CATERPILLAR®

3600 Marine Engine Application and Installation Guide

- **Engine Data**
- **Engine Performance**

LEKM8461 8-98

CATERPILLAR®

Engine Data

Dimensions and Weights
Center of Gravity
Technical Data
Noise
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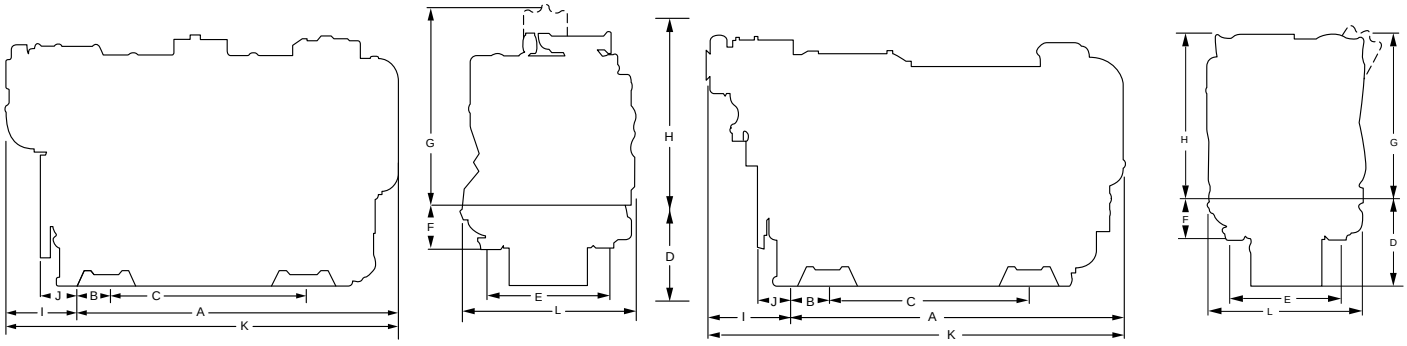
Dimensions and Weights

The dimensions and weights of 3600 Marine Propulsion Engines are shown below. Engine outline drawings are included in the *Drawings* section of this guide. Marine auxiliary dimensions, weights and outline drawings are included in the *Technical Data* section of the EPG A&I guide (LEKX6559).

3600 Marine Propulsion



In-Line Vee

Dimensions

A	B	C	D	E	F1	F2	G	H	I	J	K	L	W

3606 In-Line

mm	3261	265	2050	841	1120	405	450	2035	1785	727	360	3988	1748	kg	15,680
in	128.39	10.43	80.71	33.11	44.09	15.95	17.72	80.12	70.28	28.62	14.17	157.01	68.82	lb	34,500

3608 In-Line

mm	4081	265	2870	841	1120	405	450	2035	1785	727	360	4808	1748	kg	19,000
in	160.67	10.43	112.99	33.11	44.09	15.95	17.72	80.12	70.28	28.62	14.17	189.29	68.82	lb	41,800

3612 VEE

mm	3657	300	2300	976	1120	405	450	1850	2255	905	360	4562	1714	kg	25,740
in	143.98	11.81	90.55	38.43	44.09	15.95	17.72	72.84	88.78	35.63	14.17	179.61	67.48	lb	56,630

3616 VEE

mm	4577	300	3220	976	1120	405	450	1850	2255	905	360	5482	1714	kg	30,750
in	180.2	11.81	126.77	38.43	44.09	15.95	17.72	72.84	88.78	35.63	14.17	215.83	67.48	lb	67,650

C	centerline distance between mounting feet
F1 and F2	optional mounting dimensions
G	removal distance for piston
J	distance from flywheel mounting face to cylinder block rear face
W	approximate dry weight of engine with attachments such as filters, oil cooler, flywheel, pumps, etc.

Center of Gravity

Center of gravity locations apply to dry runable engines:

Model	Distance From Cylinder Block Rear Face	Vertical Distance Above Crankshaft Centerline	Transverse Distance from Crankshaft Centerline
3606	1290 mm 50.8 in.	350 mm 13.8 in.	On Crank Center
3608	1700 mm 66.9 in.	350 mm 13.8 in.	On Crank Center
3612	1411 mm 55.6 in.	380 mm 14.9 in.	On Crank Center
3616	1858 mm 73.1 in.	380 mm 14.9 in.	On Crank Center

Technical Data

Distillate Fuel

Pages 7 through 23 are Marine Propulsion technical data sheets for distillate fuel engines. The data is given at 750, 800, 900, and 1000 rpm. Technical data for distillate fuel Marine Auxiliary generator sets is in the 3600 EPG A&I guide (LEKX6559). See the *Engine Performance* section of this guide for a complete description of ratings and limitations.

Heavy Fuel

Pages 24 through 43 are Marine Propulsion technical data sheets for heavy fuel engines. See the *Engine Performance* section of this guide for a complete description of ratings and limitations.

TECHNICAL DATA

Engine: 3606 In-Line
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1490	(2000)	1560	(2090)	1730	(2320)	1850	(2480)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2152	(312)	2111	(306)	2081	(302)	2003	(291)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-5-3-6-2-4				1-5-3-6-2-4			
Firing Order - CW			1-4-2-6-3-5				1-4-2-6-3-5			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	145.2	(5128)	160.9	(5682)	164.3	(5802)	181.4	(6406)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	52.9	(127)	51	(124)	52.9	(127)	53.5	(128)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	201	(29.2)	242	(35.1)	220	(31.9)	232	(33.6)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	309	(10912)	334.3	(11806)	372.1	(13141)	412.6	(14571)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	530	(986)	514	(957)	563	(1045)	564	(1047)
Exhaust Stack Temperature @ 100% load	°C	(°F)	362	(684)	347	(657)	403	(757)	406	(763)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	160	(9099)	168	(9554)	185	(10521)	205	(11658)
Jacket Water Circuit	kW	(Btu/min.)	307	(17459)	323	(18369)	373	(21212)	381	(21667)
Aftercooler	kW	(Btu/min.)	396	(22535)	430	(24470)	402	(22877)	496	(28226)
Total Heat rejected to Raw Water	kW	(Btu/min.)	863	(49093)	921	(52393)	960	(54610)	1082	(61551)
Exhaust Gas[2]	kW	(Btu/min.)	974	(55428)	1007	(57305)	1256	(71475)	1360	(77394)
Radiation	kW	(Btu/min.)	67	(3813)	68	(3870)	73	(4154)	74	(4211)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	31.5	(8.3)	33.6	(8.85)	38	(10)	41.5	(11)
Flow Rate, return	Lpm	(gpm)	24.5	(6.5)	26.2	(6.9)	30	(7.9)	32.4	(8.6)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	191.7	(.315)	191.8	(.315)	195.5	(.321)	198.6	(.326)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	697	(184)	697	(184)	697	(184)	697	(184)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3606 In-Line
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

TECHNICAL DATA

Engine: 3606 In-Line
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1640	(2200)	1720	(2310)	1900	(2550)	2030	(2720)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2368	(343)	2328	(338)	2286	(332)	2198	(319)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-5-3-6-2-4				1-5-3-6-2-4			
Firing Order - CW			1-4-2-6-3-5				1-4-2-6-3-5			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	159.7	(5640)	172	(6074)	179.9	(6353)	196.4	(6936)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	53.1	(128)	52.7	(127)	54.6	(130)	55	(127)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	232	(33.6)	268	(38.9)	254	(36.8)	261	(37.9)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	339.6	(11993)	363.7	(12844)	407.5	(14391)	450.1	(15895)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	540	(1004)	540	(1004)	574	(1065)	580	(1076)
Exhaust Stack Temperature @ 100% load	°C	(°F)	362	(684)	358	(676)	403	(757)	411	(772)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	169	(9611)	175	(9952)	196	(11146)	215	(12227)
Jacket Water Circuit	kW	(Btu/min.)	327	(18596)	340	(19336)	397	(22577)	411	(23374)
Aftercooler	kW	(Btu/min.)	473	(26917)	507	(28852)	511	(29080)	624	(35510)
Total Heat rejected to Raw Water	kW	(Btu/min.)	969	(55124)	1022	(58140)	1104	(62803)	1250	(71111)
Exhaust Gas[2]	kW	(Btu/min.)	1039	(59126)	1136	(64646)	1332	(75800)	1464	(83312)
Radiation	kW	(Btu/min.)	70	(3983)	71	(4040)	74	(4211)	76	(4325)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	31.5	(8.3)	33.6	(8.85)	38	(10)	41.5	(11)
Flow Rate, return	Lpm	(gpm)	22.1	(5.8)	23.6	(6.2)	27	(7.1)	29.2	(7.7)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	190.8	(.314)	193.2	(.318)	195.3	(.321)	199.8	(.328)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	697	(184)	697	(184)	697	(184)	697	(184)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3606 In-Line*
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 1000	
General Data				
Engine Output[1]	bkW	(bhp)	2030	(2720)
Cylinder Bore	mm	(in)	280	(11.0)
Stroke	mm	(in)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)
Compression Ratio			13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)
BMEP	kPa	(psi)	2198	(319)
Mean Piston Speed	m/s	(f/s)	10.0	(32.8)
Idle Speed	rpm	rpm	350	
Crash Reversal Speed, minimum	rpm	rpm	300	
Firing Order - CCW			1-5-3-6-2-4	
Firing Order - CW			1-4-2-6-3-5	
Combustion Air System				
Flow of air @ 100% load	cmm	(cfm)	200.7	(7088)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	48.0	(118)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	261	(37.9)
Exhaust Gas System				
Exhaust Gas Flow @ 100% load	cmm	(cfm)	459.2	(16216)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	573	(1063)
Exhaust Stack Temperature @ 100% load	°C	(°F)	410	(770)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)
Heat Balance @ 100% Load				
Lube Oil Cooler	kW	(Btu/min.)	215	(12227)
Jacket Water Circuit	kW	(Btu/min.)	411	(23374)
Aftercooler	kW	(Btu/min.)	662	(37673)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1288	(73274)
Exhaust Gas[2]	kW	(Btu/min.)	1450	(82515)
Radiation	kW	(Btu/min.)	76	(4325)
Fuel System				
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	41.5	(11)
Flow Rate, return	Lpm	(gpm)	29.2	(7.7)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	200.8	(.330)
Lubricating Oil System				
Manifold Pressure, minimum	kPa	(psi)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)
Sump Capacity (marine)	L	(gal)	697	(184)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)

* Data for 3606 engine with 3608 aftercooler installed

TECHNICAL DATA

Engine: 3606 In-Line
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

TECHNICAL DATA

Engine: 3608 In-Line
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1980	(2660)	2080	(2790)	2300	(3080)	2460	(3300)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2144	(311)	2111	(306)	2075	(301)	1998	(290)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-6-2-5-8-3-7-4				1-6-2-5-8-3-7-4			
Firing Order - CW			1-4-7-3-8-5-2-6				1-4-7-3-8-5-2-6			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	193.3	(6826)	205.4	(7254)	213.8	(7550)	225.3	(7956)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	53.4	(128)	54.9	(131)	55.4	(132)	53.8	(129)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	238	(34.5)	247	(35.8)	219	(31.8)	209	(30.3)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	410.7	(14504)	437.6	(15454)	482.8	(17050)	520.1	(18367)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	519	(966)	524	(975)	559	(1038)	564	(1047)
Exhaust Stack Temperature @ 100% load	°C	(°F)	361	(682)	363	(685)	401	(754)	416	(781)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	222	(12625)	218	(12398)	247	(14047)	273	(15525)
Jacket Water Circuit	kW	(Btu/min.)	414	(23544)	420	(23885)	494	(28094)	504	(28662)
Aftercooler	kW	(Btu/min.)	681	(38754)	638	(36307)	595	(33860)	745	(42396)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1317	(74923)	1276	(72590)	1336	(76001)	1522	(86583)
Exhaust Gas[2]	kW	(Btu/min.)	1036	(58956)	1231	(70053)	1643	(93498)	1709	(97254)
Radiation	kW	(Btu/min.)	74	(4211)	77	(4382)	81	(4609)	85	(4837)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	31.5	(8.3)	33.8	(8.9)	38	(10)	41.5	(11)
Flow Rate, return	Lpm	(gpm)	22.6	(6)	24.5	(6.5)	27.6	(7.3)	30	(7.9)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	187.3	(.308)	188.7	(.310)	196.1	(.322)	197.6	(.325)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	760	(200)	760	(200)	760	(200)	760	(200)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3608 In-Line
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

TECHNICAL DATA

Engine: 3608 In-Line
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	2180	(2920)	2290	(3070)	2530	(3390)	2710	(3630)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2360	(342)	2324	(337)	2283	(331)	2201	(319(
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-6-2-5-8-3-7-4				1-6-2-5-8-3-7-4			
Firing Order - CW			1-4-7-3-8-5-2-6				1-4-7-3-8-5-2-6			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	209.3	(7391)	220.1	(7773)	230.8	(8151)	240.8	(8504)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	55.6	(132)	56.9	(134)	59.2	(139)	57.7	(136)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	270	(39.2)	275	(39.9)	244	(35.4)	233	(33.8)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	449.4	(15870)	477.0	(16845)	529.0	(18681)	567.1	(20027)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	537	(999)	547	(1017)	582	(1080)	590	(1094)
Exhaust Stack Temperature @ 100% load	°C	(°F)	368	(694)	374	(705)	411	(772)	430	(806)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	236	(13421)	253	(14388)	262	(14900)	288	(16379)
Jacket Water Circuit	kW	(Btu/min.)	446	(25364)	460	(26160)	528	(30027)	547	(31108)
Aftercooler	kW	(Btu/min.)	788	(44843)	636	(36193)	720	(40973)	884	(50306)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1470	(83628)	1349	(76741)	1510	(85900)	1719	(97793)
Exhaust Gas[2]	kW	(Btu/min.)	1145	(65159)	1451	(82572)	1813	(103173)	1869	(106359)
Radiation	kW	(Btu/min.)	80	(4553)	80	(4553)	85	(4837)	88	(5008)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	31.5	(8.3)	33.8	(8.9)	38	(10)	41.5	(11)
Flow Rate, return	Lpm	(gpm)	20.3	(5.4)	22.1	(5.8)	24.5	(6.5)	27	(7.1)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	188.2	(.309)	190	(.312)	197.5	(.325)	198.3	(.326)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	760	(200)	760	(200)	760	(200)	760	(200)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3608 In-Line
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

TECHNICAL DATA

Engine: 3612 Vee
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	2980	(4000)	3120	(4180)	3460	(4640)	3700	(4960)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2152	(312)	2111	(306)	2081	(302)	2003	(291)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-12-9-4-5-8-11-2-3-10-7-6				1-12-9-4-5-8-11-2-3-10-7-6			
Firing Order - CW			1-6-7-10-3-2-11-8-5-4-9-12				1-6-7-10-3-2-11-8-5-4-9-12			
Combustion Air System	cmm	(cfm)	290.4	(10255)	321.7	(11361)	328.6	(11604)	362.8	(12812)
Flow of air @ 100% load	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	52.9	(127)	51	(124)	52.9	(127)	53.5	(128)
Air Temperature after Aftercooler	°C	(°F)	75	(167)	75	(167)	75	(167)	75	(167)
Air Temperature after Aftercooler, alarm	kPa	(psi)	190	(27.6)	233	(33.8)	226	(32.8)	219	(31.8)
Intake Manifold Pressure @ 100% load										
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	617.9	(21821)	668.3	(23601)	744.2	(26281)	825.3	(29145)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	530	(986)	514	(957)	563	(1045)	564	(1047)
Exhaust Stack Temperature @ 100% load	°C	(°F)	362	(684)	347	(657)	403	(757)	406	(763)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	320	(18198)	335	(19051)	371	(21099)	398	(22634)
Jacket Water Circuit	kW	(Btu/min.)	612	(34804)	644	(36624)	746	(42425)	721	(41003)
Aftercooler	kW	(Btu/min.)	702	(39949)	760	(43249)	713	(40575)	733	(41713)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1634	(92951)	1739	(98924)	1830	(104099)	1852	(105350)
Exhaust Gas[2]	kW	(Btu/min.)	2015	(114668)	2143	(121952)	2605	(148243)	2984	(169811)
Radiation	kW	(Btu/min.)	92	(5235)	94	(5349)	102	(5805)	104	(5918)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	61.2	(16.2)	68.8	(18.1)	72	(19)	78.5	(20.7)
Flow Rate, return	Lpm	(gpm)	47.3	(12.5)	53.2	(14)	55.4	(14.6)	60.1	(15.9)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	189.8	(.312)	191.4	(.315)	194.5	(.320)	196.5	(.323)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	910	(240)	910	(240)	910	(240)	910	(240)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3612 Vee
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(618)	2630	(695)	2920	(771)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

