



MAN Diesel & Turbo

Main Engine Room Data

Main Engine	6S35ME-B9.2-TII
Compliance	IMO-NOx Tier II

Project name

Project type

Project number

Date	2010-12-15
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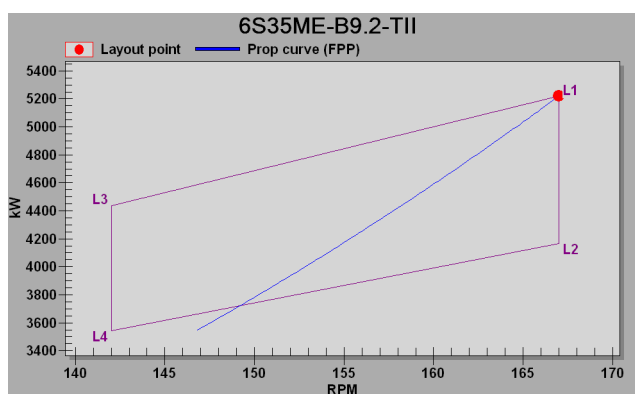
Yard

Country

Made by

Department

Specified Main Engine and Ratings



Further reading: www.mandieselturbo.com/Papers/Basic_Principles_Of_Ship_Propulsion p. 20-29

Specified Main Engine and Ratings

Turbocharger/engine version		conv.
Type of propeller		Fixed pitch
Cylinder oil lubricator type		Alpha ACC (power control)
Sulphur content in fuel	%	3.0

Nominal Maximum Continuous Rating (NMCR)

Nominal engine power	(NMCR)	kW	5,220
Nominal engine speed		r/min	167.0
Mean effective pressure		bar	21.0
Mean piston speed		m/s	8.6

Specified MCR (SMCR)

Engine shaft power		kW	5,220
Engine speed		r/min	167.0
Mean effective pressure		bar	21.0
Mean piston speed		m/s	8.6

Normal Continuous Rating (NCR)

Service power	% of SMCR		90.0
Engine shaft power		kW	4,698
Engine speed		r/min	161.2



Ambient reference conditions

ISO Conditions

Scavenge air coolant temperature	°C	25.0
Ambient air temperature	°C	25.0
Barometric pressure	mbar	1,000
Exhaust gas back pressure	mmWC	300

Tropical conditions

Sea water temperature	°C	32.0
Central water temperature	°C	36.0
Ambient air temperature	°C	45.0
Barometric pressure	mbar	1,000

Specified ambient conditions

Scavenge air coolant temperature	°C	10.0
Ambient air temperature	°C	10.0
Barometric pressure	mbar	1,000

Further reading: www.mandieselturbo.com/Papers/Influence_Of_Ambient_Temperature_Conditions p. 7-11



Expected SFOC, Lube Oil Consumption, Air and Exhaust gas data

Tolerances

Reference LCV of fuel	kJ/kg	42,700
SFOC tolerance (matching point)	%	+/- 5
Exhaust gas amount tolerance	%	+/- 5
Exhaust gas temperature tolerance	°C	-/+ 15

ISO ambient conditions

Specific Fuel Oil Consumption

Nominal Maximum Continuous Rating (NMCR)	g/kWh	175.0
SMCR	g/kWh	175.0
NCR	g/kWh	172.9

Exhaust Gas Amount

SMCR	kg/h	39,900
NCR	kg/h	37,100

Exhaust Gas Temperature

SMCR	°C	260
NCR	°C	248

Air consumption

SMCR	kg/s	10.8
NCR	kg/s	10.1

Tropical ambient conditions

Specific Fuel Oil Consumption

SMCR	g/kWh	178.3
NCR	g/kWh	176.2

Exhaust Gas Amount

SMCR	kg/h	37,500
NCR	kg/h	34,900

Exhaust Gas Temperature

SMCR	°C	294
NCR	°C	282

Air consumption

SMCR	kg/s	10.2
NCR	kg/s	9.5



Specified ambient conditions

Specific Fuel Oil Consumption

SMCR	g/kWh	172.1
NCR	g/kWh	170.0

Exhaust Gas Amount

SMCR	kg/h	41,200
NCR	kg/h	38,400

Exhaust Gas Temperature

SMCR	°C	234
NCR	°C	222

Air consumption

SMCR	kg/s	11.2
NCR	kg/s	10.4

Consumption of Lubrication Oils

System Oil

Consumption per 24 hours	kg/24h	15.0
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Cylinder Oil (SLOC)

