,400	295	105	36.1	276	160	38.1	50.0	295	716	762
1,300	270	97.0	32.9	250	143	34.8	46.2	270	654	697
1,200	244	90.0	30.7	218	125	31.0	36.8	244	581	619
1,100	206	84.1	25.5	187	110	26.4	25.7	206	496	529

Emissions Data Top

Units Filter All Units

DIESEL

RATED SPEED NOMINAL DATA: 2100 RPM

ENGINE POWER		BKW	328	246	164	82.0	32.8
PERCENT LOAD		%	100	75	50	25	10
TOTAL NOX (AS NO2)		G/HR	1,246	756	404	193	135
TOTAL CO		G/HR	590	488	152	111	227
TOTAL HC		G/HR	20	23	48	51	41
TOTAL CO2		KG/HR	233	186	136	80	42
PART MATTER		G/HR	44.0	32.7	24.8	31.5	42.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	1,264.5	952.2	694.9	647.6	719.2
TOTAL CO	(CORR 5% O2)	MG/NM3	606.9	614.8	265.2	639.2	1,206.3
TOTAL HC	(CORR 5% O2)	MG/NM3	17.1	25.6	72.4	140.1	190.7
PART MATTER	(CORR 5% O2)	MG/NM3	37.8	35.5	38.1	120.3	207.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	616	464	338	315	350
TOTAL CO	(CORR 5% O2)	PPM	486	492	212	511	965
TOTAL HC	(CORR 5% O2)	PPM	32	48	135	262	356
TOTAL NOX (AS NO2)		G/HP-HR	2.86	2.31	1.85	1.77	3.07
TOTAL CO		G/HP-HR	1.35	1.49	0.70	1.02	5.17
TOTAL HC		G/HP-HR	0.04	0.07	0.22	0.46	0.93
PART MATTER		G/HP-HR	0.10	0.10	0.11	0.29	0.97
TOTAL NOX (AS NO2)		LB/HR	2.75	1.67	0.89	0.43	0.30
TOTAL CO		LB/HR	1.30	1.08	0.33	0.25	0.50
TOTAL HC		LB/HR	0.04	0.05	0.11	0.11	0.09
TOTAL CO2		LB/HR	513	411	300	175	93
PART MATTER		LB/HR	0.10	0.07	0.05	0.07	0.09
OXYGEN IN EXH		%	10.5	12.2	14.2	16.0	17.0
DRY SMOKE OPACITY		%	0.9	0.8	0.6	1.3	2.6
BOSCH SMOKE NUMBER			0.62	0.50	0.29	0.87	1.58

RATED SPEED POTENTIAL SITE VARIATION: 2100 RPM

ENGINE POWER		BKW	328	246	164	82.0	32.8
PERCENT LOAD		%	100	75	50	25	10
TOTAL NOX (AS NO2)		G/HR	1,346	816	436	209	145
TOTAL CO		G/HR	1,103	913	284	208	424
TOTAL HC		G/HR	37	44	92	96	77
PART MATTER		G/HR	85.9	63.7	48.4	61.3	82.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	1,365.7	1,028.3	750.5	699.4	776.8
TOTAL CO	(CORR 5% O2)	MG/NM3	1,135.0	1,149.6	496.0	1,195.3	2,255.9
TOTAL HC	(CORR 5% O2)	MG/NM3	32.3	48.3	136.8	264.8	360.5
PART MATTER	(CORR 5% O2)	MG/NM3	73.7	69.3	74.3	234.5	404.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	665	501	366	341	378
TOTAL CO	(CORR 5% O2)	PPM	908	920	397	956	1,805
TOTAL HC	(CORR 5% O2)	PPM	60	90	255	494	673
TOTAL NOX (AS NO2)		G/HP-HR	3.08	2.49	2.00	1.91	3.32
TOTAL CO		G/HP-HR	2.53	2.79	1.30	1.90	9.67
TOTAL HC		G/HP-HR	0.08	0.13	0.42	0.87	1.76
PART MATTER		G/HP-HR	0.20	0.19	0.22	0.56	1.89
TOTAL NOX (AS NO2)		LB/HR	2.97	1.80	0.96	0.46	0.32
TOTAL CO		LB/HR	2.43	2.01	0.63	0.46	0.93
TOTAL HC		LB/HR	0.08	0.10	0.20	0.21	0.17
PART MATTER		LB/HR	0.19	0.14	0.11	0.14	0.18

Regulatory Information Top

EPA TIER 3 **2005 - 2010**

GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 89 SUBPART D AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE NON-ROAD REGULATIONS.

Locality	Agency	Regulation	Tier/Stage	Max Limits - G/BKW - HR
U.S. (INCL CALIF)	EPA	NON-ROAD	TIER 3	CO: 3.5 NOx + HC: 4.0 PM: 0.20

EU STAGE IIIA **2006 - 2010**

GASEOUS EMISSION DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN EU 97/68/EC, ECE REGULATION NO. 96 AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. GASEOUS EMISSION VALUES ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE NON-ROAD REGULATIONS.

Locality	Agency	Regulation	Tier/Stage	Max Limits - G/BKW - HR
EUROPE	EU	NON-ROAD	STAGE IIIA	CO: 3.5 NOx + HC: 4.0 PM: 0.20

IMO II **2011 - ----**

GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN REGULATION 13 OF REVISED ANNEX VI OF MARPOL 73/78 AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THIS ENGINE CONFORMS TO INTERNATIONAL MARINE ORGANIZATION'S (IMO) MARINE COMPRESSION-IGNITION EMISSION REGULATIONS.