TECHNICAL DATA

Engine: 3612 Vee
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	3280	(4400)	3440	(4610)	3800	(5100)	4060	(5440)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2368	(343)	2328	(338)	2286	(332)	2198	(319)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-12-9-4-5-8-11-2-3-10-7-6				1-12-9-4-5-8-11-2-3-10-7-6			
Firing Order - CW			1-6-7-10-3-2-11-8-5-4-9-12				1-6-7-10-3-2-11-8-5-4-9-12			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	319.4	(11280)	343.9	(12145)	360.0	(12713)	392.9	(13875)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	53.1	(128)	52.7	(127)	54.6	(130)	55	(131)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	218	(31.6)	258	(37.4)	261	(37.9)	246	(35.7)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	679.5	(23996)	727.1	(25677)	815.3	(28792)	900.4	(31797)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	540	(1004)	540	(1004)	574	(1065)	580	(1076)
Exhaust Stack Temperature @ 100% load	°C	(°F)	362	(684)	358	(676)	403	(757)	411	(772)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	338	(19222)	350	(19904)	392	(22293)	416	(23658)
Jacket Water Circuit	kW	(Btu/min.)	652	(37079)	678	(38558)	793	(45098)	774	(44017)
Aftercooler	kW	(Btu/min.)	838	(47688)	899	(51159)	906	(51558)	927	(52753)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1828	(103989)	1927	(109621)	2091	(118949)	2117	(120428)
Exhaust Gas[2]	kW	(Btu/min.)	2157	(122749)	2413	(137317)	2778	(158088)	3208	(182558)
Radiation	kW	(Btu/min.)	98	(5577)	101	(5748)	105	(5975)	110	(6260)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	61.2	(16.2)	68.8	(18.1)	72	(19)	78.5	(20.7)
Flow Rate, return	Lpm	(gpm)	42.6	(11.3)	47.9	(12.7)	49.9	(13.2)	54.1	(14.3)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	188.9	(.311)	192.8	(.317)	194.3	(.319)	196.8	(.324)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	910	(240)	910	(240)	910	(240)	910	(240)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3612 Vee
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(618)	2630	(695)	2920	(771)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

TECHNICAL DATA

Engine: 3616 Vee
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	3960	(5310)	4160	(5580)	4600	(6170)	4920	(6600)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2144	(311)	2111	(306)	2075	(301)	1998	(290)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8				1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8			
Firing Order - CW			1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2				1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	398.9	(14087)	423.7	(14963)	441.1	(15577)	464.7	(16411)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	43.4	(110)	44.9	(113)	45.4	(114)	43.8	(111)
Air Temperature after Aftercooler, alarm	°C	(°F)	61	(142)	61	(142)	61	(142)	61	(142)
Intake Manifold Pressure @ 100% load	kPa	(psi)	230	(33.4)	227	(32.9)	210	(30.5)	195	(28.3)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	839.3	(29640)	894.3	(31582)	987.1	(34859)	1063.4	(37554)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	509	(948)	514	(957)	549	(1020)	554	(1029)
Exhaust Stack Temperature @ 100% load	°C	(°F)	355	(671)	357	(675)	395	(743)	410	(770)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	410	(23317)	429	(24397)	463	(26331)	532	(30255)
Jacket Water Circuit	kW	(Btu/min.)	757	(43050)	840	(47771)	918	(52207)	968	(55050)
Aftercooler	kW	(Btu/min.)	977	(55598)	1212	(68971)	1075	(61175)	1265	(71987)
Total Heat rejected to Raw Water	kW	(Btu/min.)	2144	(121965)	2481	(141139)	2456	(139713)	2765	(157292)
Exhaust Gas[2]	kW	(Btu/min.)	2813	(160080)	3005	(171006)	3746	(213174)	3778	(214995)
Radiation	kW	(Btu/min.)	109	(6203)	112	(6374)	120	(6829)	125	(7113)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	61.2	(16.2)	68.8	(18.1)	72	(19)	78.5	(20.7)
Flow Rate, return	Lpm	(gpm)	43.2	(11.4)	48.6	(12.8)	51.1	(13.5)	55.2	(14.6)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	191.8	(.315)	197.4	(.325)	199.8	(.328)	198.2	(.326)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	1060	(280)	1060	(280)	1060	(280)	1060	(280)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3616 Vee
Rating: CSR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(618)	2630	(695)	2920	(771)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

[5]All 3616 engines come equipped with a High Performance Aftercooler (HPAC) to reduce the air inlet manifold temperature.

TECHNICAL DATA

Engine: 3616 Vee
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	4360	(5850)	4580	(6140)	5060	(6790)	5420	(7270)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			13:1		13:1		13:1		13:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2360	(342)	2324	(337)	2283	(331)	2201	(319)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.0	(26.2)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8				1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8			
Firing Order - CW			1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2				1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	431.7	(15245)	453.9	(16029)	475.9	(16806)	496.5	(17534)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler	°C	(°F)	45.6	(114)	46.9	(116)	49.2	(121)	47.7	(118)
Air Temperature after Aftercooler, alarm	°C	(°F)	61	(142)	61	(142)	61	(142)	61	(142)
Intake Manifold Pressure @ 100% load	kPa	(psi)	259	(37.6)	253	(36.7)	235	(34.1)	218	(31.6)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	918.4	(32433)	974.8	(34425)	1081.1	(38179)	1159.5	(40947)
Exhaust Manifold Temperature @ 100% load	°C	(°F)	527	(981)	537	(999)	572	(1062)	580	(1076)
Exhaust Stack Temperature @ 100% load	°C	(°F)	362	(684)	368	(694)	405	(761)	424	(795)
Exhaust Manifold Temperature, alarm	°C	(°F)	630	(1166)	630	(1166)	630	(1166)	630	(1166)
Exhaust Stack Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	435	(24738)	455	(25876)	488	(27753)	558	(31733)
Jacket Water Circuit	kW	(Btu/min.)	812	(46178)	896	(50955)	979	(55676)	1046	(59486)
Aftercooler	kW	(Btu/min.)	1188	(67607)	1423	(80979)	1285	(73126)	1494	(85019)
Total Heat rejected to Raw Water	kW	(Btu/min.)	2435	(138523)	2774	(157810)	2752	(156555)	3098	(176238)
Exhaust Gas[2]	kW	(Btu/min.)	3068	(174591)	3347	(190468)	4111	(233945)	4157	(236563)
Radiation	kw	(Btu/min.)	116	(6601)	119	(6772)	127	(7227)	136	(7739)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	61.2	(16.2)	68.8	(18.1)	72	(19)	78.5	(20.7)
Flow Rate, return	Lpm	(gpm)	38.9	(10.3)	43.7	(11.5)	46	(12.2)	49.7	(13.1)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	192.6	(.317)	198.8	(.327)	200.4	(.329)	198.9	(.327)
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	1060	(280)	1060	(280)	1060	(280)	1060	(280)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)	0.486	(0.0008)

TECHNICAL DATA

Engine: 3616 Vee
Rating: MCR
Fuel: MDO

	Units		Engine Speed Ratings 750		800		900		1000	
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	90	(194)	90	(194)	90	(194)	90	(194)
Inlet Temperature, maximum	°C	(°F)	95	(203)	95	(203)	95	(203)	95	(203)
Inlet Temperature, minimum	°C	(°F)	83	(181)	83	(181)	83	(181)	83	(181)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(618)	2630	(695)	2920	(771)
Pump Inlet Pressure, minimum[3]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[4]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[4]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[4]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Separate circuit

[4]Measured at starter inlet

[5]All 3616 engines come equipped with a High Performance Aftercooler (HPAC) to reduce the air inlet manifold temperature.

TECHNICAL DATA

Engine: 3606 In-Line
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1350	(1810)	1355	(1820)	1570	(2110)	1680	(2260)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	1949	(283)	1778	(258)	1889	(274)	1819	(264)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-5-3-6-2-4				1-5-3-6-2-4			
Firing Order - CW			1-4-2-6-3-5				1-4-2-6-3-5			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	150	(5298)	164	(5792)	202	(7135)	214	(7558)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	175	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	263	(38)	265	(38)	250	(36)	241	(35)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	288	(10172)	303	(10702)	373	(13174)	403	(14234)
Exhaust Stack Temperature @ 100% load	°C	(°F)	320	(608)	297	(567)	299	(570)	308	(586)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	158	(8993)	163	(9277)	177	(10074)	194	(11042)
Jacket Water Circuit	kW	(Btu/min.)	318	(18099)	337	(19180)	330	(18782)	387	(22026)
Aftercooler	kW	(Btu/min.)	430	(24474)	478	(27205)	530	(30165)	571	(32500)
Total Heat rejected to Raw Water	kW	(Btu/min.)	906	(51566)	978	(55662)	1037	(59021)	1152	(65568)
Exhaust Gas[2]	kW	(Btu/min.)	922	(52468)	889	(50590)	1112	(63281)	1250	(71134)
Radiation	kW	(Btu/min.)	63	(3585)	63	(3585)	68	(3870)	71	(4040)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	15.2	(4.0)	15.5	(4.1)	18	(4.8)	19.4	(5.1)
Flow Rate, return	Lpm	(gpm)	10.2	(2.7)	10.4	(2.8)	12.1	(3.2)	12.9	(3.4)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	202	(.332)	204	(.336)	203	(.334)	208	(.342)
Unit Injector Tip Cooling System[3]	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. Before Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Coolant Temp. After Engine, nominal	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Heat rejection/Unit injector	Lpm	(gpm)	36	(9.5)	36	(9.5)	36	(9.5)	36	(9.5)
Coolant Flow (SAE 10W oil)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Coolant Pressure Low, alarm										

TECHNICAL DATA

Engine: 3606 In-Line
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	697	(184)	697	(184)	697	(184)	697	(184)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.5	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nomina[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

TECHNICAL DATA

Engine: 3606 In-Line
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1485	(1995)	1490	(2000)	1730	(2320)	1850	(2485)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2144	(311)	1955	(282)	2081	(302)	2003	(290)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-5-3-6-2-4				1-5-3-6-2-4			
Firing Order - CW			1-4-2-6-3-5				1-4-2-6-3-5			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	159	(5616)	172	(6075)	213	(7523)	229	(8088)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	175	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	290	(42)	284	(41)	273	(40)	266	(39)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	307	(10843)	320	(11302)	399	(14093)	433	(15294)
Exhaust Stack Temperature @ 100% load	°C	(°F)	320	(608)	302	(576)	306	(583)	313	(595)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	171	(9732)	176	(10017)	194	(11042)	212	(12066)
Jacket Water Circuit	kW	(Btu/min.)	335	(19067)	347	(19750)	355	(20205)	385	(21912)
Aftercooler	kW	(Btu/min.)	477	(27149)	526	(29937)	592	(33694)	653	(37166)
Total Heat rejected to Raw Water	kW	(Btu/min.)	983	(55948)	1049	(59704)	1141	(64941)	1250	(71144)
Exhaust Gas[2]	kW	(Btu/min.)	977	(55598)	935	(53208)	1188	(67606)	1377	(78361)
Radiation	kW	(Btu/min.)	67	(3813)	67	(3813)	73	(4154)	74	(4211)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	16.5	(4.4)	17	(4.5)	20	(5.3)	22	(5.8)
Flow Rate, return	Lpm	(gpm)	11.0	(2.9)	11.4	(3)	13.5	(3.6)	15	(4.0)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	199	(.327)	200	(.329)	201	(.330)	207	(.340)
Unit Injector Tip Cooling System[3]										
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	36	(9.5)	36	(9.5)	36	(9.5)	36	(9.5)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3606 In-Line
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	697	(184)	697	(184)	697	(184)	697	(184)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.5	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

TECHNICAL DATA

Engine: 3608 In-Line
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1800	(2415)	1800	(2415)	2090	(2805)	2110	(2830)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	1949	(283)	1772	(257)	1886	(273)	1713	(264)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-6-2-5-8-3-7-4				1-6-2-5-8-3-7-4			
Firing Order - CW			1-4-7-3-8-5-2-6				1-4-7-3-8-5-2-6			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	197	(6958)	205	(7241)	244	(8619)	255	(9007)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	175	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	261	(37.8)	243	(35)	240	(34.8)	246	(35.7)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	380	(13422)	387	(13669)	467	(16495)	489	(17272)
Exhaust Stack Temperature @ 100% load	°C	(°F)	322	(612)	310	(590)	318	(604)	319	(606)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	207	(11781)	213	(12123)	236	(13432)	245	(13944)
Jacket Water Circuit	kW	(Btu/min.)	447	(25441)	485	(27604)	527	(29994)	563	(32043)
Aftercooler	kW	(Btu/min.)	525	(29880)	567	(32271)	641	(36483)	701	(39898)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1179	(67102)	1265	(71998)	1404	(79909)	1509	(85885)
Exhaust Gas[2]	kW	(Btu/min.)	1206	(68630)	1184	(67378)	1496	(85133)	1569	(89287)
Radiation	kW	(Btu/min.)	72	(4097)	72	(4097)	77	(4382)	78	(4439)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	20	(5.3)	21	(5.5)	24	(6.3)	25	(6.6)
Flow Rate, return	Lpm	(gpm)	13.4	(3.5)	14.3	(3.8)	16	(4.2)	16.8	(4.4)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	199	(.327)	202	(.332)	204	(.336)	210	(.345)
Unit Injector Tip Cooling System[3]										
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	48	(12.7)	48	(12.7)	48	(12.7)	48	(12.7)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3608 In-Line
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	760	(200)	760	(200)	760	(200)	760	(200)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.5	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

TECHNICAL DATA

Engine: 3608 In-Line
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	1980	(2660)	1980	(2660)	2300	(3090)	2320	(3115)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2144	(311)	1949	(283)	2075	(301)	1884	(273)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-6-2-5-8-3-7-4				1-6-2-5-8-3-7-4			
Firing Order - CW			1-4-7-3-8-5-2-6				1-4-7-3-8-5-2-6			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	209	(7382)	217	(7664)	257	(9077)	266	(9395)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	175	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	286	(41.5)	268	(38.9)	261	(37.8)	264	(38.3)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	408	(14410)	417	(14728)	500	(17660)	519	(18331)
Exhaust Stack Temperature @ 100% load	°C	(°F)	328	(622)	319	(606)	327	(621)	330	(626)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	228	(12977)	234	(13318)	258	(14684)	267	(15196)
Jacket Water Circuit	kW	(Btu/min.)	470	(26750)	497	(27262)	541	(30791)	618	(35174)
Aftercooler	kW	(Btu/min.)	606	(34491)	649	(36938)	721	(41036)	740	(42117)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1304	(74218)	1380	(77518)	1520	(86511)	1625	(92487)
Exhaust Gas[2]	kW	(Btu/min.)	1301	(74036)	1295	(73695)	1647	(93726)	1708	(97197)
Radiation	kW	(Btu/min.)	74	(4211)	74	(4211)	81	(4609)	81	(4609)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	22	(5.8)	22	(5.8)	26	(6.9)	27	(7.1)
Flow Rate, return	Lpm	(gpm)	14.7	(3.9)	14.6	(3.8)	17.4	(4.6)	18	(4.7)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	198	(.326)	201	(.331)	203	(.334)	208	(.342)
Unit Injector Tip Cooling System[3]										
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	48	(12.7)	48	(12.7)	48	(12.7)	48	(12.7)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3608 In-Line
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	760	(200)	760	(200)	760	(200)	760	(200)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.5	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	1095	(289)	1168	(308.5)	1315	(347)	1460	(386)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	295	(42.1)
Pump capacity	Lpm	(gpm)	900	(238)	960	(254)	1080	(285)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