SMCR	g/kWh	0.78
NCR	g/kWh	0.78



Necessary Capacities of Auxiliary Machinery (SMCR)

Layout of Systems

Cooling water system		Central cooling
Seawater inlet temperature	°C	32.0
Central water outlet temperature	°C	36.0
Tropical ambient air temperature	°C	45.0
Lubricating oil system		
Separate hydraulic control oil system		No
Separate turbocharger L.O. system		No

Pumps

Fuel oil circulating pump

Flow capacity	m³/h	2.2
Pump head	bar	6.0

Fuel oil supply pump

Flow capacity	m³/h	1.4
Pump head	bar	4.0

Jacket water pump

Flow capacity	m³/h	44.0
Pump head	bar	3.0

Central cooling water pump

Flow capacity	m³/h	140.0
Pump head	bar	2.5

Seawater pump

Flow capacity	m³/h	170.0
Pump head	bar	2.5

Lubricating oil pump

Flow capacity	m³/h	110.0
Pump head	bar	3.9



Coolers

Scavenge air coolers

Heat dissipation	kW	2,030
Central water flow	m³/h	73

Lubricating oil cooler

Heat dissipation	kW	550
Lubricating oil flow	m³/h	110
Central water flow	m³/h	67

Jacket water cooler

Heat dissipation	kW	830
Jacket water flow	m³/h	44
Central water flow	m³/h	67

Central cooler

Heat dissipation	kW	3,410
Central water flow	m³/h	140
Seawater flow	m³/h	170

Fuel oil preheater

Heat capacity	kW	58
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The pump heads stated are for guidance only, and depend on the actual pressure drop across coolers, filters, etc. in the systems.

Pertaining cooling water flow diagram, temperatures, viscosities and pressures for pumps and coolers, see "Engine Project Guide".



Starting Air System, Engine dimensions, Tanks, etc.

Starting air system, 30.0 bar g

Reversible engine

Receiver volume (12 starts)	m ³	2 x 2.00
Compressors (total)	m ³ /h	120.0

Main engine dimensions

Dimensions

Length excl. tuning wheel, tanktop	mm	4,990
Min length excl. tuning wheel, c/l	mm	0
Max length incl. tuning wheel, c/l	mm	0
Cylinder distance	mm	612
Width of bedplate	mm	2,265
Distance, foot - crankshaft c/l	mm	830

Overhaul

Normal lift, c/l - crane hook	mm	6,875
Crane capacity, normal lifting procedure	t	1.00
Double jib crane, c/l - deck beam	mm	6,325
Crane capacity, double jib crane	t	2 x 0.50

Weight

Weight of main engine, dry	t	81.0
Weight of water and oil in engine	t	0.7

The real engine length at crankshaft centreline level (c/l) may be between the above min and max lengths, and depends on the vibration conditions of the main engine and shaft system, i.e. on whether a vibration damper need to be installed.

The mass can vary up to 10% depending on the design and options chosen



Dimensions of tanks, centrifuges and aux. blowers

Fuel oil system

Marine diesel oil service tank, 4 hour	m ³	4.5
Fuel oil settling tanks, 2 x 12 hour	m ³	2 x 13.0
Fuel oil centrifuge, 98 °C	l/h	1,409
Fuel oil service tank, 6 h/95 °C	m ³	6.5

The capacity of the F.O. centrifuge(s) is for guidance only. Actual capacity should be given by the maker

Lubrication oil system

Lube oil storage tanks,(2x3 months)	m ³	2 x 1.8
Lube oil centrifuge, 95 °C	l/h	710
Lube oil bottom (sump) tank, appr.	m ³	6.7

