

PERFORMANCE DATA [C9A00498]

MAY 05, 2023

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Perf No: DM7553

Change Level: 03

General

Heat Rejection

Emissions

Regulatory

Altitude Derate

Cross Reference

Perf Param Ref

View PDF

SALES MODEL:	C9	COMBUSTION:	DIRECT INJECTION
BRAND:	CAT	ENGINE SPEED (RPM):	1,500
MACHINE SALES MODEL:		HERTZ:	50
ENGINE POWER (BKW):	215.0	ASPIRATION:	TA
COMPRESSION RATIO:	17	AFTERCOOLER TYPE:	SCAC
RATING LEVEL:	PRIME	AFTERCOOLER CIRCUIT TYPE:	JW+OC, AC
PUMP QUANTITY:	1	AFTERCOOLER TEMP (C):	52
FUEL TYPE:	DIESEL	JACKET WATER TEMP (C):	89
MANIFOLD TYPE:	WATER COOLED	TURBO CONFIGURATION:	SINGLE
GOVERNOR TYPE:	ELEC	TURBO QUANTITY:	1
CAMSHAFT TYPE:	STANDARD	TURBOCHARGER MODEL:	S300W072-0.70
IGNITION TYPE:	CI	CERTIFICATION YEAR:	2003
INJECTOR TYPE:	EUI	PISTON SPD @ RATED ENG SPD (M/SEC):	7.5
REF EXH STACK DIAMETER (MM):	152		
MAX OPERATING ALTITUDE (M):	1,000		

INDUSTRY	SUB INDUSTRY	APPLICATION
MARINE	GENERAL CARGO	MARINE AUXILIARY ENGINE

General Performance Data [Top](#)

PERCENT LOAD	ENGINE POWER	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)
%	BKW	KPA	G/BKW-HR	G/BKW-HR	L/HR	L/HR
110	236	2,148	207.6	203.6	57.8	56.7
100	215	1,953	206.6	202.6	52.3	51.3
90	194	1,758	208.3	204.3	47.4	46.5
80	172	1,562	210.7	206.6	42.6	41.8
75	161	1,465	212.2	208.1	40.3	39.5
70	150	1,367	213.9	209.9	37.9	37.2
60	129	1,172	218.3	214.2	33.1	32.5
50	108	976	224.3	220.0	28.4	27.8
40	86.0	781	232.6	228.2	23.5	23.1
30	64.5	586	245.9	241.2	18.7	18.3
25	53.8	488	255.8	250.9	16.2	15.9
20	43.0	391	269.4	264.3	13.6	13.4
10	21.5	195	334.1	327.7	8.5	8.3

PERCENT LOAD	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
%	BKW	KPA	DEG C	DEG C	KPA	DEG C	KPA	DEG C
110	236	215.3	60.2	584.7	194.3	379.0	216	175.7
100	215	191.1	65.1	573.3	168.6	375.1	187	158.9
90	194	169.5	63.8	557.0	148.5	367.2	165	146.5
80	172	148.7	60.5	539.4	129.3	359.2	144	135.2
75	161	137.7	60.0	530.6	119.8	357.3	134	128.3
70	150	126.7	59.7	521.3	110.5	355.4	124	121.4
60	129	105.0	59.3	501.5	92.5	350.5	104	107.7
50	108	84.2	58.6	476.6	75.8	341.0	84	93.9
40	86.0	64.9	57.5	439.3	60.7	323.4	66	80.2
30	64.5	46.9	56.4	390.4	47.1	297.1	49	66.4

PERCENT LOAD	ENGINE POWER	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP
25	53.8	38.6	56.0	358.0	40.7	277.2	41	59.6
20	43.0	30.8	55.6	317.6	34.7	250.2	33	52.9
10	21.5	16.5	55.0	221.3	23.7	182.9	17	39.7

PERCENT LOAD	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)
%	BKW	M3/MIN	M3/MIN	KG/HR	KG/HR	M3/MIN	M3/MIN
110	236	17.7	40.0	1,225.3	1,274.4	16.7	15.3
100	215	16.4	36.6	1,128.2	1,172.6	15.4	14.1
90	194	15.3	33.4	1,047.4	1,087.7	14.3	13.1
80	172	14.2	30.5	966.3	1,002.6	13.2	12.1
75	161	13.6	29.1	925.1	959.3	12.6	11.6
70	150	13.0	27.7	883.8	916.0	12.0	11.1
60	129	11.9	24.9	802.2	830.4	10.9	10.1
50	108	10.7	22.1	723.7	747.8	9.8	9.1
40	86.0	9.6	19.2	649.8	669.8	8.8	8.2
30	64.5	8.6	16.4	580.1	596.0	7.8	7.4
25	53.8	8.1	14.9	547.5	561.3	7.4	7.0
20	43.0	7.7	13.4	517.0	528.6	7.0	6.6
10	21.5	6.9	10.2	460.4	467.6	6.1	5.9