TECHNICAL DATA

Engine: 3608 In-Line
Rating: CSR & MCR**
Fuel: HEAVY

	Units		Engine Speed Ratings 1000 (CSR)		1000 (MCR)	
General Data						
Engine Output[1]	bkW	(bhp)	2240	(3005)	2460	(3300)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	20	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)
Compression Ratio				12.4:1	12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	1819	(264)	1998	(290)
Mean Piston Speed	m/s	(f/s)	10.0	(32.8)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300	
Firing Order - CCW			1-6-2-5-8-3-7-4			
Firing Order - CW			1-4-7-3-8-5-2-6			
Combustion Air System						
Flow of air @ 100% load	cmm	(cfm)	246	(8689)	259	(9148)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	248	(36)	271	(39.3)
Exhaust Gas System						
Exhaust Gas Flow @ 100% load	cmm	(cfm)	494	(17448)	533	(18826)
Exhaust Stack Temperature @ 100% load	°C	(°F)	347	(657)	361	(682)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)
Exhaust System Backressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load						
Lube Oil Cooler	kW	(Btu/min.)	258	(14684)	280	(15936)
Jacket Water Circuit	kW	(Btu/min.)	647	(36824)	632	(35970)
Aftercooler	kW	(Btu/min.)	658	(37450)	738	(42003)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1563	(88958)	1650	(93909)
Exhaust Gas[2]	kW	(Btu/min.)	1654	(94124)	1798	(102319)
Radiation	kW	(Btu/min.)	80	(4553)	85	(4837)
Fuel System						
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	26	(6.9)	28	(7.4)
Flow Rate, return	Lpm	(gpm)	17.4	(4.6)	18.7	(4.9)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	208	(.342)	205	(.337)
Unit Injector Tip Cooling System[3]						
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	48	(12.7)	48	(12.7)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3608 In-Line
Rating: CSR & MCR**
Fuel: HEAVY

	Units		Engine Speed Ratings 1000 (CSR)		1000 (MCR)	
Lubricating Oil System						
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	760	(200)	760	(200)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.55	(0.0009)	0.55	(0.0009)
Cooling Water System - Block Cooling						
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	295	(42.1)	295	(42.1)
Pump capacity	Lpm	(gpm)	1460	(386)	1460	(386)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling						
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	295	(42.1)	295	(42.1)
Pump capacity	Lpm	(gpm)	1200	(317)	1200	(317)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)
Starting Air System						
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values have been corrected to an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

****Always requires CP propeller. See guide section on Engine Performance.**

TECHNICAL DATA

Engine: 3612 Vee
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	2700	(3625)	2710	(3640)	3140	(4215)	3360	(4510)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	1949	(283)	17778	(258)	1889	(274)	1819	(264)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-12-9-4-5-8-2-3-4-10-7-6				1-12-9-4-5-8-11-2-3-10-7-6			
Firing Order - CW			1-6-7-10-3-2-11-8-5-4-9-12				1-6-7-10-3-2-11-8-5-4-9-12			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	299	(10560)	329	(11620)	403	(14234)	429	(15152)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	175	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	263	(38)	265	(38.4)	250	(36)	250	(36)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	575	(20309)	606	(21404)	745	(26313)	794	(28045)
Exhaust Stack Temperature @ 100% load	°C	(°F)	320	(608)	297	(567)	299	(570)	299	(570)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	315	(17428)	326	(18554)	355	(20205)	388	(22083)
Jacket Water Circuit	kW	(Btu/min.)	636	(36198)	674	(38361)	659	(37507)	773	(43995)
Aftercooler	kW	(Btu/min.)	709	(S40353)	788	(44849)	874	(49744)	943	(53671)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1660	(94479)	1788	(101764)	1888	(107456)	2104	(119749)
Exhaust Gas[2]	kW	(Btu/min.)	2001	(113871)	1951	(111026)	2415	(137431)	2742	(156039)
Radiation	kW	(Btu/min.)	88	(5008)	88	(5008)	94	(5349)	99	(5634)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	30.5	(8.1)	31	(7.8)	35.5	(9.4)	39	(10.3)
Flow Rate, return	Lpm	(gpm)	20.4	(5.4)	21	(5.3)	23.7	(6.3)	26	(6.9)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	201	(.330)	203	(.334)	202	(.332)	208	(.342)
Unit Injector Tip Cooling System[3]										
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	72	(19)	72	(19)	72	(19)	72	(19)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3612 Vee
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	910	(240)	910	(240)	910	(240)	910	(240)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.5	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	290	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(6`8)	2630	(695)	2920	(711)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	104	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

TECHNICAL DATA

Engine: 3612 Vee
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	2970	(3985)	2980	(4000)	3460	(4645)	3700	(4965)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2144	(311)	1955	(284)	2081	(302)	2003	(290)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-12-9-4-5-8-11-2-3-4-10-7-6				1-12-9-4-5-8-11-2-3-10-7-6			
Firing Order - CW			1-6-7-10-3-2-11-8-5-4-9-12				1-6-7-10-3-2-11-8-5-4-9-12			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	320	(11302)	343	(12115)	426	(15046)	457	(16141)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)	75	(167)	175	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	289	(42)	284	(41)	273	(40)	273	(40)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	614	(21686)	640	(22605)	798	(28185)	857	(30270)
Exhaust Stack Temperature @ 100% load	°C	(°F)	320	(608)	302	(576)	306	(582)	306	(583)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	341	(19408)	352	(20034)	387	(22076)	424	(24132)
Jacket Water Circuit	kW	(Btu/min.)	670	(38133)	695	(39556)	711	(40467)	770	(43825)
Aftercooler	kW	(Btu/min.)	849	(48321)	936	(53273)	1054	(59987)	1162	(66135)
Total Heat rejected to Raw Water	kW	(Btu/min.)	1860	(105862)	1983	(112863)	2152	(122480)	2356	(134092)
Exhaust Gas[2]	kW	(Btu/min.)	2066	(117570)	1992	(113359)	2509	(142780)	2941	(167364)
Radiation	kW	(Btu/min.)	92	(5235)	92	(5235)	102	(5805)	104	(5918)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	33	(8.7)	33	(8.7)	39	(10.3)	43	(11.4)
Flow Rate, return	Lpm	(gpm)	22	(5.8)	22	(5.8)	26	(6.9)	28.8	(7.6)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	198	(.326)	199	(.327)	200	(.329)	207	(.340)
Unit Injector Tip Cooling System[3]										
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	72	(19)	72	(19)	72	(19)	72	(19)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3612 Vee
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	910	(240)	910	(240)	910	(240)	910	(240)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.55	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	290	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(6`8)	2630	(695)	2920	(711)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

TECHNICAL DATA

Engine: 3616 Vee
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	3600	(4830)	3600	(4830)	4180	(5610)	4220	(5665)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	1949	(283)	1772	(257)	1886	(273)	1713	(248)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8				1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8			
Firing Order - CW			1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2				1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2			
Combustion Air System										
Flow of air	cmm	(cfm)	411.5	(14532)	429.3	(15161)	511.0	(18046)	534.1	(18862)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	61	(142)	61	(142)	61	(142)	61	(142)
Intake Manifold Pressure @ 100% load	kPa	(psi)	248	(36.0)	231	(33.5)	223	(32.3)	234	(33.9)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	812.0	(28676)	829.9	(29308)	1001.5	(35368)	1048.6	(37031)
Exhaust Stack Temperature @ 100% load	°C	(°F)	316	(601)	304	(579)	312	(594)	313	(595)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	415	(23620)	426	(24246)	472	(26864)	491	(27945)
Jacket Water Circuit	kW	(Btu/min.)	895	(50939)	970	(55208)	1054	(59989)	1125	(64030)
Aftercooler	kW	(Btu/min.)	1069	(60834)	1194	(67947)	1358	(77280)	1480	(84221)
Total Heat rejected to Raw Water	kW	(Btu/min.)	2379	(135393)	2590	(147401)	2884	(164133)	3096	(176196)
Exhaust Gas[2]	kW	(Btu/min.)	2262	(128724)	2308	(131342)	2584	(147048)	2890	(164462)
Radiation	kW	(Btu/min.)	101	(5748)	101	(5748)	113	(6431)	114	(6487)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	40	(10.6)	41	(10.8)	47.5	(12.5)	49	(12.9)
Flow Rate, return	Lpm	(gpm)	26.8	(7.1)	27.6	(7.3)	31.8	(8.4)	32.7	(8.6)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	195.0	(.321)	201.0	(.330)	196.5	(.323)	205.8	(.338)
Unit Injector Tip Cooling System[3]										
Coolant Temp. Before Engine, nominal	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. After Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Heat rejection/Unit injector	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Coolant Flow (SAE 10W oil)	Lpm	(gpm)	96	(25.4)	96	(25.4)	96	(25.4)	96	(25.4)
Coolant Pressure Low, alarm	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)

TECHNICAL DATA

Engine: 3616 Vee
Rating: CSR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	1060	(280)	1060	(280)	1060	(280)	1060	(280)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.55	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	290	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(6`8)	2630	(695)	2920	(711)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

[6]All 3616 engines come equipped with a High Performance Aftercooler (HPAC) to reduce the air inlet manifold temperature.

TECHNICAL DATA

Engine: 3616 Vee
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
General Data										
Engine Output[1]	bkW	(bhp)	3960	(5315)	3960	(5315)	4600	(6175)	4640	(6230)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	300	(11.8)	300	(11.8)	300	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)	18.5	(1127)	18.5	(1127)
Compression Ratio			12.4:1		12.4:1		12.4:1		12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	2144	(311)	1949	(283)	2076	(301)	1884	(273)
Mean Piston Speed	m/s	(f/s)	7.5	(24.6)	8.25	(27.1)	9.0	(29.5)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350		350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300		300		300	
Firing Order - CCW			1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8				1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8			
Firing Order - CW			1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2				1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2			
Combustion Air System										
Flow of air @ 100% load	cmm	(cfm)	437.7	(15457)	454.5	(16051)	538.2	(19006)	556.0	(19635)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	61	(142)	61	(142)	61	(142)	61	(142)
Intake Manifold Pressure @ 100% load	kPa	(psi)	272	(39.5)	255	(37.0)	243	(35.2)	251	(36.4)
Exhaust Gas System										
Exhaust Gas Flow @ 100% load	cmm	(cfm)	872.5	(30812)	892.3	(31511)	1071.1	(37826)	1112.1	(39273)
Exhaust Stack Temperature @ 100% load	°C	(°F)	322	(612)	313	(595)	321	(610)	324	(615)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load										
Lube Oil Cooler	kW	(Btu/min.)	457	(26010)	467	(26580)	515	(29311)	534	(30393)
Jacket Water Circuit	kW	(Btu/min.)	941	(53557)	993	(56517)	1083	(63639)	1235	(70290)
Aftercooler	kW	(Btu/min.)	1260	(71703)	1370	(77963)	1430	(81377)	1540	(87637)
Total Heat rejected to Raw Water	kW	(Btu/min.)	2658	(151270)	2830	(161060)	3028	(174327)	3309	(188320)
Exhaust Gas[2]	kW	(Btu/min.)	2454	(139650)	2513	(143008)	2993	(170323)	3173	(180566)
Radiation	kW	(Btu/min.)	109	(6203)	109	(6203)	120	(6829)	121	(6886)
Fuel System										
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	44	(11.6)	44	(11.6)	52	(13.7)	54	(14.2)
Flow Rate, return	Lpm	(gpm)	29.5	(7.8)	29.3	(7.7)	34.8	(9.2)	36.2	(9.6)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	195.1	(.321)	200.0	(.329)	196.5	(.323)	203.9	(.335)
Unit Injector Tip Cooling System[3]	°C	(°F)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. Before Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)	56-71	(133-160)
Coolant Temp. After Engine, nominal	kW	(Btu/min.)	1.0	(57)	1.0	(57)	1.0	(57)	1.0	(57)
Heat rejection/Unit injector	Lpm	(gpm)	96	(25.4)	96	(25.4)	96	(25.4)	96	(25.4)
Coolant Flow (SAE 10W oil)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Coolant Pressure Low, alarm										

TECHNICAL DATA

Engine: 3616 Vee
Rating: MCR
Fuel: HEAVY

	Units		Engine Speed Ratings 750		825		900		1000	
Lubricating Oil System										
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)	85	(1985)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	1060	(280)	1060	(280)	1060	(280)	1060	(280)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.45	(0.0007)	0.50	(0.0008)	0.50	(0.0008)	0.55	(0.0009)
Cooling Water System - Block Cooling										
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	170	(24.3)	190	(27.1)	240	(34.3)	290	(41.4)
Pump capacity	Lpm	(gpm)	2190	(579)	2338	(6`8)	2630	(695)	2920	(711)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling										
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	170	(24.3)	194	(27.7)	245	(35)	305	(43.6)
Pump capacity	Lpm	(gpm)	1300	(343)	1387	(366)	1560	(412)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)	-5	(-1.48)
Starting Air System										
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values are based on an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is required with heavy fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

[6]All 3616 engines come equipped with a High Performance Aftercooler (HPAC) to reduce the air inlet manifold temperature.

TECHNICAL DATA

Engine: 3616 Vee
Rating: CSR & MCR**
Fuel: HEAVY

	Units		Engine Speed Ratings 1000 (CSR)		1000 (MCR)	
General Data						
Engine Output[1]	bkW	(bhp)	4480	(6015)	4920	(6600)
Cylinder Bore	mm	(in)	280	(11.0)	280	(11.0)
Stroke	mm	(in)	300	(11.8)	20	(11.8)
Displacement/Cylinder	L	(in^3)	18.5	(1127)	18.5	(1127)
Compression Ratio				12.4:1	12.4:1	
Firing Pressure, maximum	kPa	(psi)	16200	(2350)	16200	(2350)
BMEP	kPa	(psi)	1819	(264)	1998	(290)
Mean Piston Speed	m/s	(f/s)	10.0	(32.8)	10.0	(32.8)
Idle Speed	rpm	rpm	350		350	
Crash Reversal Speed, minimum	rpm	rpm	300		300	
Firing Order - CCW	1-2-5-6-3-4-9-10-15-16-11-12-13-14-7-8					
Firing Order - CW	1-8-7-14-13-12-11-16-15-10-9-4-3-6-5-2					
Combustion Air System						
Flow of air @ 100% load	cmm	(cfm)	514.2	(18159)	541.4	(19119)
Air Temperature @ Air Cleaner, maximum	°C	(°F)	45	(113)	45	(113)
Air Temperature after Aftercooler, alarm	°C	(°F)	75	(167)	75	(167)
Intake Manifold Pressure @ 100% load	kPa	(psi)	236	(34.2)	257	(37.3)
Exhaust Gas System						
Exhaust Gas Flow @ 100% load	cmm	(cfm)	1057.8	(37356)	1139.1	(40227)
Exhaust Stack Temperature @ 100% load	°C	(°F)	341	(646)	355	(671)
Exhaust Manifold Temperature, alarm	°C	(°F)	550	(1022)	550	(1022)
Exhaust Stack Temperature, alarm	°C	(°F)	450	(842)	450	(842)
Exhaust System Backpressure, maximum	kPa	(in H_2O)	2.5	(10)	2.5	(10)
Heat Balance @ 100% Load						
Lube Oil Cooler	kW	(Btu/min.)	517	(29425)	559	(31816)
Jacket Water Circuit	kW	(Btu/min.)	1293	(73591)	1264	(71941)
Aftercooler	kW	(Btu/min.)	1387	(78930)	1460	(83084)
Total Heat rejected to Raw Water	kW	(Btu/min.)	3197	(181946)	3283	(186841)
Exhaust Gas[2]	kW	(Btu/min.)	2785	(158486)	3336	(189842)
Radiation	kW	(Btu/min.)	116	(6601)	125	(7113)
Fuel System						
Pump Suction Restriction, maximum	kPa	(psi)	-39	(-5.7)	-39	(-5.7)
Return Line Backpressure, maximum	kPa	(psi)	350	(51)	350	(51)
Manifold Pressure @ 100% load	kPa	(psi)	430-676	(62.4-98)	430-676	(62.4-98)
Flow Rate, supply	Lpm	(gpm)	52	(13.7)	56	(14.8)
Flow Rate, return	Lpm	(gpm)	34.8	(9.2)	37.4	(9.9)
BSFC (with pumps)[1]	g/kW-hr	(lb/hp-hr)	198.7	(.327)	199.5	(.328)
Unit Injector Tip Cooling System[3]	°C	(°F)	50-65	(122-149)	50-65	(122-149)
Coolant Temp. Before Engine, nominal	°C	(°F)	56-71	(133-160)	56-71	(133-160)
Coolant Temp. After Engine, nominal	kW	(Btu/min.)	1.0	(57)	1.0	(57)
Heat rejection/Unit injector	Lpm	(gpm)	96	(25.4)	96	(25.4)
Coolant Flow (SAE 10W oil)	kPa	(psi)	260	(38)	260	(38)
Coolant Pressure Low, alarm						