Cylinder oil system

Cylinder oil storage tanks	m ³	2 x 12.0
Cylinder oil service tank	m ³	0.9

Various drain tanks

Stuffing box drain tank	m ³	0.30
Scavenge air drain tank	m ³	0.40

Air cooler cleaning unit

Air cooler cleaning tank	m ³	0.30
Capacity of pump	m ³ /h	1.00

Jacket water

Expansion tank for jacket water	m ³	1.00
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Auxiliary blower(s)

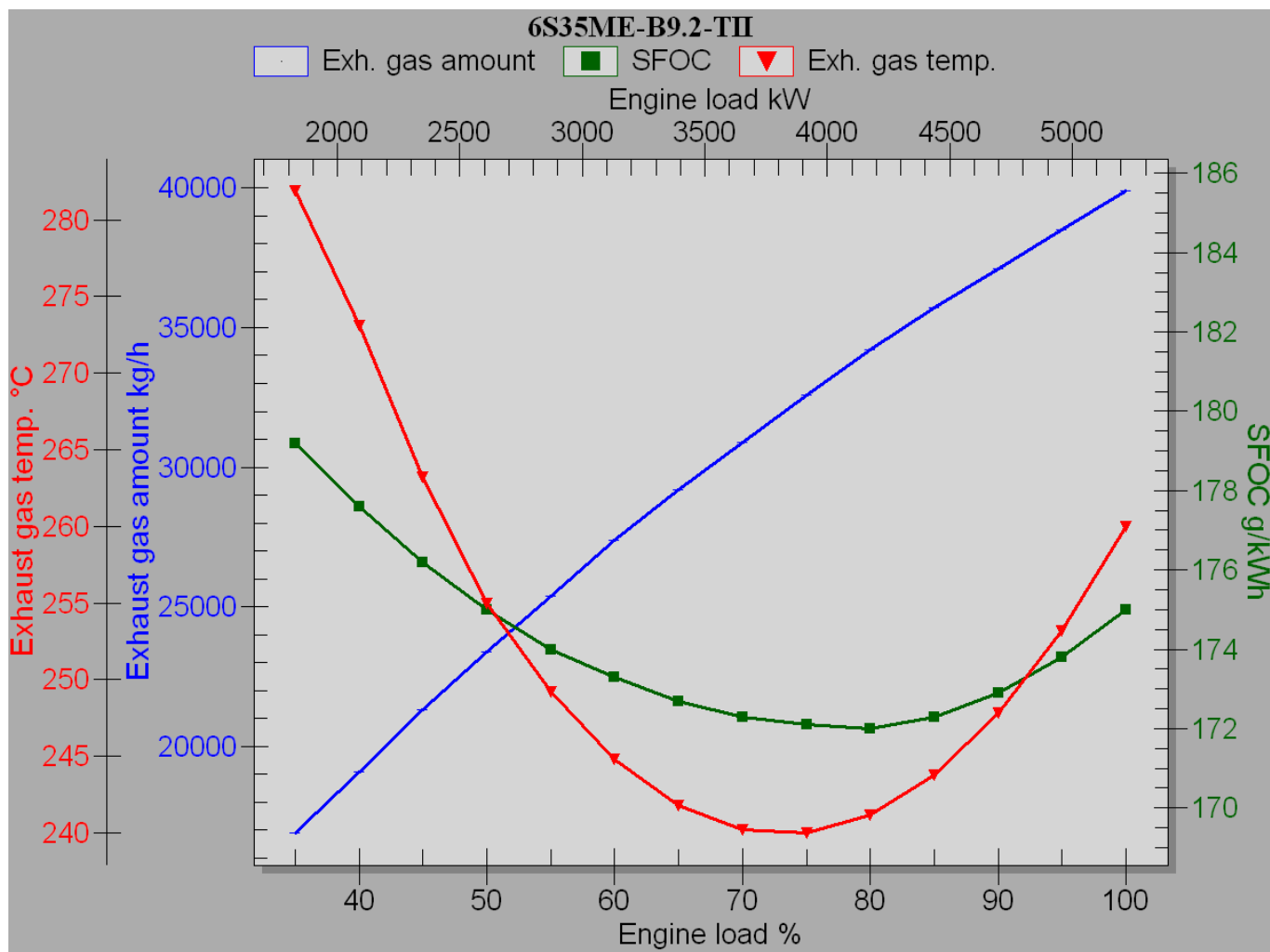
Electric motor rating of aux.blower(s)	kW	2 x 20
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Tables of SFOC and Exhaust Gas Data