Heat Rejection Data [Top](#)

PERCENT LOAD	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
%	BKW	KW	KW	KW	KW	KW	KW	KW	KW	KW
110	236	172	26.8	147	75.6	31.1	39.5	236	583	622
100	215	159	24.3	134	68.1	28.1	29.6	215	528	562
90	194	147	22.4	123	60.6	25.5	24.2	194	479	510
80	172	134	20.8	112	53.4	22.9	20.2	172	431	459
75	161	128	20.0	106	50.5	21.7	17.7	161	407	433
70	150	121	19.2	101	47.7	20.4	15.3	150	383	408
60	129	108	17.5	91.3	41.9	17.8	10.8	129	335	357
50	108	94.0	15.7	80.8	35.6	15.3	7.1	108	286	305
40	86.0	79.7	13.8	69.7	28.3	12.7	4.1	86.0	238	253
30	64.5	64.7	11.9	58.1	20.5	10.0	1.6	64.5	189	201
25	53.8	56.9	10.8	52.0	16.1	8.7	0.5	53.8	163	174
20	43.0	48.9	9.8	45.4	11.0	7.3	-0.4	43.0	138	147
10	21.5	32.6	7.7	31.2	0.8	4.5	-2.0	21.5	85.4	90.9

Emissions Data [Top](#)

Units Filter

All Units

DIESEL

RATED SPEED NOMINAL DATA: 1500 RPM

ENGINE POWER	BKW	236	215	161	108	53.8	21.5
PERCENT LOAD	%	110	100	75	50	25	10
TOTAL NOX (AS NO2)	G/HR	1,911	1,675	1,120	626	268	217
TOTAL CO	G/HR	91	99	100	95	124	112
TOTAL HC	G/HR	18	16	14	15	24	41
TOTAL CO2	KG/HR	154	140	107	76	43	23
PART MATTER	G/HR	7.7	7.4	7.3	8.6	9.9	3.9
TOTAL NOX (AS NO2)	(CORR 5% O2) MG/NM3	3,157.2	3,049.0	2,653.6	2,116.7	1,612.4	2,345.6
TOTAL CO	(CORR 5% O2) MG/NM3	135.9	165.1	221.5	284.3	670.5	1,120.8
TOTAL HC	(CORR 5% O2) MG/NM3	23.3	22.5	25.9	40.4	116.7	345.9
PART MATTER	(CORR 5% O2) MG/NM3	9.5	10.0	13.1	23.9	45.6	38.2
TOTAL NOX (AS NO2)	(CORR 5% O2) PPM	1,538	1,485	1,293	1,031	785	1,143

ENGINE POWER		BKW	236	215	161	108	53.8	21.5
PERCENT LOAD		%	110	100	75	50	25	10
TOTAL CO	(CORR 5% O2)	PPM	109	132	177	227	536	897
TOTAL HC	(CORR 5% O2)	PPM	44	42	48	75	218	646
TOTAL NOX (AS NO2)		G/HP-HR	6.06	5.83	5.18	4.34	3.71	7.49
TOTAL CO		G/HP-HR	0.29	0.35	0.46	0.66	1.72	3.88
TOTAL HC		G/HP-HR	0.06	0.06	0.06	0.11	0.33	1.41
PART MATTER		G/HP-HR	0.02	0.03	0.03	0.06	0.14	0.14
TOTAL NOX (AS NO2)		LB/HR	4.21	3.69	2.47	1.38	0.59	0.48
TOTAL CO		LB/HR	0.20	0.22	0.22	0.21	0.27	0.25
TOTAL HC		LB/HR	0.04	0.04	0.03	0.03	0.05	0.09
TOTAL CO2		LB/HR	341	310	236	167	95	50
PART MATTER		LB/HR	0.02	0.02	0.02	0.02	0.02	0.01
OXYGEN IN EXH		%	8.5	8.9	9.8	11.1	13.7	16.5
DRY SMOKE OPACITY		%	0.4	0.4	0.5	0.8	1.2	0.4
BOSCH SMOKE NUMBER			0.08	0.09	0.22	0.50	0.79	0.03