TECHNICAL DATA

Engine: 3616 Vee
Rating: CSR & MCR**
Fuel: HEAVY

	Units		Engine Speed Ratings 1000 (CSR)		1000 (MCR)	
Lubricating Oil System						
Manifold Pressure, minimum	kPa	(psi)	380	(55)	380	(55)
Manifold Pressure, alarm (650-1000 rpm)	kPa	(psi)	320	(46)	320	(46)
Manifold Pressure, alarm (0-650 rpm)	kPa	(psi)	120	(17)	120	(17)
Manifold Pressure, stop (650-1000 rpm)	kPa	(psi)	260	(38)	260	(38)
Manifold Pressure, stop (0-650 rpm)	kPa	(psi)	105	(15)	105	(15)
Manifold Temperature, alarm	°C	(°F)	92	(198)	92	(198)
Manifold Temperature, stop	°C	(°F)	98	(208)	98	(208)
Manifold Temperature, nominal	°C	(°F)	85	(185)	85	(185)
Prelube Pump Capacity - intermittent	Lpm	(gpm)	76	(20)	76	(20)
Prelube Pump Capacity - continuous	Lpm	(gpm)	23	(6)	23	(6)
Sump Capacity (marine)	L	(gal)	1060	(280)	1060	(280)
BSOC @ 100% load (nominal)	g/kW-hr	(lb/hp-hr)	0.55	(0.0009)	0.55	(0.0009)
Cooling Water System - Block Cooling						
Inlet Temperature, nominal	°C	(°F)	93	(199)	93	(199)
Inlet Temperature, maximum	°C	(°F)	96	(205)	96	(205)
Inlet Temperature, minimum	°C	(°F)	85	(185)	85	(185)
Outlet Temp., before Regulator, maximum	°C	(°F)	99	(210)	99	(210)
Pump Rise (Delta P) @ 90°C (194°)	kPa	(psi)	290	(41.4)	290	(41.4)
Pump capacity	Lpm	(gpm)	2920	(771)	2920	(771)
Pump Inlet Pressure, minimum[4]	kPa	(psi)	30	(4.3)	30	(4.3)
Outlet Temperature, alarm	°C	(°F)	100	(212)	100	(212)
Outlet Temperature, stop	°C	(°F)	104	(219)	104	(219)
Cooling Water System - AC/OC Cooling						
Inlet Temperature, nominal	°C	(°F)	32	(90)	32	(90)
Inlet Temperature, maximum	°C	(°F)	38	(100)	38	(100)
Pump Rise (Delta P) @ 32°C (90°F)	kPa	(psi)	305	(43.6)	305	(43.6)
Pump capacity	Lpm	(gpm)	1730	(457)	1730	(457)
Pump Inlet Pressure, minimum	kPa	(in-Hg)	-5	(-1.48)	-5	(-1.48)
Starting Air System						
Air Pressure, nominal[5]	kPa	(psi)	1225	(175)	1225	(175)
Air Pressure, minimum[5]	kPa	(psi)	620	(90)	620	(90)
Air Pressure, maximum[5]	kPa	(psi)	1575	(225)	1575	(225)
Low Air Pressure, alarm	kPa	(psi)	850	(125)	850	(125)

[1]Performance based on SAE J1995 and ISO 3046/1 standard conditions of 100 kPa (29.61 in-Hg) and 25°C (77°F). BSFC values are shown with a Caterpillar tolerance of ±6 g/kW-hr (.010 lbs/hp-hr). For an ISO fuel consumption, subtract 4 g/kW-hr (.007 lbs/hp-hr) from the values shown. This takes into account the ±5% tolerance allowed by ISO. BSFC values have been corrected to an LHV of 42780 kJ/kg (18390 Btu/lb.)

[2]Exhaust heat rejection is based on fuel LHV although TMI values are based on fuel HHV. The fuel HHV includes the latent heat of vaporization of water in the exhaust gas which is not recoverable in diesel engine applications.

[3]Injector tip cooling is not required with MDO fuel. A separate external injector tip cooling module is required when heavy fuels above 40 cSt @ 50°C (122°F) are used. The coolant flow is based upon a separate circuit system.

[4]Separate circuit

[5]Measured at starter inlet

[6]All 3616 engines come equipped with a High Performance (HPAC) to reduce the air inlet manifold temperature.

****Always requires CP propeller. See guide section on Engine Performance.**

Noise

Sound Waves — Behavior and Measurement

As sound waves radiate their strength diminishes. As distance traveled doubles, the wave amplitude is reduced by one-half. This rule applies if the first measuring point is at least two or three times the largest dimension of the noise source, usually about three feet.

Distance	Sound Strength
X	100%
2X	50%
4X	25%

Sound waves impinging on a microphone produce voltages proportional to sound pressures. The signals measure amplitude or strength of the *sound pressure* waves. Amplitude and frequency are the only sound properties measurable using ordinary techniques.

The extensive audible range of sound complicates noise ratings. The human ear hears pressure levels 100,000 times stronger than the lowest detectable level without damage. Noise measuring instruments have extraordinary range and are scaled in decibels (dB).

Sound Terms

Sound strength, or sound pressure level (SPL), is rated in the logarithmic decibel scale. The scale allows rating over the entire sound pressure range of interest with two to three digit numbers (e.g., 90 dB or 100 dB). For illustration, 80 dB is a sound pressure of only 0.00003 psi as shown in Figure 38.

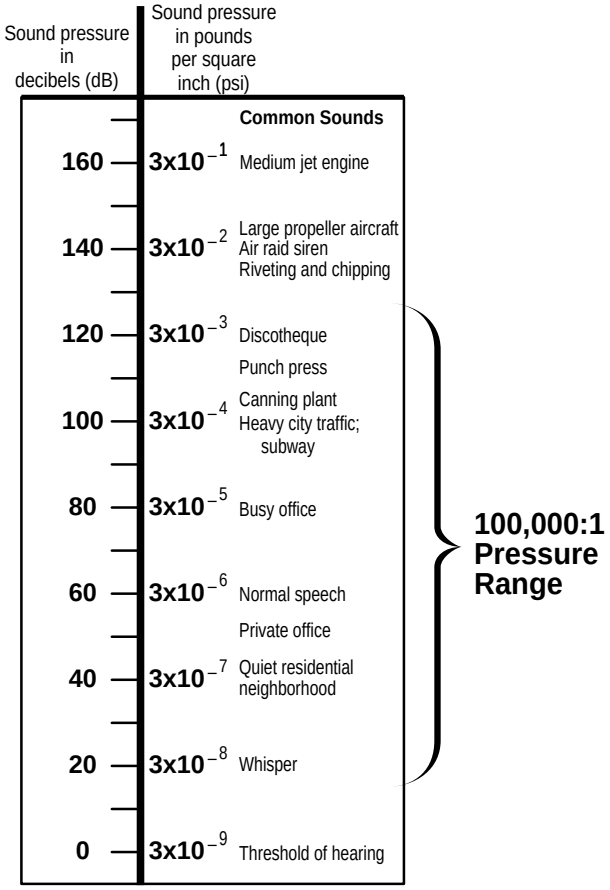


Figure 1

The system provides a meaningful human reference as the average ear first detects noise at 0 dB.

Humans can comfortably tolerate sound levels of 80 dB (10,000 times the sound pressure at 0 dB). Between 80 dB and 90 dB they show some intolerance to the noise, and above 90 dB the level becomes intense.

Sound pressure levels of common exposures to noise are shown in Figure 1.

Because of the logarithmic nature, differences in two decibel ratings indicate the wave strength ratio between the two measured levels. The following relations are noted from the scale.

Difference In Two Signal Levels In Decibels	Pressure Level Ratio
1	1.12 to 1
3	1.41 to 1
6	2.00 to 1
10	3.1 to 1
12*	4.00 to 1
20	10.00 to 1
40	100.00 to 1

*See example in Figure 2.

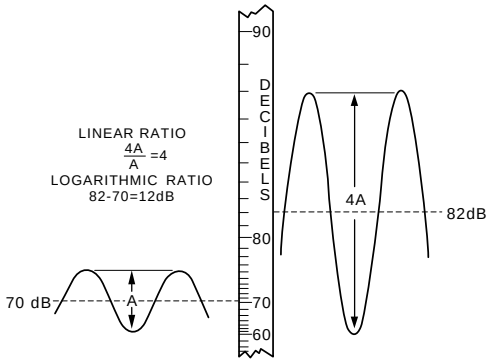


Figure 2

Loudness

The human ear does not use sound pressure decibels to judge loudness. Rating noise loudness is a complex operation because human hearing is also frequency sensitive.

Sounds with frequencies in the 5,000-10,000 Hz range are the easiest to hear; sounds with very low frequencies are the hardest. Hearing loss from exposure to noise is similarly frequency sensitive.

An example of the frequency selectivity of the human ear is shown in Figure 3.

It considers three single-frequency sounds at 50 Hz, 500 Hz, and 5000 Hz. When their strength is adjusted until they sound equally loud, the 50 Hz sound must be 19 dB stronger than the 5000 Hz sound and 8 dB stronger than the 500 Hz sound.

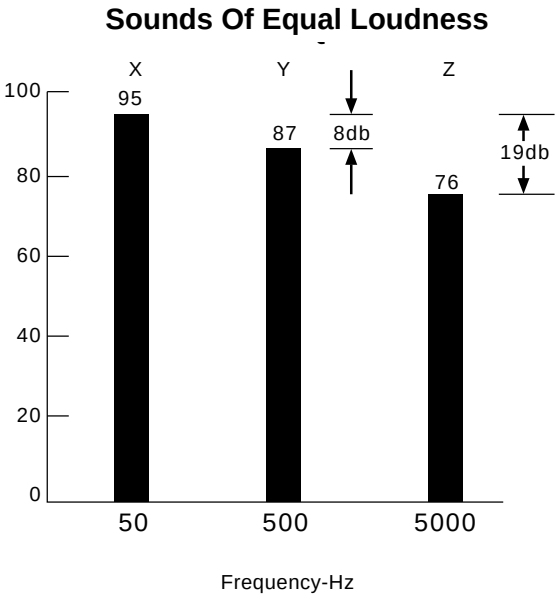


Figure 3

A-Weighted, dB(A) Measurements

Loudness can be measured by filtering the microphone signal to reduce the strength of the low frequency signals and give more weight to frequencies in the 5,000-10,000 Hz range. (These are the frequencies to which the ear is most sensitive). This is done with a standardized (international) “A” filter network to make adjustments throughout the frequency range according to Figure 4. The result is a total decibel rating with a correction approximating the ear’s sensitivity. The measurements are A-scale, A-weighted or dB(A) levels.

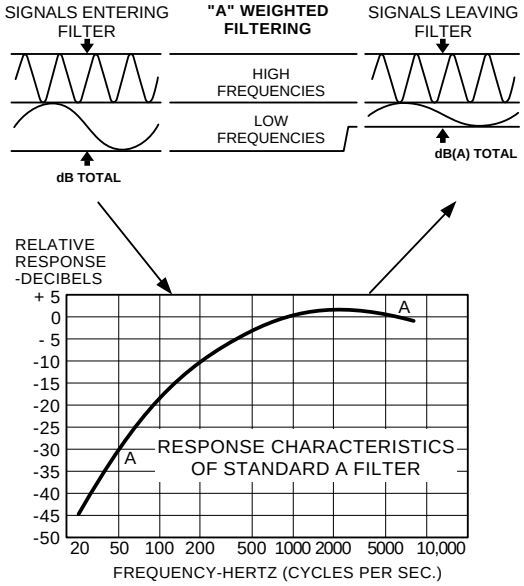


Figure 4

The previously discussed equal loudness sounds have the following dB and dB(A) ratings:

	Frequency	dB	dB(A)
(X)	50 Hz	95	65
(Y)	500 Hz	87	84
(Z)	5000 Hz	76	76

Note the A-weighted ratings are overcorrected for sound X, while slight or no corrections were made in Y and Z.

Since differences in sound pressure levels are small for noises of practical interest, the dB(A) scale is widely used throughout the world.

Octave Band Levels

More detail is required of the frequency distribution of a noise than provided by a A-weighted measurement. Measurements are made with filters subdividing sounds over the entire audible range into standardized frequency bands, permitting the pressure levels of only the sound within each subdivision to be measured. Each filter spans an octave; that is, the upper frequency limit is twice the lower limit as shown in Figure 5. Sound levels in each octave are measured in decibels and are referred to as octave band levels.

STANDARD OCTAVE BANDS
ANSI STD.S1.11 IEC 225

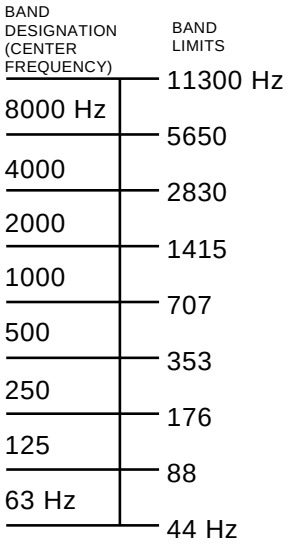


Figure 5

Loudness Calculations

Loudness can be calculated from octave band data by a number of methods. The most popular in the United States was developed by S.S. Stevens at Harvard University and is documented in ANSI Standard S3.4 and in ISO R532, Method A.

The method uses the unit SONE calculated by adjusting each octave band level according to human ear sensitivity in that band and then adding the effect of all of the bands. Once a sones value is obtained, loudness comparisons with other noises can be made linearly.

A noise judged to be twice as loud as another will probably have a sones rating twice that of the other noise.

Sones-Loudness Comparison	
Sones	Loudness Category
Below 30	Very Quiet
30-40	Quiet
40-45	Medium Quiet
45-50	Medium Loud
50-60	Loud
Above 60	Very Loud

Sones and dB(A) are both loudness ratings, and care must be used to convert from one to the other. When one is plotted against the other for actual noises, their relationship is evident. However, the scatter on the plot in Figure 6 is so great that it is not practical to calculate one from the other. If this conversion must be used, errors of ±10% sones or ±1.5 dB(A) must be accepted.

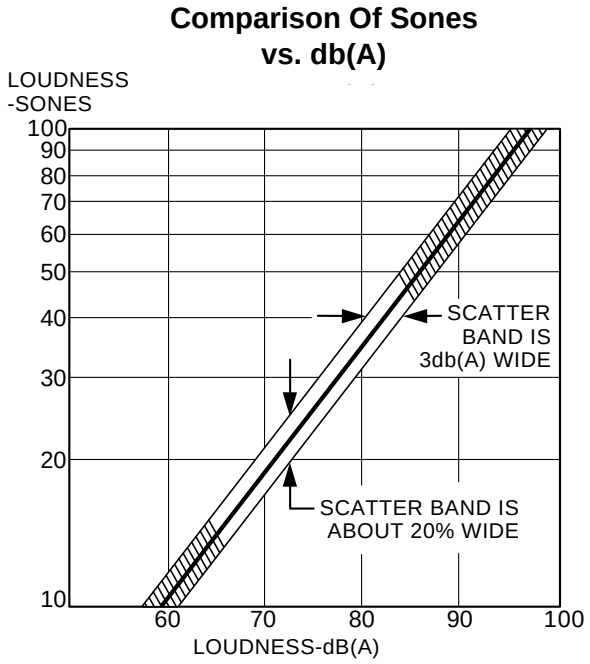


Figure 6

Sound Power

When combining the effect of several noise sources at a given distance from machinery, sound power being radiated is of more concern than sound pressure at that distance. Confusion arises as a decibel scale is also used to rate sound power.

With sound power, 80 dB expresses an acoustic radiation of 0.0003 watts. In this scale, a difference of 3 dB is a ratio of 2:1; 10 dB a ratio of 10:1.

The chart in Figure 7 illustrates differences in decibels and ratios in sound pressure and power. Sound power in decibels is a measure of the total sound radiation from a unit, while sound pressure, also in decibels, is the strength of a sound wave after it travels a specified distance from the unit.

The two decibel scales are related despite the discussed differences. The change in one will produce the same numerical change in the other.

For example: If the sound power of a engine was increased by 10 dB, the sound pressure of that noise at any given point would also increase 10 dB.

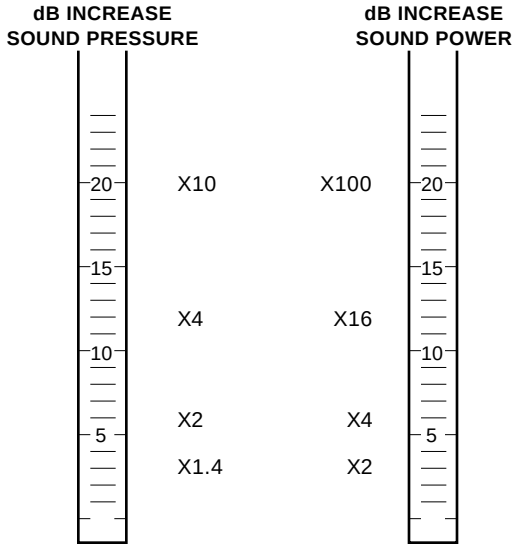


Figure 7

Noise Addition

When standing by an engine, the noise heard from other engines operating in the same area will depend on the spacing of the engines and where the person is in relation to the spacing.