Part Load Data at ISO Ambient Conditions

Load	Power	Speed	SFOC	Exh. gas amount	Exh. gas temp.
% of SMCR	kW	r/min	g/kWh	kg/h	°C
100.0	5,220	167.0	175.0	39,900	260.0
95.0	4,959	164.2	173.8	38,500	253.2
90.0	4,698	161.2	172.9	37,100	247.8
85.0	4,437	158.2	172.3	35,700	243.8
80.0	4,176	155.0	172.0	34,200	241.2
75.0	3,915	151.7	172.1	32,600	240.0
70.0	3,654	148.3	172.3	30,900	240.2
65.0	3,393	144.7	172.7	29,200	241.8
60.0	3,132	140.9	173.3	27,400	244.8
55.0	2,871	136.8	174.0	25,400	249.2
50.0	2,610	132.5	175.0	23,400	255.0
45.0	2,349	128.0	176.2	21,300	263.2
40.0	2,088	123.0	177.6	19,100	273.1
35.0	1,827	117.7	179.2	16,900	281.9

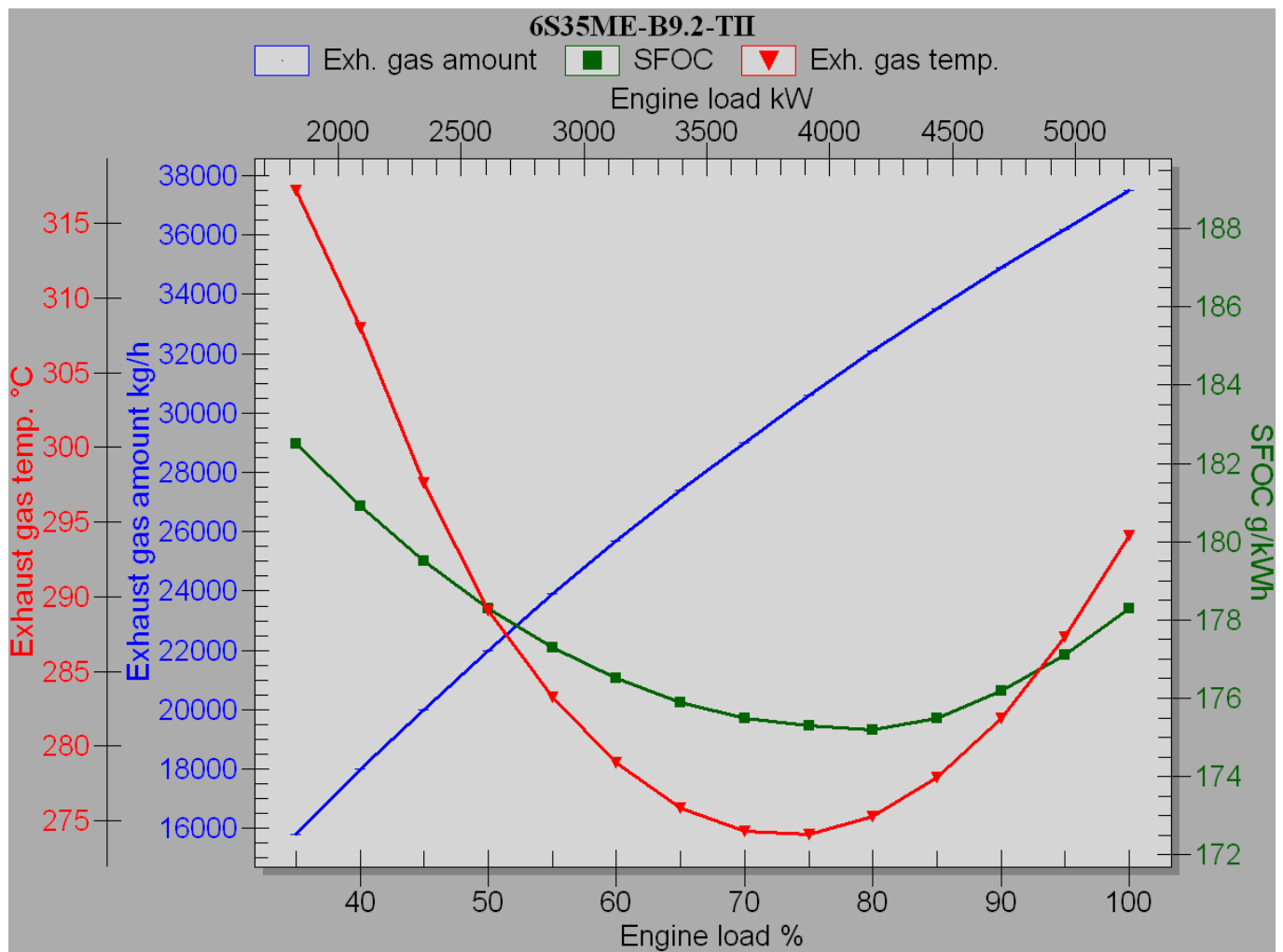
Ambient air suction temperature: 25.0 °C Cooling water temperature: 25.0 °C