Altitude Derate Data Top

STANDARD

ALTITUDE CORRECTED POWER CAPABILITY (BKW)

AMBIENT OPERATING TEMP (C)	10	15	20	25	30	35	40	45	50	NORMAL
ALTITUDE (M)										
0	328	328	328	328	328	328	328	328	328	328
250	328	328	328	328	328	328	328	326	321	328
500	328	328	328	328	328	326	321	316	311	328
750	328	328	328	327	321	316	311	306	301	328
1,000	328	327	322	316	311	306	301	297	292	323
1,250	323	317	312	307	302	297	292	287	283	314
1,500	313	307	302	297	292	287	283	278	274	306
1,750	303	297	292	288	283	278	274	269	265	298
2,000	293	288	283	278	274	269	265	261	257	290
2,250	284	279	274	269	265	261	256	252	249	282
2,500	274	270	265	261	256	252	248	244	240	275
2,750	265	261	256	252	248	244	240	236	233	267
3,000	257	252	248	244	240	236	232	228	225	260
3,250	248	244	240	236	232	228	224	221	218	253
3,500	240	236	232	228	224	220	217	214	210	246
3,750	232	228	224	220	217	213	210	206	203	239
4,000	224	220	216	213	209	206	203	199	196	232
4,250	216	213	209	205	202	199	196	193	190	226
4,500	209	205	202	198	195	192	189	186	183	219

Cross Reference Top

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
0K5712	PP5378	2413804	E707	-	LGK21070	
0K5712	PP5378	3605981	E707	-	RRA00001	
0K5712	PP5378	3606744	E707	-	RRA00001	
4581416	PP7720	5099216	EE382	-	PK300001	

Performance Parameter Reference Top

Parameters Reference: DM9600 - 14

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600

APPLICATION: Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.

PERFORMANCE PARAMETER TOLERANCE FACTORS: Power +/- 3% Torque +/- 3% Exhaust stack temperature +/- 8% Inlet airflow +/- 5% Intake manifold pressure-gage +/- 10% Exhaust flow +/- 6% Specific fuel consumption +/- 3% Fuel rate +/- 5% Specific DEF consumption +/- 3% DEF rate +/- 5% Heat rejection +/- 5% Heat rejection exhaust only +/- 10% Heat rejection CEM only +/- 10%
Heat Rejection values based on using treated water.
Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.
On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.
On 3500 and C175 engines, at speeds below Peak Torque these values are provided for reference only, and may not meet the tolerance listed.
These values do not apply to C280/3600. For these models, see the tolerances listed below.

C280/3600 HEAT REJECTION TOLERANCE FACTORS: Heat rejection +/- 10% Heat rejection to Atmosphere +/- 50%

Heat rejection to Lube Oil +/- 20% Heat rejection to Aftercooler +/- 5%

TEST CELL TRANSDUCER TOLERANCE FACTORS: Torque +/- 0.5% Speed +/- 0.2% Fuel flow +/- 1.0% Temperature +/- 2.0 C degrees Intake manifold pressure +/- 0.1 kPa
OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.

REFERENCE ATMOSPHERIC INLET AIR FOR 3500 ENGINES AND SMALLER SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp. FOR 3600 ENGINES Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

REFERENCE EXHAUST STACK DIAMETER The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.

REFERENCE FUEL DIESEL Reference fuel is #2 distillate diesel with a 35API gravity; A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 15 deg C (59 deg F), where the density is 850 G/Liter (7.0936 Lbs/Gal).
GAS Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.

ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators. For Tier 4 ratings additional Parasitic losses would also include Intake, and Exhaust Restrictions.

ALTITUDE CAPABILITY Altitude capability is the maximum altitude above sea level at standard temperature and standard pressure at which the engine could develop full rated output power on the current performance data set. Standard temperature values versus altitude could be seen on TM2001.
When viewing the altitude capability chart the ambient temperature is the inlet air temp at the compressor inlet.
Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001.
Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.

REGULATIONS AND PRODUCT COMPLIANCE TMI Emissions information is presented at 'nominal' and 'Potential Site Variation' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.

EMISSION CYCLE LIMITS: Cycle emissions Max Limits apply to cycle-weighted averages only. Emissions at individual load points may exceed the cycle-weighted limit.

WET & DRY EXHAUST/EMISSIONS DESCRIPTION: Wet - Total exhaust flow or concentration of total exhaust flow Dry - Total exhaust flow minus water vapor or concentration of exhaust flow with water vapor excluded

EMISSIONS DEFINITIONS: Emissions : DM1176

EMISSION CYCLE DEFINITIONS
1. For constant-speed marine engines for ship main propulsion, including,diesel-electric drive, test cycle E2 shall be applied, for controllable-pitch propeller sets test cycle E2 shall be applied.
2. For propeller-law-operated main and propeller-law-operated auxiliary engines the test cycle E3 shall be applied.
3. For constant-speed auxiliary engines test cycle D2 shall be applied.
4. For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied.

HEAT REJECTION DEFINITIONS: Diesel Circuit Type and HHV Balance : DM9500

HIGH DISPLACEMENT (HD) DEFINITIONS: 3500: EM1500

RATING DEFINITIONS: Agriculture : TM6008
Fire Pump : TM6009
Generator Set : TM6035
Generator (Gas) : TM6041
Industrial Diesel : TM6010
Industrial (Gas) : TM6040
Irrigation : TM5749
Locomotive : TM6037
Marine Auxiliary : TM6036
Marine Prop (Except 3600) : TM5747
Marine Prop (3600 only) : TM5748
MSHA : TM6042
Oil Field (Petroleum) : TM6011
Off-Highway Truck : TM6039
On-Highway Truck : TM6038

SOUND DEFINITIONS: Sound Power : DM8702
Sound Pressure : TM7080

Date Released : 10/27/21