Example: At a point equidistant among four identical engines with one operating at a measured 80 dB(A) at the reference point, what will the measurement be when a second engine is running?

As doubling sound pressure increases the decibel level by 6 dB, a meter will read 83 dB(A) after the second engine is started. The second machine doubles sound power, not sound pressure. Noise addition is made on the basis of sound power.

Starting the second pair of engines would double the sound power again and the level would rise another 3 dB to 86 dB(A). The sound pressure is now twice that of a single engine.

A chart showing the combined effect of up to ten equal sound sources is shown in Figure 8. Note that loudness is changed less than sound pressure as additional units are considered. Two sources are 20% and four sources are 40% louder than a single source when considered in sones.

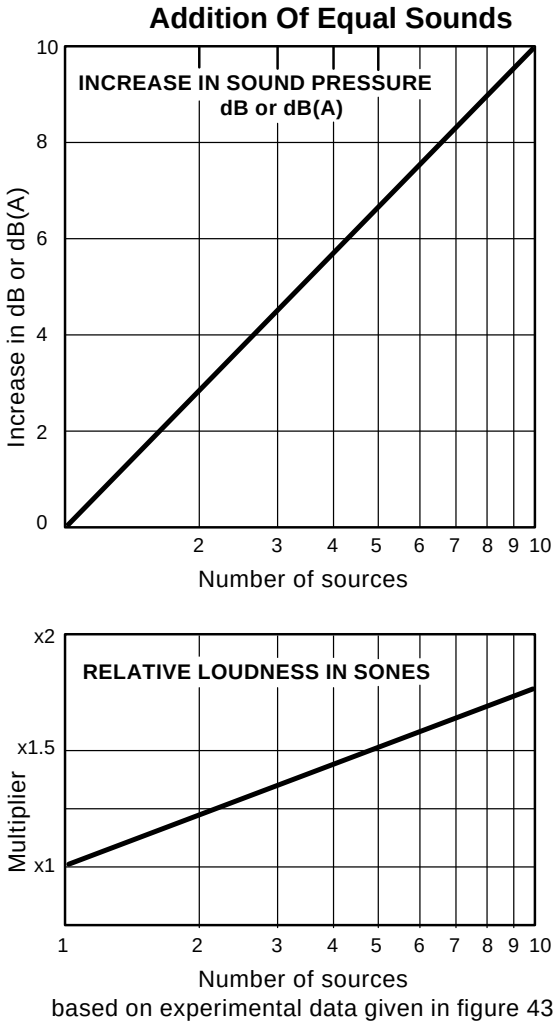


Figure 8

The example selected is easy to visualize. However, it is no more difficult when considering engines with different sound power levels or if the measurement point is not an equal distance from all machines. In such cases, the chart of Figure 9 can be used.

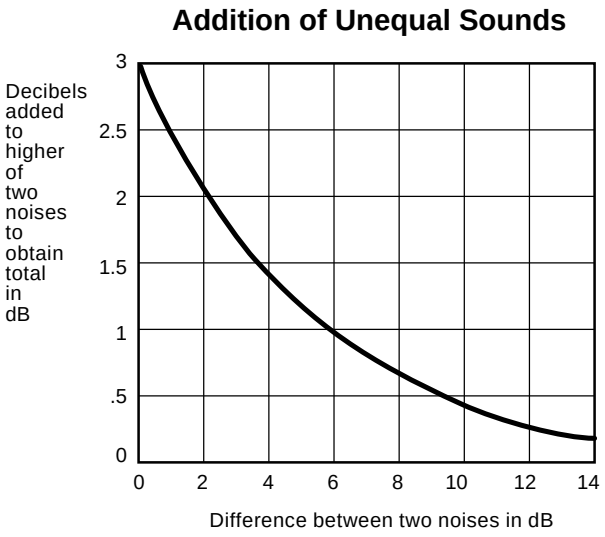


Figure 9

Figure 9 shows the versatility of the decibel system. Although calculations are made on the basis of sound power, the system uses measured or calculated sound pressures. Use the difference in the pressure levels of two sounds to find how their combined level exceeds the higher of the two. First adjust the levels for the distances from the source to the spot where the noises are being added, as explained on page 46. To add a third level, use the same process to combine it with the total of the first two. Figure 9 can be used to check the data in Figure 8.

Noise Exposure

Exposure to excessive noise causes permanent hearing damage and adversely affects working efficiency and comfort. Recognizing this, the U.S. Government created the Occupational Safety and Health Act (OSHA) which established limits for industrial environments.

When an individual's daily noise exposure, designated D(8), is composed of two or more periods of noise at different levels, the combined effect is calculated by: D(8) = (C1/T1) + (C2/T2) + ... + (Cn/Tn). Cn is the duration of exposure at a specified sound level and Tn is the total time of exposure permitted at a specified sound level as shown in Figure 10. The noise exposure is acceptable when equal to or less than 1.

Duration of Daily Exposure Hours	Allowable level dB(A)
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Figure 10

Noise Control

Noise can be either airborne or structureborne transmitted. Structureborne noise is vibration transmitted through a structure, typically that supporting the engine. Noise control methods are different for the two sources.

Mechanical Noise Control

Structureborne noise can be controlled by isolating the engine from the supporting structure using Caterpillar's resilient mounts for propulsion engines and spring isolators for ship set generator engines. See the Mounting section of this guide for details. Airborne noise can be controlled through baffles, sound enclosures, absorption materials, or any combination of the above methods. An approximate guide comparing various isolation methods is illustrated in Figure 11.

Free-field mechanical airborne noise plots for various 3600 Engines and ratings are plotted on pages 51 through 54.

The top curve indicates sound *power* level in dB. The three lower curves are the sound *pressure* levels in *dB* at distances of 1, 7, and 15 meters (arranged top to bottom). The *dB* levels are plotted at octave band center frequencies of 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz. Below the charts the number in parentheses is the overall *dB(A)* level at the indicated distance. The abbreviation SP stands for Sound Power.

The mechanical noise plots are valid for all power settings at a given engine speed.

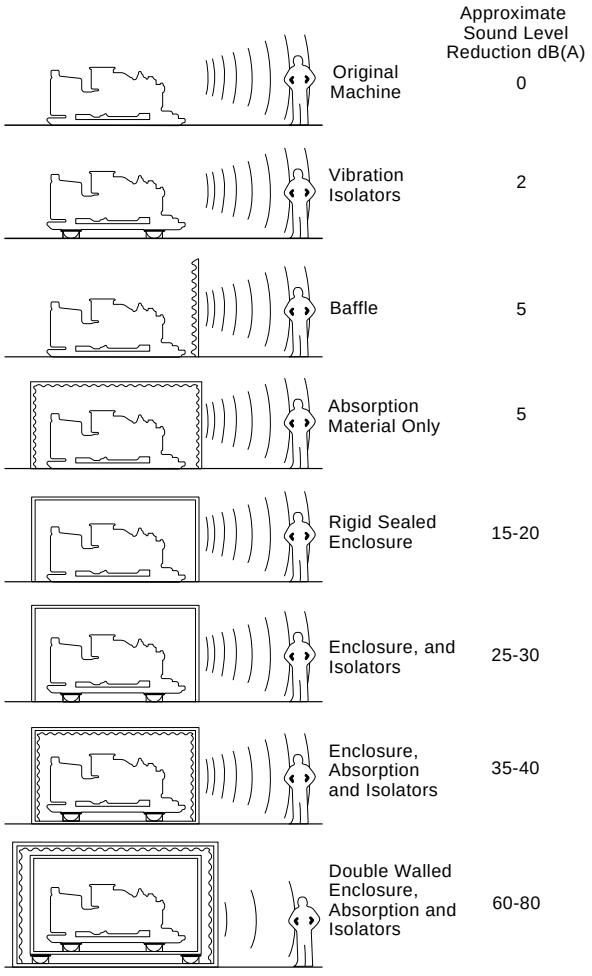
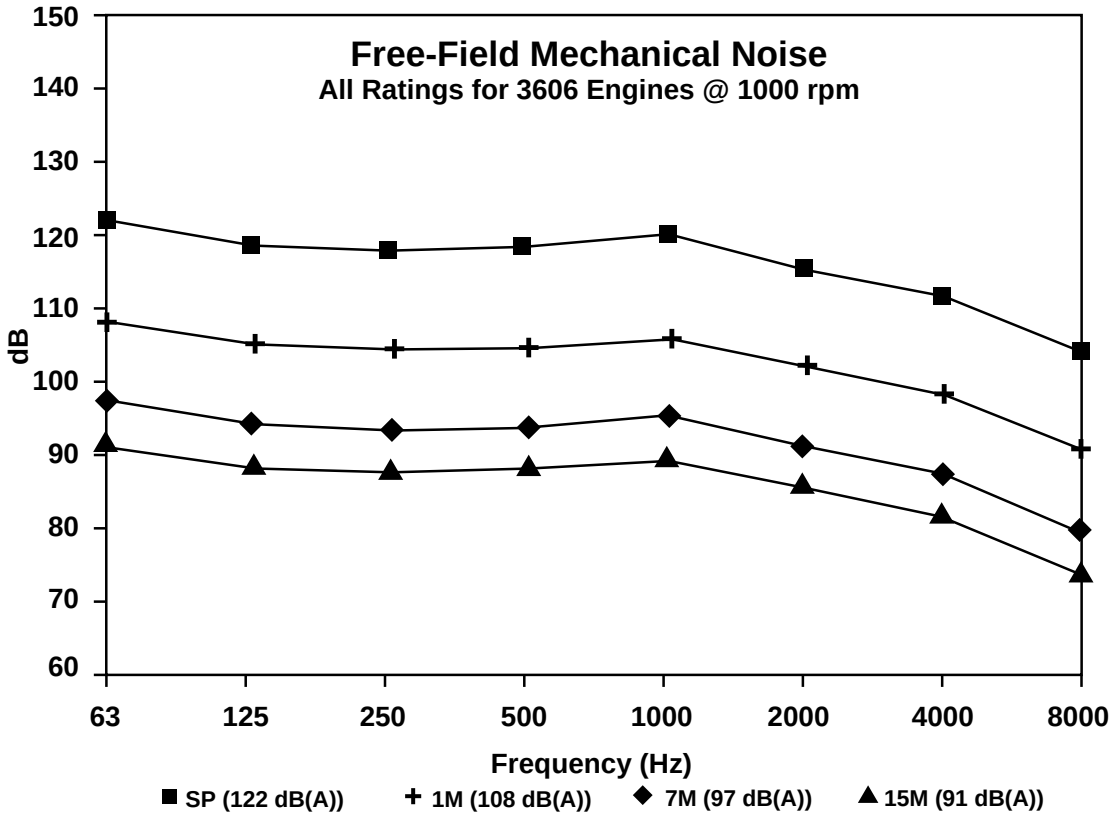