Part Load Data at Tropical Ambient Conditions

Load	Power	Speed	SFOC	Exh. gas amount	Exh. gas temp.
% of SMCR	kW	r/min	g/kWh	kg/h	°C
100.0	5,220	167.0	178.3	37,500	294.1
95.0	4,959	164.2	177.1	36,200	287.3
90.0	4,698	161.2	176.2	34,900	281.9
85.0	4,437	158.2	175.5	33,500	277.9
80.0	4,176	155.0	175.2	32,100	275.3
75.0	3,915	151.7	175.3	30,600	274.1
70.0	3,654	148.3	175.5	29,000	274.3
65.0	3,393	144.7	175.9	27,400	275.9
60.0	3,132	140.9	176.5	25,700	278.9
55.0	2,871	136.8	177.3	23,900	283.3
50.0	2,610	132.5	178.3	22,000	289.1
45.0	2,349	128.0	179.5	20,000	297.6
40.0	2,088	123.0	180.9	18,000	308.0
35.0	1,827	117.7	182.5	15,800	317.2

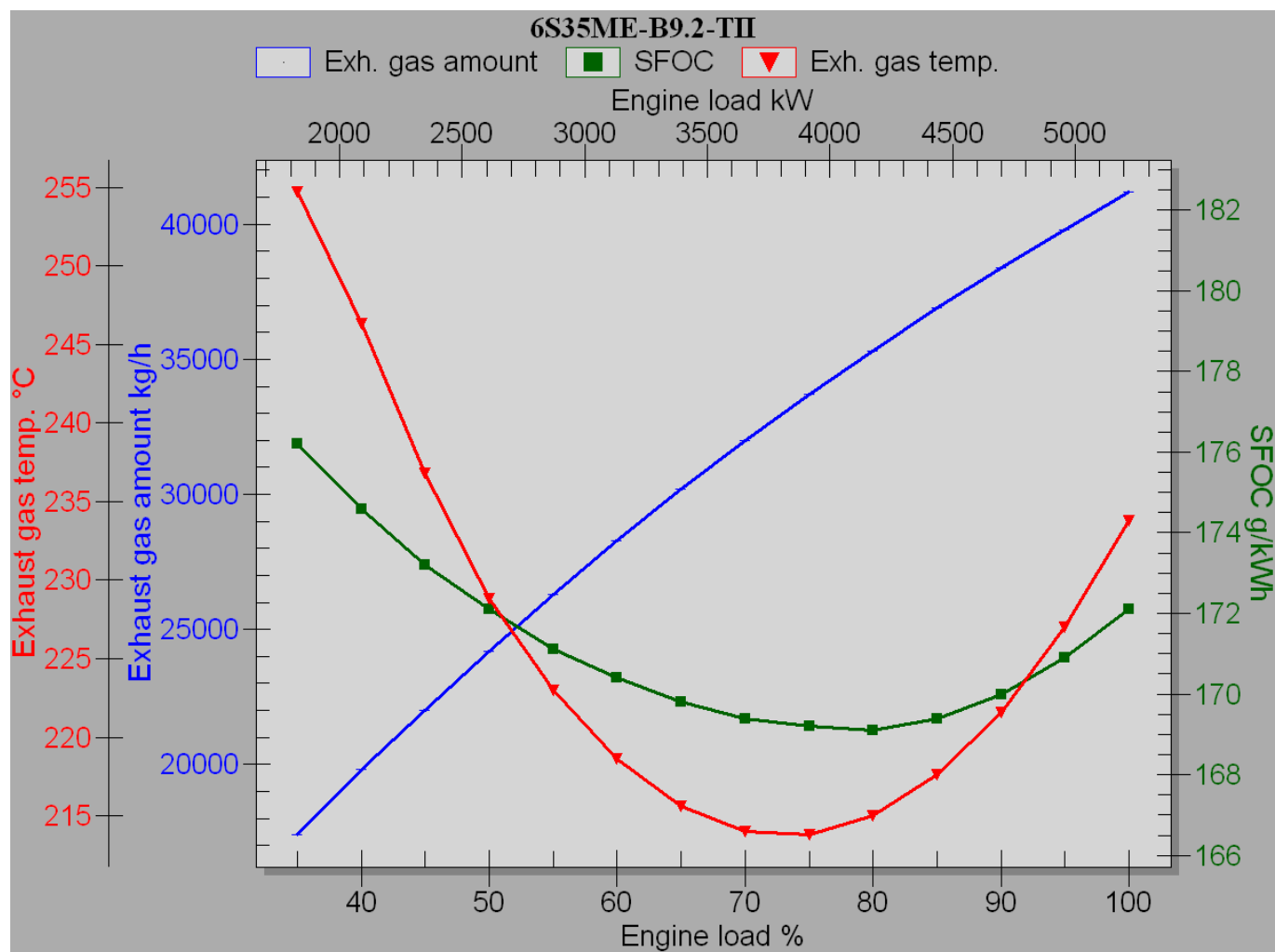
Ambient air suction temperature: 45.0 °C Cooling water temperature: 36.0 °C



Part Load Data at Specified Ambient Conditions

Load	Power	Speed	SFOC	Exh. gas amount	Exh. gas temp.
% of SMCR	kW	r/min	g/kWh	kg/h	°C
100.0	5,220	167.0	172.1	41,200	233.8
95.0	4,959	164.2	170.9	39,800	227.0
90.0	4,698	161.2	170.0	38,400	221.6
85.0	4,437	158.2	169.4	36,900	217.6
80.0	4,176	155.0	169.1	35,300	215.0
75.0	3,915	151.7	169.2	33,700	213.8
70.0	3,654	148.3	169.4	32,000	214.0
65.0	3,393	144.7	169.8	30,200	215.6
60.0	3,132	140.9	170.4	28,300	218.6
55.0	2,871	136.8	171.1	26,300	223.0
50.0	2,610	132.5	172.1	24,200	228.8
45.0	2,349	128.0	173.2	22,000	236.8
40.0	2,088	123.0	174.6	19,800	246.3
35.0	1,827	117.7	176.2	17,400	254.7