RATED SPEED POTENTIAL SITE VARIATION: 1500 RPM

ENGINE POWER		BKW	236	215	161	108	53.8	21.5
PERCENT LOAD		%	110	100	75	50	25	10
TOTAL NOX (AS NO2)		G/HR	2,312	2,026	1,355	758	324	262
TOTAL CO		G/HR	170	186	187	177	232	210
TOTAL HC		G/HR	34	31	26	29	44	77
PART MATTER		G/HR	15.0	14.5	14.2	16.7	19.2	7.7
TOTAL NOX (AS NO2)	(CORR 5% O2)	MG/NM3	3,820.3	3,689.3	3,210.9	2,561.2	1,951.0	2,838.1
TOTAL CO	(CORR 5% O2)	MG/NM3	254.2	308.7	414.2	531.6	1,253.8	2,095.9
TOTAL HC	(CORR 5% O2)	MG/NM3	44.1	42.5	49.0	76.3	220.6	653.7
PART MATTER	(CORR 5% O2)	MG/NM3	18.5	19.4	25.6	46.6	88.9	74.4
TOTAL NOX (AS NO2)	(CORR 5% O2)	PPM	1,861	1,797	1,564	1,248	950	1,382
TOTAL CO	(CORR 5% O2)	PPM	203	247	331	425	1,003	1,677
TOTAL HC	(CORR 5% O2)	PPM	82	79	91	143	412	1,220
TOTAL NOX (AS NO2)		G/HP-HR	7.33	7.06	6.27	5.25	4.49	9.06
TOTAL CO		G/HP-HR	0.54	0.65	0.86	1.23	3.21	7.26
TOTAL HC		G/HP-HR	0.11	0.11	0.12	0.20	0.62	2.67
PART MATTER		G/HP-HR	0.05	0.05	0.07	0.12	0.27	0.27
TOTAL NOX (AS NO2)		LB/HR	5.10	4.47	2.99	1.67	0.71	0.58
TOTAL CO		LB/HR	0.37	0.41	0.41	0.39	0.51	0.46
TOTAL HC		LB/HR	0.08	0.07	0.06	0.06	0.10	0.17
PART MATTER		LB/HR	0.03	0.03	0.03	0.04	0.04	0.02

Regulatory Information [Top](#)

EPA TIER 2		2004 - 2014		CYCLE : E2,D2	
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 94.103 AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THIS ENGINE CONFORMS TO US EPA MARINE COMMERCIAL COMPRESSION-IGNITION EMISSION REGULATIONS. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE MARINE REGULATIONS.					
Locality	Agency	Regulation	Tier/Stage	Max Limits - G/BKW - HR	
U.S. (INCL CALIF)	EPA	MARINE COMMERCIAL	TIER 2	CO: 5.0 NOx + HC: 7.2 PM: 0.20	

IMO		2000 - 2010		CYCLE : E2,D2	
GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN REGULATION 13 OF 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.					

IMO II		2011 - ----		CYCLE : E2,D2	
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)	0	5	10	15	20	25	30	35	40	45	50	55	60	NORMAL
ALTITUDE (M)														
0	215	215	215	215	215	215	215	215	215	215	215	215	215	215

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MAX Performance Data Display

AMBIENT OPERATING TEMP (C)	0	5	10	15	20	25	30	35	40	45	50	55	60	NORMAL
250	215	215	215	215	215	215	215	215	215	215	215	215	211	215
500	215	215	215	215	215	215	215	215	215	215	211	208	205	215
750	215	215	215	215	215	215	215	215	211	208	205	202	199	215
1,000	215	215	215	215	215	215	211	208	205	201	198	195	192	215
1,250	215	215	215	215	212	208	205	202	198	195	192	189	186	213
1,500	215	215	212	209	205	202	198	195	192	189	186	183	181	208
1,750	213	209	206	202	199	195	192	189	186	183	180	177	175	202
2,000	206	203	199	196	192	189	186	183	180	177	174	172	169	197
2,250	200	196	193	189	186	183	180	177	174	171	169	166	164	192
2,500	193	190	186	183	180	177	174	171	169	166	163	161	158	187
2,750	187	184	180	177	174	171	168	166	163	161	158	156	153	182
3,000	181	178	174	171	168	166	163	160	158	155	153	151	148	177
3,250	175	172	169	166	163	160	158	155	152	150	148	146	143	172
3,500	169	166	163	160	157	155	152	150	147	145	143	141	139	167
3,750	163	160	158	155	152	150	147	145	142	140	138	136	134	162
4,000	158	155	152	150	147	145	142	140	138	135	133	131	129	158
4,250	152	150	147	144	142	140	137	135	133	131	129	127	125	153
4,500	147	144	142	139	137	135	133	130	128	126	124	122	121	149

Cross Reference

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Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
OK5608	PP5258	2423452	E792	-	C9A00001	
OK6605	NAP	2423452	E792	-	C9A00001	
OK5608	PP5258	2423452	GS280	-	C9A00001	
OK6605	NAP	2423452	GS280	-	C9A00001	
OK9761	PP5412	3395169	E792	-	C9Y00001	

Performance Parameter Reference

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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 <u>FOR 3500 ENGINES AND SMALLER</u> 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. <u>FOR 3600 ENGINES</u> 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.
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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