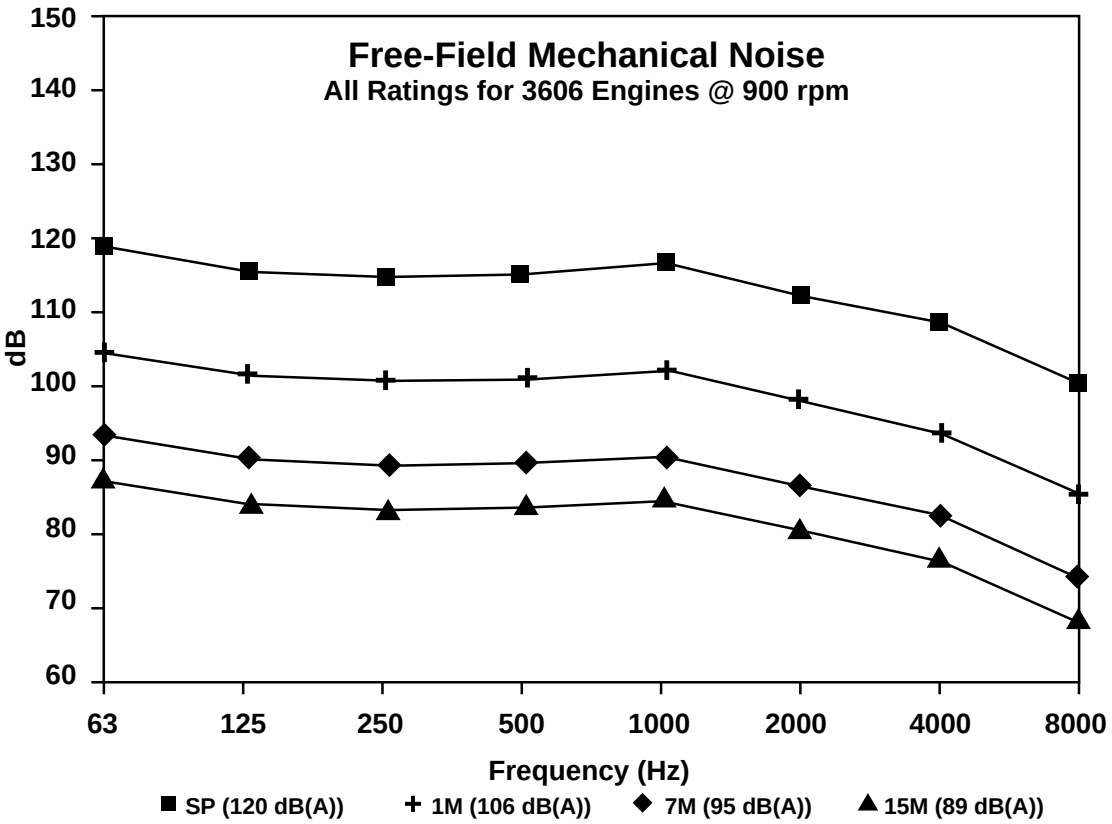
Figure 11

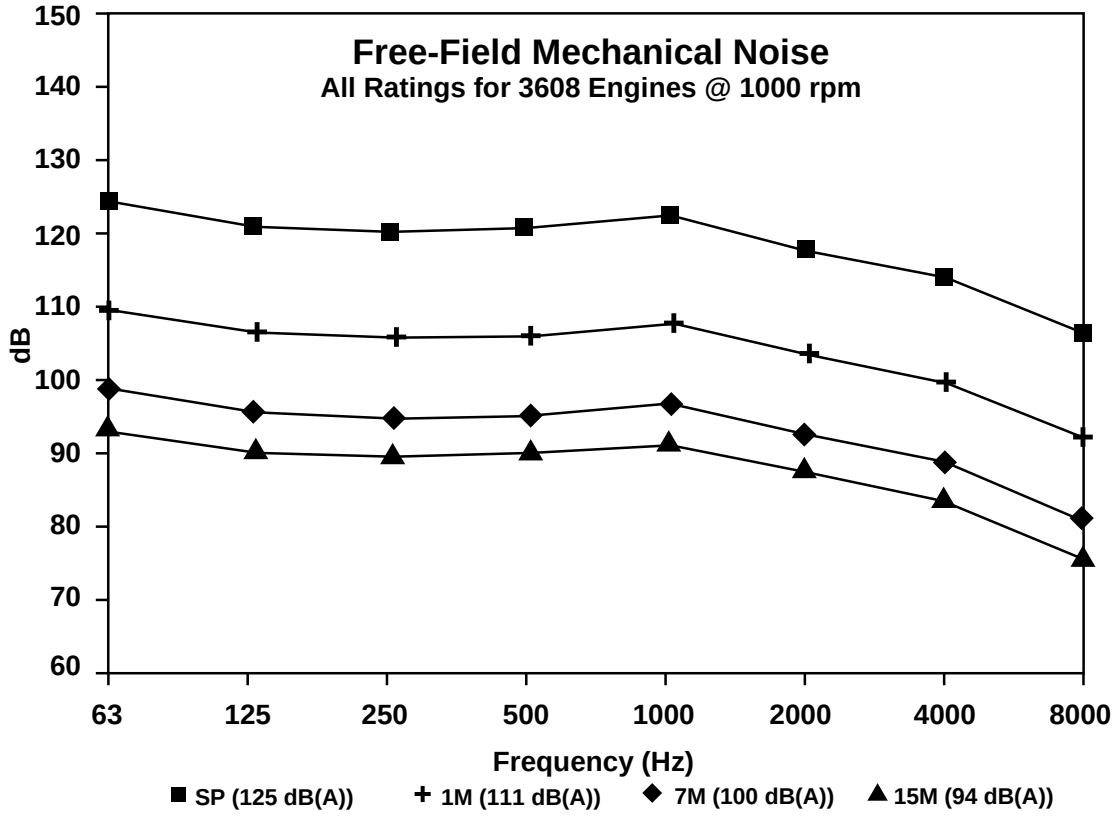
Exhaust Noise Control

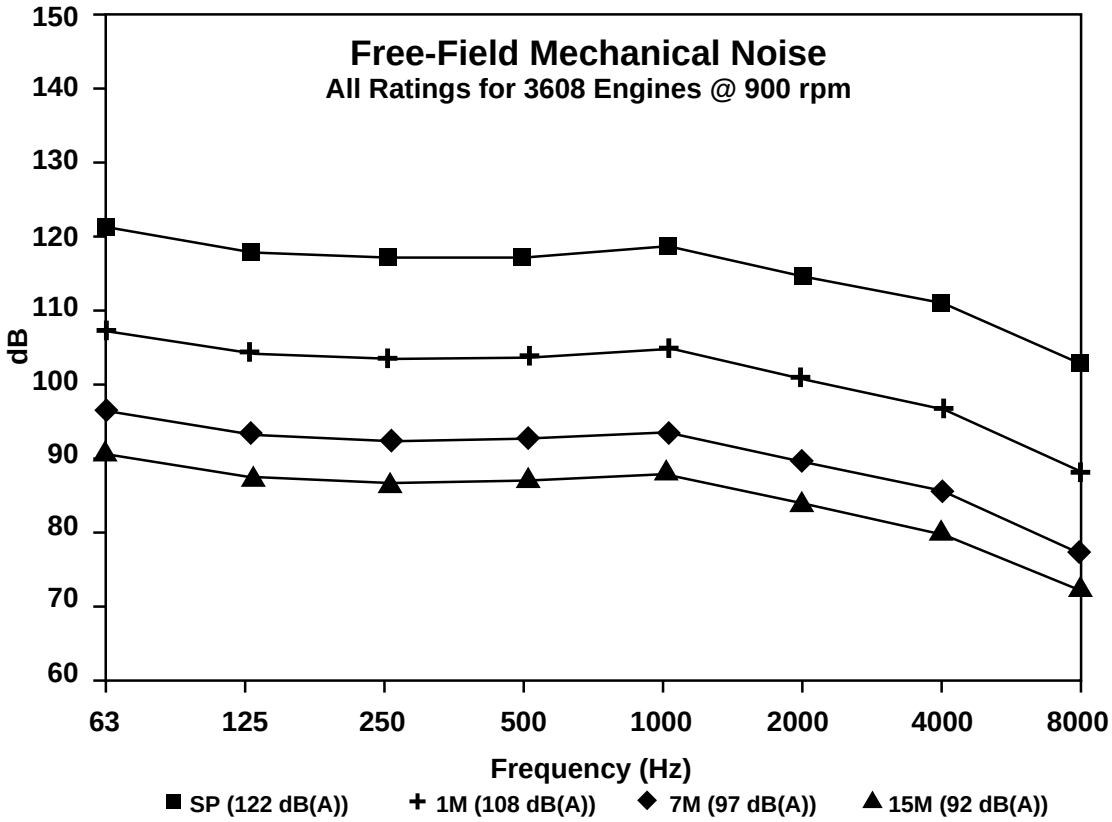
Exhaust noise is typically airborne. Exhaust noise attenuation is commonly achieved with a silencer typically capable of reducing exhaust noise 15 dB(A) when measured 3.3 m (10 ft) perpendicular to the exhaust outlet. See guide section on *Exhaust* for exhaust silencer information.

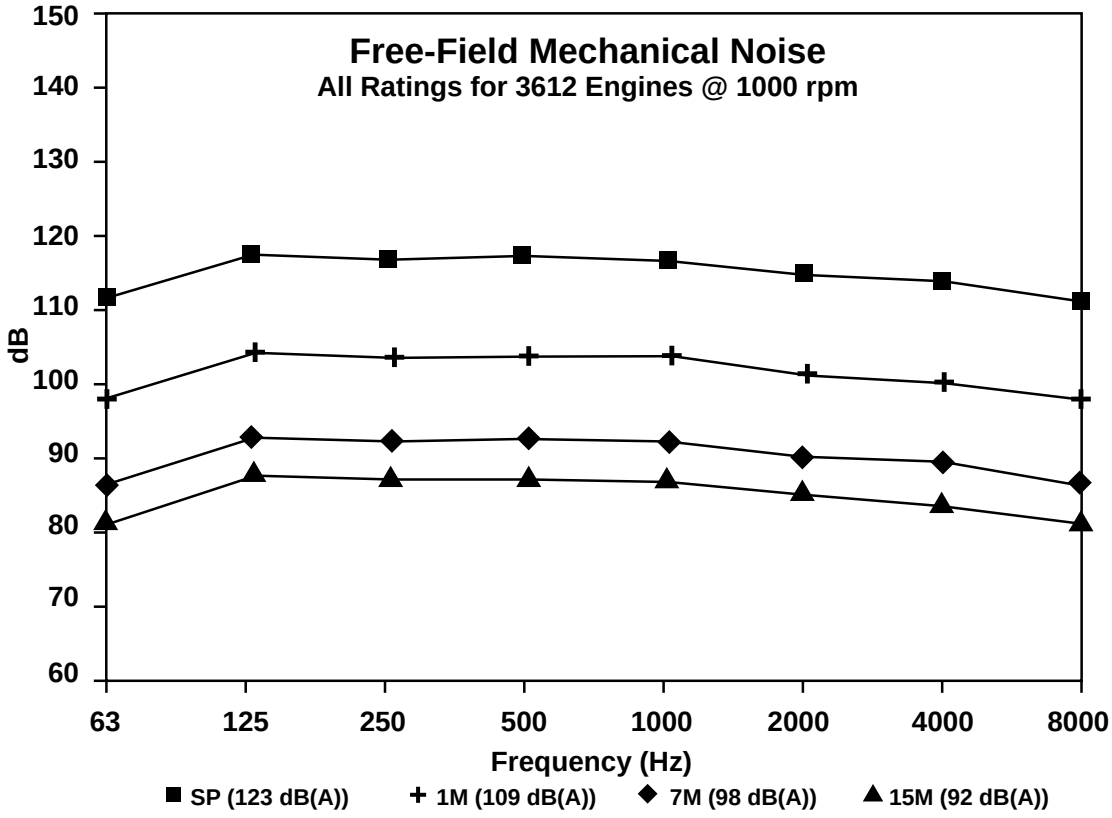
Free-field exhaust noise plots for 3600 Engines with MCR and CSR ratings are shown on pages 55 and 56. The exhaust noise plots are valid only at the indicated power and speed. Only plots for the 3606 are shown with dB(A) modifications for the other engines listed on each 3606 chart. The format is identical to the mechanical noise curves except that sound pressure levels are shown at distances of 1.5, 7, and 15 meters.

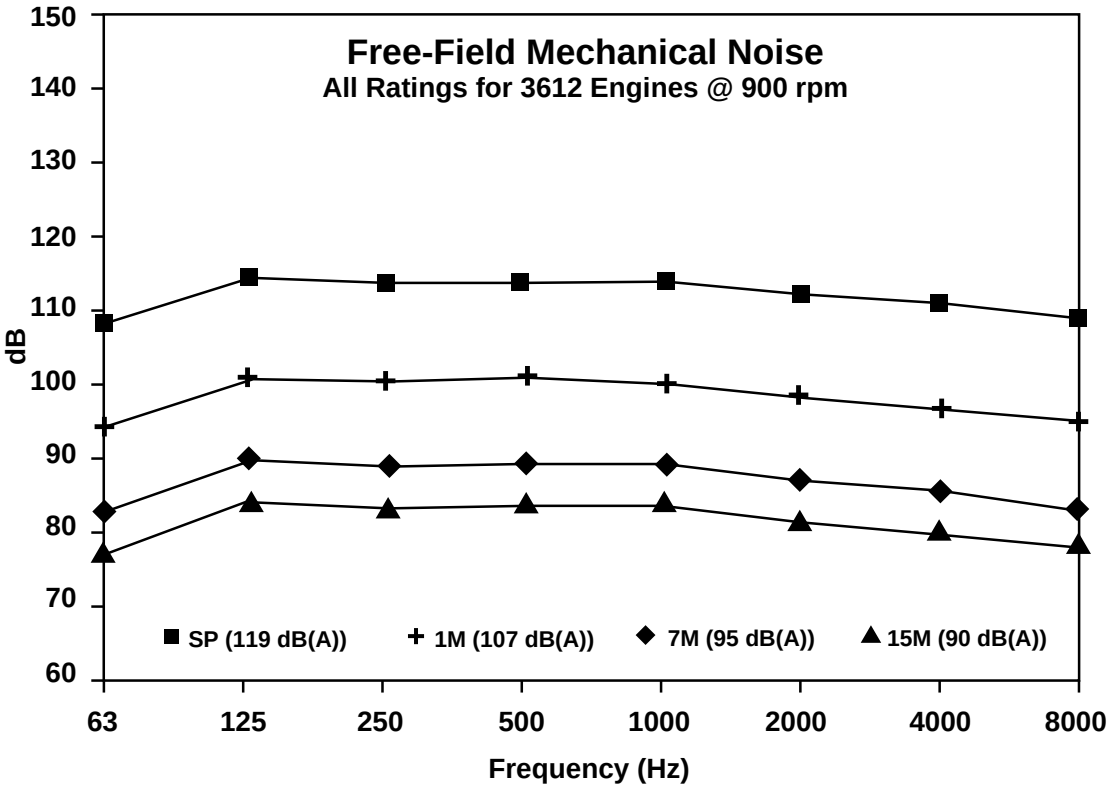

Free-Field Mechanical Noise
All Ratings for 3606 Engines @ 1000 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (122 dB(A))
1M (108 dB(A))
7M (97 dB(A))
15M (91 dB(A))

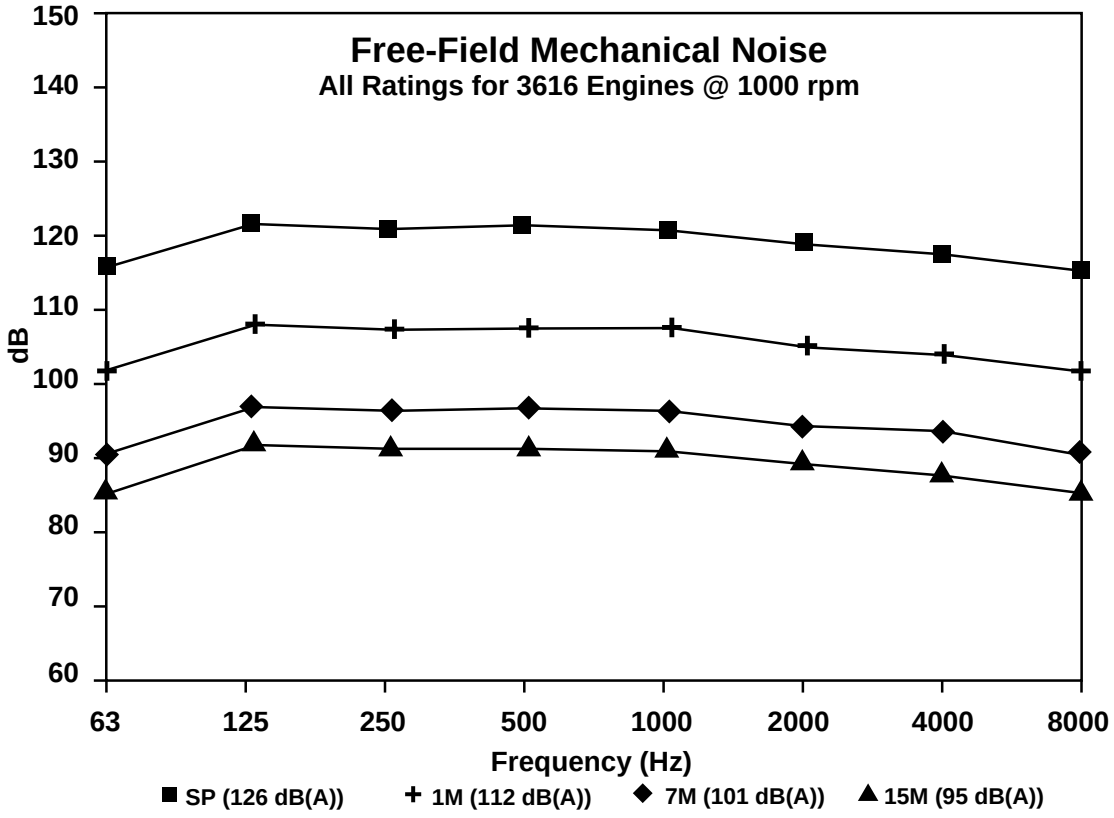

Free-Field Mechanical Noise
All Ratings for 3606 Engines @ 900 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (120 dB(A))
1M (106 dB(A))
7M (95 dB(A))
15M (89 dB(A))

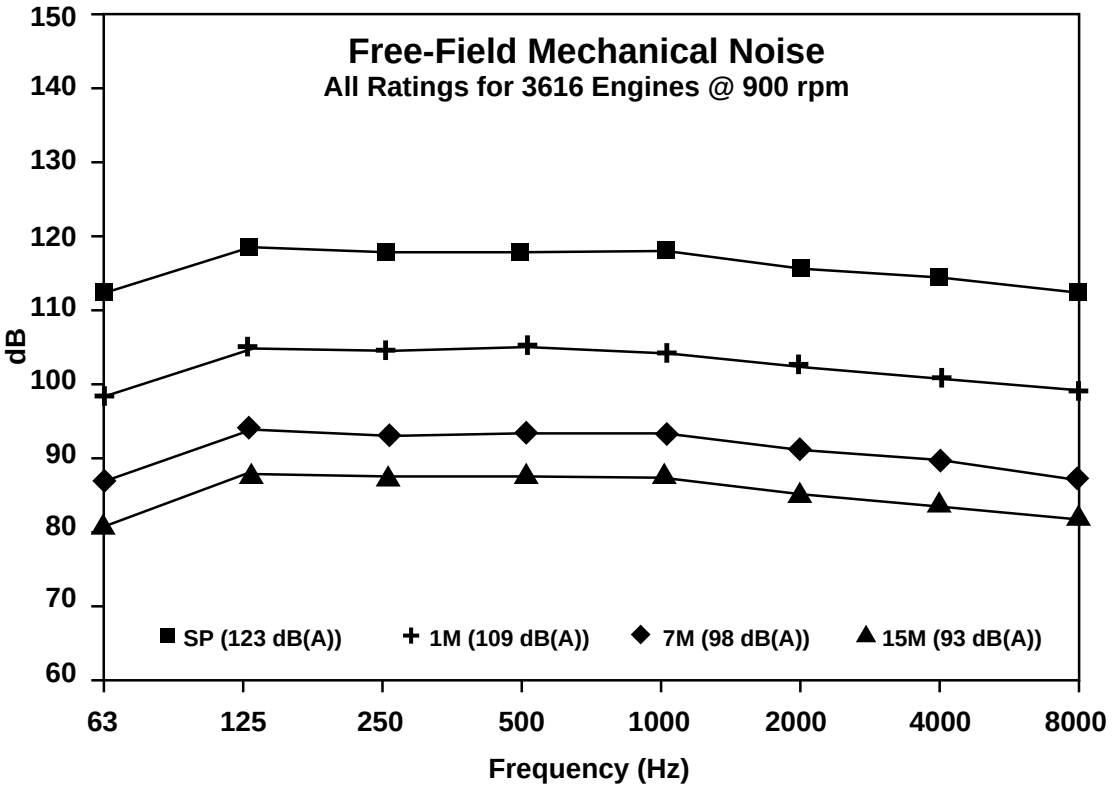

Free-Field Mechanical Noise
All Ratings for 3608 Engines @ 1000 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (125 dB(A))
1M (111 dB(A))
7M (100 dB(A))
15M (94 dB(A))