Ambient air suction temperature: 10.0 °C Cooling water temperature: 10.0 °C





Tables of Cooler Heat

① Engine load (% SMCR)	④ Scavenge air amount +/- 5% (kg/h)	⑨ Jacket water cooler heat -15/+0% (kW)
② Engine power (kW)	⑤ Scavenge air pressure (bar abs)	⑩ Main lubrication oil heat (kW)
③ Engine speed (r/min)	⑥ Scavenge air temperature BEFORE air cooler (°C)	⑪ Condensed water (t/24h)
	⑦ Scavenge air temperature AFTER air cooler (°C)	
	⑧ Scavenge air cooler heat (kW)	

ISO Ambient Conditions

Air suction temperature: 25.0°C Cooling water temperature: 25.0°C

① %	② kW	③ r/min	④ kg/h	⑤ bar (abs)	⑥ °C	⑦ °C	⑧ kW	⑨ kW	⑩ kW	⑪ t/24h
100.0	5,220	167.0	39,000	4.30	219.0	37.0	1,980	730	480	0.0
95.0	4,959	164.2	37,600	4.11	211.0	36.0	1,850	700	480	0.0
90.0	4,698	161.2	36,300	3.92	204.0	34.0	1,720	670	470	0.0
85.0	4,437	158.2	34,900	3.73	196.0	33.0	1,590	650	460	0.0
80.0	4,176	155.0	33,500	3.54	188.0	32.0	1,460	620	450	0.0
75.0	3,915	151.7	31,900	3.35	180.0	31.0	1,330	590	440	0.0
70.0	3,654	148.3	30,300	3.16	171.0	30.0	1,190	570	430	0.0
65.0	3,393	144.7	28,600	2.97	162.0	29.0	1,060	540	420	0.0
60.0	3,132	140.9	26,900	2.78	152.0	29.0	930	510	410	0.0
55.0	2,871	136.8	24,900	2.59	142.0	28.0	800	490	390	0.0
50.0	2,610	132.6	22,900	2.40	132.0	27.0	670	460	380	0.0
45.0	2,349	128.0	20,900	2.21	121.0	27.0	550	430	360	0.0
40.0	2,088	123.1	18,700	2.02	109.0	26.0	430	400	340	0.0
35.0	1,827	117.7	16,600	1.84	97.0	26.0	330	380	320	0.0
30.0	1,566	111.8	14,200	1.67	85.0	26.0	230	350	300	0.0
25.0	1,305	105.2	12,000	1.51	73.0	32.0	160	320	280	0.0

Tropical Ambient Conditions

Air suction temperature: 45.0°C Cooling water temperature: 36.0°C

① %	② kW	③ r/min	④ kg/h	⑤ bar (abs)	⑥ °C	⑦ °C	⑧ kW	⑨ kW	⑩ kW	⑪ t/24h
100.0	5,220	167.0	36,600	4.16	246.0	48.0	2,030	740	490	17.8
95.0	4,959	164.2	35,300	3.98	238.0	47.0	1,890	710	480	17.6
90.0	4,698	161.2	34,100	3.79	230.0	45.0	1,760	690	480	17.2
85.0	4,437	158.2	32,700	3.61	222.0	44.0	1,630	660	470	16.7
80.0	4,176	155.0	31,400	3.43	214.0	43.0	1,500	630	460	16.1
75.0	3,915	151.7	29,900	3.24	205.0	42.0	1,360	600	450	15.4
70.0	3,654	148.3	28,400	3.06	196.0	41.0	1,230	580	440	14.5
65.0	3,393	144.7	26,800	2.88	186.0	40.0	1,090	550	430	13.5
60.0	3,132	140.9	25,100	2.70	176.0	40.0	960	520	410	12.4
55.0	2,871	136.8	23,400	2.51	166.0	39.0	830	490	400	11.3
50.0	2,610	132.6	21,500	2.33	155.0	38.0	700	470	380	10.0
45.0	2,349	128.0	19,600	2.15	143.0	38.0	580	440	370	8.6
40.0	2,088	123.1	17,600	1.96	131.0	37.0	460	410	350	7.2
35.0	1,827	117.7	15,500	1.79	118.0	37.0	350	380	330	5.7
30.0	1,566	111.8	13,400	1.63	105.0	37.0	260	360	300	4.4
25.0	1,305	105.2	11,200	1.48	93.0	43.0	180	330	280	0.7