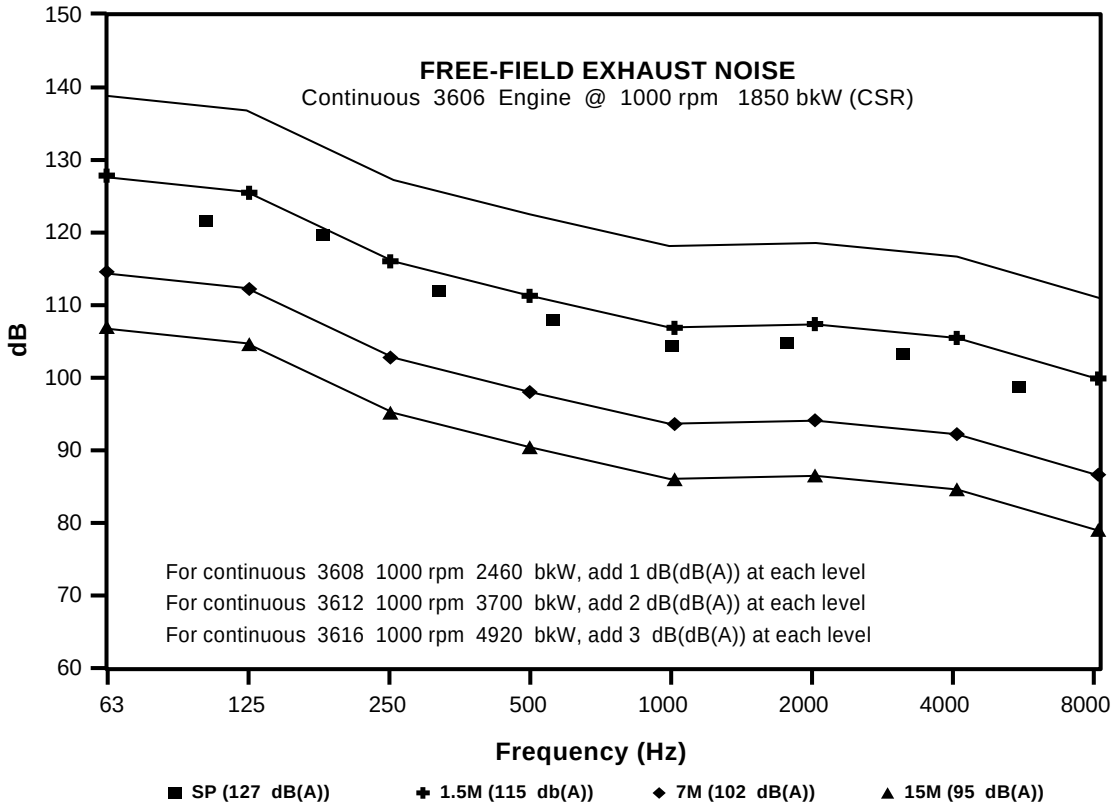

Free-Field Mechanical Noise
All Ratings for 3608 Engines @ 900 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (122 dB(A))
1M (108 dB(A))
7M (97 dB(A))
15M (92 dB(A))

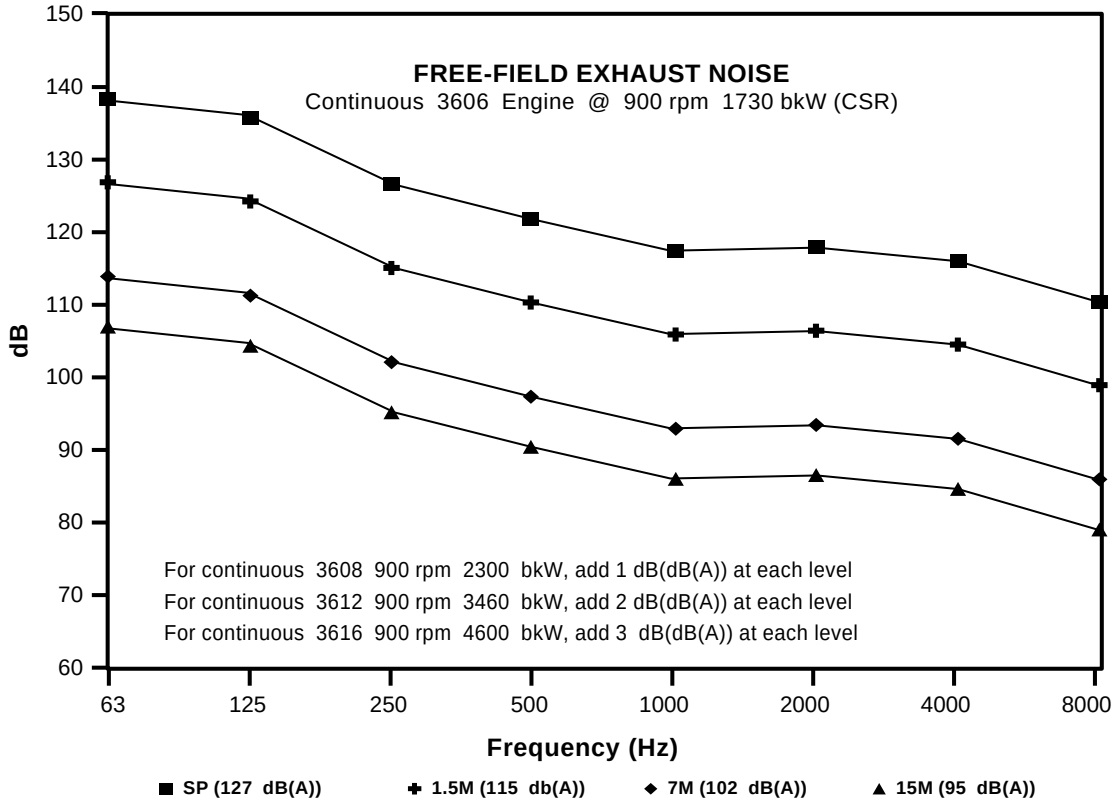

Free-Field Mechanical Noise
All Ratings for 3612 Engines @ 1000 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (123 dB(A))
1M (109 dB(A))
7M (98 dB(A))
15M (92 dB(A))

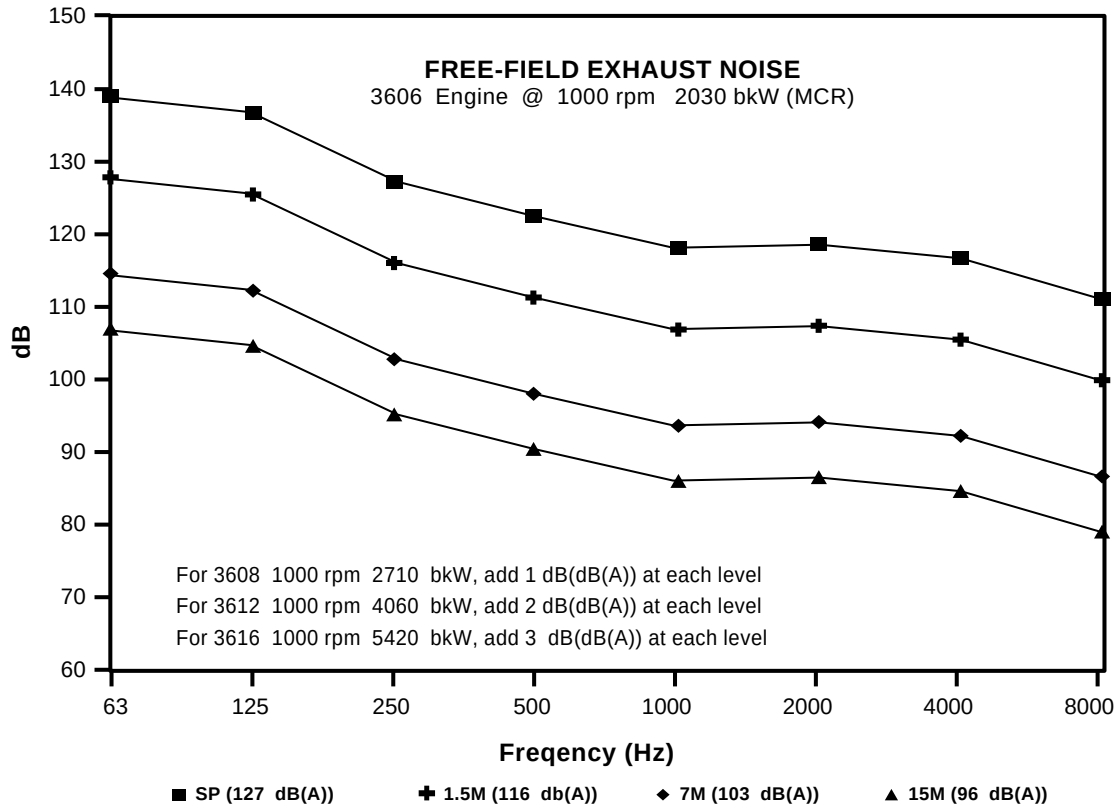

Free-Field Mechanical Noise
All Ratings for 3612 Engines @ 900 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (119 dB(A))
1M (107 dB(A))
7M (95 dB(A))
15M (90 dB(A))

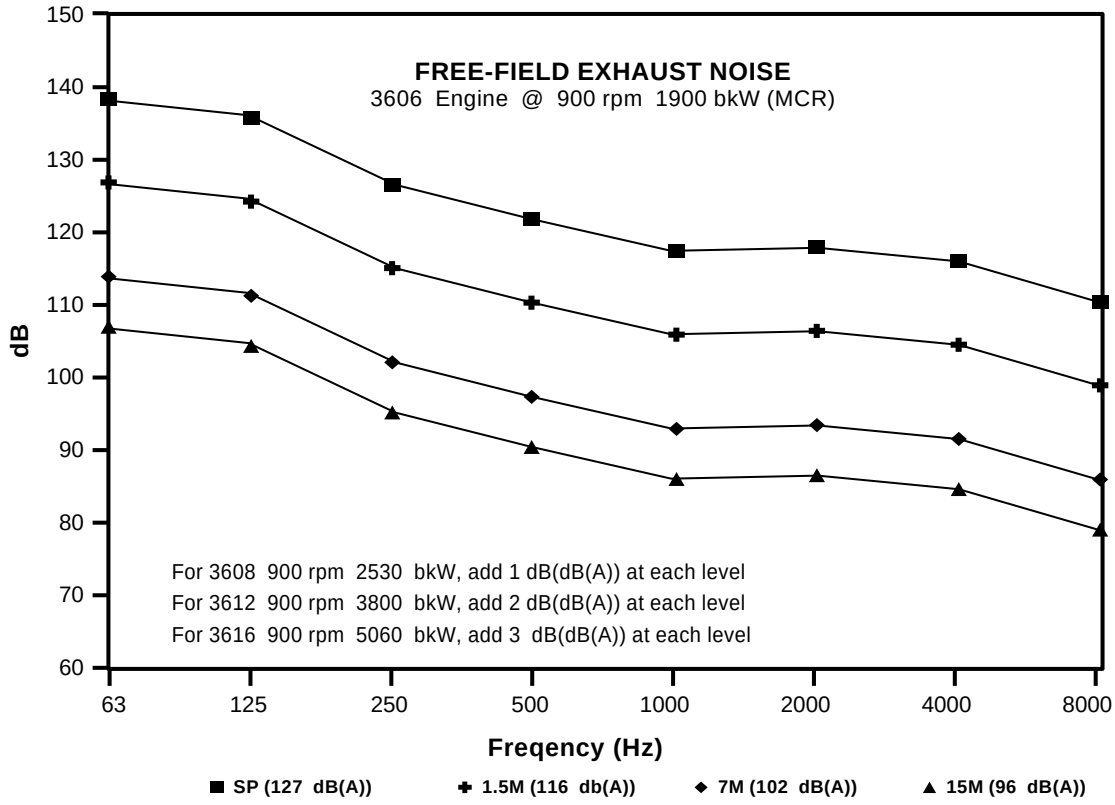

Free-Field Mechanical Noise
All Ratings for 3616 Engines @ 1000 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (126 dB(A))
1M (112 dB(A))
7M (101 dB(A))
15M (95 dB(A))


Free-Field Mechanical Noise
All Ratings for 3616 Engines @ 900 rpm
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
SP (123 dB(A))
1M (109 dB(A))
7M (98 dB(A))
15M (93 dB(A))


FREE-FIELD EXHAUST NOISE
Continuous 3606 Engine @ 1000 rpm 1850 bkW (CSR)
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
For continuous 3608 1000 rpm 2460 bkW, add 1 dB(dB(A)) at each level
For continuous 3612 1000 rpm 3700 bkW, add 2 dB(dB(A)) at each level
For continuous 3616 1000 rpm 4920 bkW, add 3 dB(dB(A)) at each level
SP (127 dB(A))
1.5M (115 db(A))
7M (102 dB(A))
15M (95 dB(A))


FREE-FIELD EXHAUST NOISE
Continuous 3606 Engine @ 900 rpm 1730 bkW (CSR)
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Frequency (Hz)
For continuous 3608 900 rpm 2300 bkW, add 1 dB(dB(A)) at each level
For continuous 3612 900 rpm 3460 bkW, add 2 dB(dB(A)) at each level
For continuous 3616 900 rpm 4600 bkW, add 3 dB(dB(A)) at each level
SP (127 dB(A))
1.5M (115 db(A))
7M (102 dB(A))
15M (95 dB(A))


FREE-FIELD EXHAUST NOISE
3606 Engine @ 1000 rpm 2030 bkW (MCR)
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Freqency (Hz)
For 3608 1000 rpm 2710 bkW, add 1 dB(dB(A)) at each level
For 3612 1000 rpm 4060 bkW, add 2 dB(dB(A)) at each level
For 3616 1000 rpm 5420 bkW, add 3 dB(dB(A)) at each level
SP (127 dB(A))
1.5M (116 db(A))
7M (103 dB(A))
15M (96 dB(A))


FREE-FIELD EXHAUST NOISE
3606 Engine @ 900 rpm 1900 bkW (MCR)
dB
150
140
130
120
110
100
90
80
70
60
63
125
250
500
1000
2000
4000
8000
Freqency (Hz)
For 3608 900 rpm 2530 bkW, add 1 dB(dB(A)) at each level
For 3612 900 rpm 3800 bkW, add 2 dB(dB(A)) at each level
For 3616 900 rpm 5060 bkW, add 3 dB(dB(A)) at each level
SP (127 dB(A))
1.5M (116 db(A))
7M (102 dB(A))
15M (96 dB(A))

Intake Noise Control

Intake noise is typically airborne. Intake noise attenuation is achieved through either air cleaner elements or intake silencers. Noise attenuation due to various air cleaners and silencers can be supplied by the component manufacturer.

Sound Level Conversion

3600 sound level information is presented both in terms of sound power level dB(A) and sound pressure level dB(A) at a given distance from the noise source.

Sound power level is the total sound power being radiated from a source and its magnitude is independent of the distance from the source. Relative loudness comparisons between engines is simply a comparison of their sound power levels at equivalent operating conditions. When the sound power level is known, the sound pressure level at any distance from a point source (such as exhaust noise) can be easily calculated. A disadvantage of this system is that sound pressure level conversion is valid for a point source only. It cannot be used for mechanical noise since the source (overall engine) is quite large.

The equation for determining the sound pressure level of exhaust noise is:

Sound Pressure Level, dB(A) = Sound POWER Level, dB(A) - 10 X Log_{10} ($C\pi D^2$)

Where C = 2 For exhaust source adjacent to a flat surface. such as a horizontal exhaust pipe adjacent to a flat roof.

or C = 4 For exhaust source some distance from surrounding surfaces.

D = Distance from exhaust noise source, (m).

If the sound pressure level of a point source at some distance is known, the sound pressure level at a second distance can be calculated using this formula:

$SPL_2 = SPL_1 - 20 \text{ X } \text{Log}_{10} (D2 \div D_1)$

Where SPL_1 = known sound pressure level, dB(A)

SPL_2 = desired sound pressure level, dB(A)

D_1 = known distance, m (ft)

D_2 = desired distance, m (ft)

Vibration

All engines produce vibration due to combustion forces, torque reactions, and foundation designs. Vibrations can create conditions ranging from unwanted noise to excessive stress levels.

Vibrating stresses can reach destructive levels at engine speeds which cause resonance. Resonance occurs when natural system frequencies coincide with engine excitation frequencies. *Each 3600 application must be analyzed for critical linear and torsional vibration.*

Linear Vibration

Linear vibration is difficult to define without instrumentation. Human senses cannot detect relationships between the magnitude of vibration and period of occurrence. A first order (1 x rpm) vibration of 0.254 mm (0.010 in.) displacement may feel the same as third order (3 x rpm) measurement of 0.051 mm (0.002 in.).

Vibration occurs when a mass is deflected and returned along the same path, as illustrated in Figure 12. The mass travels through its original position until stopped by frictional forces. When external forces, such as the engine, continue to affect the vibrating system, *"forced vibration"* occurs.

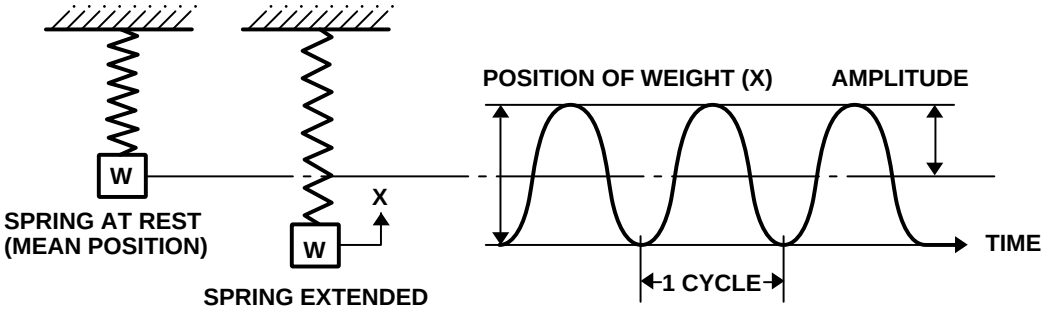


Figure 12

The time required for the weight to complete one movement is a *period* (see Figure 13).

Amplitude is the maximum displacement from the mean position. A *cycle* is the interval for the motion to repeat.

If the weight completes a cycle in one second, the *frequency* is one cycle per second or one *Hertz*.

A system completing full motion 20 times a minute has a frequency of 20 cycles per minute (20 cpm) or .33 cycles per second (.33 Hertz).

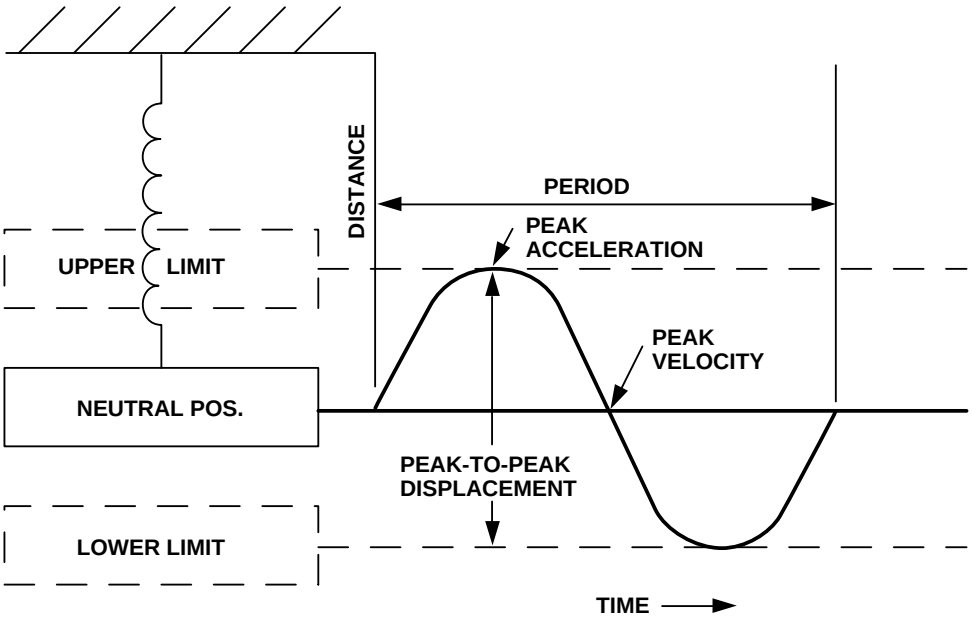


Figure 13

Total distance traveled is *peak-to-peak displacement*, usually expressed in mm or mils. (One mil equals 0.00l in. (.025 mm)). It is a guide to vibration severity.

Average and *root-mean-square* (rms) amplitudes are used to measure vibration (rms = 0.707 times peak amplitudes.)

Mass velocity measurement is another method of analyzing vibration. Note the example is changing direction as it moves. The mass speed is also constantly changing. At the displacement limit the speed is "0." The velocity is greatest while passing through the neutral position.

Velocity is important but because of its changing nature, peak velocity is the point selected for measurement. It is normally expressed in mm per second or inches per second. The relationship between peak velocity and peak-to-peak displacement is:

Metric Units: $V\ Peak = 3.138\ D\ F$

Where:

V Peak = Vibration velocity in mm per sec, (peak).

D = Peak-to-peak displacement, in mm.

F = Frequency in hertz, (cps).

English Units:

$V\ Peak = 52.3\ D\ F \times 10^{-6}$

Where:

V Peak = Vibration velocity in in. per sec, (peak).

D = Peak-to-peak displacement, in mils.

F = Frequency in cycles per minute (cpm).

Acceleration is another characteristic of vibration. In the example, peak acceleration is at the extreme limit of travel where velocity is "0." As velocity increases, acceleration decreases until it reaches "0" at the neutral point.

Acceleration is dimensioned in units of "g" (peak), where "g" equals gravitational acceleration 9.8 m/s^2 = 32.2 ft/s^2.

Acceleration measurements, or "g's," are used to express large forces. At very high frequencies, e.g., 1000 Hz (60,000 cpm), it is perhaps the best indicator of vibration.

Vibration acceleration can be calculated from peak displacement as follows:

Metric Units:

Number of g's (Peak) = $2.01\ DF \times 10^{-3}$

Where:

D = Peak to peak displacement in mm

F = Frequency in Hertz (cycles/sec)

English Units:

Number of gs (Peak) = $1.42\ D\ F^2 \times 10^{-8}$

Where:

D = Peak-to-peak displacement, in mils

F = Frequency in cycles per minute (cpm).

Machinery vibration is complex and consists of many frequencies. Displacement, velocity, and acceleration are all used to diagnose particular problems. Displacement measurements are commonly used as indicators of dynamic stresses.

Isolation

Isolation is required if (1) engine vibration must be separated from vessel structures, or (2) vibrations from nearby equipment are transmitted to inoperative engines.

Running units are rarely affected by exterior vibrations. Methods of isolation are the same for external or self-generated vibrations.

Piping connected to engines requires isolation, particularly when resilient mounting is used. Fuel and water lines, exhaust pipes, and conduit can transmit vibrations long distances. Isolator pipe hangers should have springs to attenuate low frequencies, and rubber or cork to minimize high frequency transmissions. To prevent buildup of resonant pipe vibrations, long piping runs must be supported at unequal distances (see Figure 14).

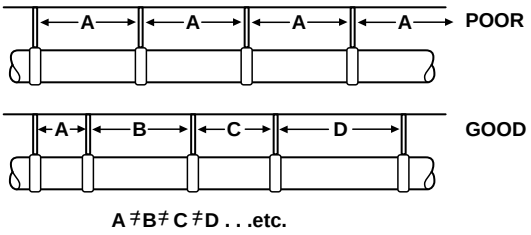


Figure 14

Isolation-Propulsion Engines

Caterpillar offers two types of isolation mounting systems for marine propulsion engines.

1. Silicon shear pads located between the engine mounting feet and the ship foundation.

2. Christie and Grey spring and rubber mounts also located between the engine mounting feet and the ship foundation.

These systems are covered in detail in the *Mounting and Alignment* section of this guide.

Linear Vibration Measurement

Equipment measurements should be made using the Caterpillar vibration analyzer (Part No 4C3030). If Caterpillar measuring equipment is not available, an equivalent device capable of measuring peak-to-peak displacement at selected frequencies, overall velocity, and overall displacement should be used.

Measurement Location

Vibration should be measured at eight points on propulsion engine and ship set generator packages. The points are illustrated in Figure 15 for propulsion engines and Figure 16 for ship set generator packages.

Point 1
Vertical direction at the front of the engine; locate probe on the top deck of the block in the plane of the crank centerline for inline engines, and at the base of the aftercooler housing at the crank centerline on vee engines.

Point 2
Horizontal direction at the front of the engine; locate probe on the side of the block at the crank centerline.

Point 3
Vertical direction at the rear of the engine; locate probe on the top deck of the block in the plane of the crank centerline for inline engines, and at the top of the rear housing at the crank centerline on vee engines.

Point 4
Horizontal direction at the rear of the engine; locate probe on the side of the block at the crank centerline.

Point 5
Vertical direction at the rear of the marine gear (or at the rear of the generator); locate probe on the top of the output shaft bearing (or generator frame) at the shaft centerline.

Point 6
Horizontal direction at the rear of the marine gear (generator); locate probe on the side of the marine gear (generator frame) at the shaft centerline.

Point 7
Vertical direction at the right rear engine foot.

Point 8
Axial direction at the rear of the marine gear (generator); locate the probe on the rear of the marine gear housing (generator frame) on a rigid member — not sheet metal — at the shaft centerline.

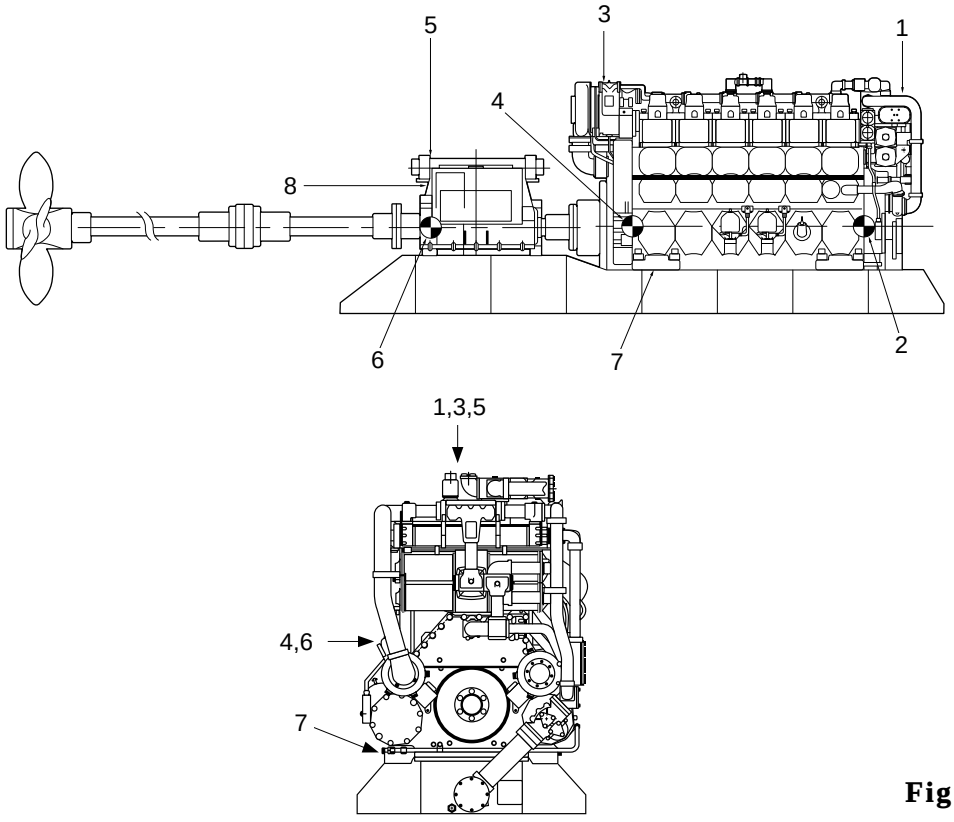


Figure 15

Vibration Measurement Locations

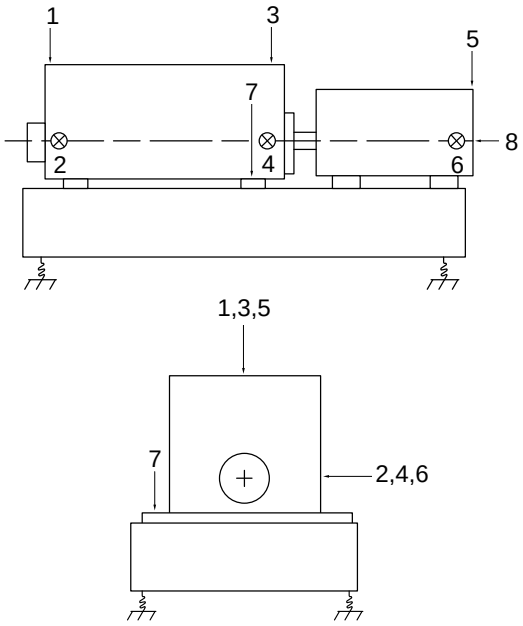


Figure 16

Operating Conditions and Data Format

Vibration measurements must be made at the advertised engine rating (100% load). If additional data is desired, it is recommended that measurements be made at 0% load, 50% load, and 75% load.

Data must be reported in terms of peak-to-peak displacement (mils) at 1/2 order frequency, 1st order frequency, overall velocity level (inches per second) and overall displacement (mils) for each of the eight measuring locations.

Linear Vibration Limits

The vibration levels for any load condition at any of the eight measuring locations cannot exceed the following limits for rigidly mounted engines:

- Peak-to-peak displacement limit at 1/2 order frequency = .13 mm (5.0 mils)
- Peak-to-peak displacement limit at 1st order frequency = .13 mm (5.0 mils)
- Overall displacement = .22 mm (8.5 mils)
- Overall velocity = 34.3 mm/sec (1.35 in./sec)

If the measured vibration levels exceed the limits, contact your Caterpillar dealer representative or Caterpillar factory representative for assistance.

Engines which are mounted on resilient mounts (rubber or spring and rubber isolators) may exhibit first order vibration levels between 6 and 15 mils peak-to-peak depending on the natural frequency of the resilient mounts. A contributing factor to this first order vibration is that the engine is intentionally misaligned to the marine gear at low load conditions to ensure that the torque reaction of the engine under load will result in acceptable alignment. The resilient mount system supplier must perform extensive calculations. This ensures that the natural frequency of the isolators will not be excited at normal operating engine speed and load conditions. Vibrations occuring near low idle are normally not objectionable.

Alignment and Trim Balance

Engine alignment out of specification can result in excessive first order vibration displacement. If excessive first order displacement is found while other limits are met, the alignment must be measured and corrected.

If alignment is found to be acceptable and first order vibration displacement is unacceptable, engine trim balancing can reduce engine first order vibration levels by using weights available from Caterpillar Inc. A vibration balancer (Part No. 4C3020) and the Caterpillar 3600 Engine Trim Balance chart are also available through Caterpillar Inc.

Torsional Vibrations

Torsional vibrations occur as engine components, such as an engine crankshaft, twist and recover. Standard engine components, withstand normal stresses caused by combustion forces and torque reactions. Engine mounting systems and drive arrangements must be designed to prevent the natural frequency of the drive train from approaching the unit's operating speed. Failure of crankshaft, couplings, gears or bearings may result without up front careful attention.

Torsional Analysis

All 3600 engine applications require a torsional vibration analysis. This includes factory packaged ship set generator packages on Caterpillar designed bases. The analysis must be performed by either the customer or by Caterpillar, depending on the customer's preference. Customer performed analyses are subject to Caterpillar review and approval and Caterpillar does not assume responsibility for an analysis performed by others without the approval. For a Caterpillar performed analysis, one complete set of technical data must be submitted to Caterpillar before calculations are undertaken (see the *General Information* section of this guide on Torsional and Vibration Analysis). The report will include a mathematical determination of the natural frequency, critical speeds, relative amplitudes of angular displacement, and approximate nodal locations of the complete elastic system (both engine and driven equipment).

Note: *Consult factory on compound installations. There may be additional charges for analysis of applications where more than one engine drives a single load. A separate torsional analysis is also required for each engine with different driven equipment in multiple engine installations.*

Engine Torsional Pickup

Each 3600 Engine is equipped with a magnetic pickup (7C1897) installed inside the front housing. It generates a signal from the front crankshaft gear (96 teeth) and can be connected to a torsiograph. The electrical characteristics of the pickup are:

Internal impedance .....100 Ohms

Open circuit voltage at 1000 rpm .....Approx. 80V A.C.

Max. current output capability.....10 milliamperes

The pickup output voltage is approximately 50 volts when using a test instrument of approximately 10,000 Ohms impedance.

The pickup should be used when measuring torsionals on all 3600 engine installations, particularly when a high inertia front drive is used. It can also be used to check eventual damper or flexible coupling deterioration.

Reference Material

LEHX1086	EDS 31.1, Linear Vibration Isolators
LEHX9166	EDS 73.1, Linear Vibration
LEKQ2352	EDS 206.1, Torsional Vibration Dampers
SEHS9162	Special Instructions - Spring Isolators