Specified Ambient Conditions

Air suction temperature: 10.0°C Cooling water temperature: 10.0°C

① %	② kW	③ r/min	④ kg/h	⑤ bar (abs)	⑥ °C	⑦ °C	⑧ kW	⑨ kW	⑩ kW	⑪ t/24h
100.0	5,220	167.0	40,300	4.34	195.0	22.0	1,960	720	480	0.0
95.0	4,959	164.2	39,000	4.15	188.0	21.0	1,830	690	470	0.0
90.0	4,698	161.2	37,600	3.96	181.0	19.0	1,700	660	460	0.0
85.0	4,437	158.2	36,100	3.76	174.0	18.0	1,570	640	460	0.0
80.0	4,176	155.0	34,600	3.57	166.0	17.0	1,440	610	450	0.0
75.0	3,915	151.7	33,000	3.38	158.0	16.0	1,310	580	440	0.0
70.0	3,654	148.3	31,400	3.19	150.0	15.0	1,180	560	430	0.0
65.0	3,393	144.7	29,600	3.00	141.0	14.0	1,050	530	410	0.0
60.0	3,132	140.9	27,800	2.80	132.0	14.0	920	500	400	0.0
55.0	2,871	136.8	25,800	2.61	123.0	13.0	790	480	390	0.0
50.0	2,610	132.6	23,800	2.42	113.0	12.0	670	450	370	0.0
45.0	2,349	128.0	21,600	2.23	102.0	12.0	540	420	360	0.0
40.0	2,088	123.1	19,400	2.04	91.0	11.0	430	400	340	0.0
35.0	1,827	117.7	17,100	1.85	79.0	11.0	320	370	320	0.0
30.0	1,566	111.8	14,700	1.68	67.0	11.0	230	340	300	0.0
25.0	1,305	105.2	12,400	1.52	56.0	17.0	160	320	270	0.0

Scavenge air pressure and air cooler data for guidance only - not to be used for dimensioning of turbochargers and scavenge air coolers. See the design specification of the engine.

Typical noise and vibration levels

SMCR

Octave band centre freq.	31.5 Hz	63.0 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dB(Lin)	dB(A)	Max dB(A)
A) Exhaust gas system (2×10^{-5} Pa)	121.0	116.0	110.5	102.8	98.1	96.4	92.3	81.3	71.4	122.5	102.1	-
B) Standard noise reduction (2×10^{-5} Pa)	96.6	96.5	95.5	95.9	94.9	94.3	94.2	92.2	87.9	104.3	100.4	104.3
C) Additional noise reduction (2×10^{-5} Pa)	96.6	96.4	94.5	93.5	93.2	92.4	92.3	90.0	83.3	103.2	98.3	103.2
D) Structureborne vibrations (5×10^{-8} m/s)	79.2	77.7	75.7	72.8	71.0	68.7	63.1	56.9	48.7	-	-	-

NCR (90.0% of SMCR)

Octave band centre freq.	31.5 Hz	63.0 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dB(Lin)	dB(A)	Max dB(A)
A) Exhaust gas system (2×10^{-5} Pa)	119.8	114.8	109.3	101.6	97.1	95.4	91.0	80.1	70.2	121.4	101.0	-
B) Standard noise reduction (2×10^{-5} Pa)	95.9	95.6	94.8	95.1	94.1	93.6	93.4	91.3	87.0	103.6	99.5	103.6
C) Additional noise reduction (2×10^{-5} Pa)	95.9	95.5	93.7	92.8	92.4	91.7	91.5	89.0	82.4	102.4	97.5	102.4
D) Structureborne vibrations (5×10^{-8} m/s)	78.4	76.9	74.8	71.9	70.2	67.7	62.0	55.7	47.6	-	-	-

Notes

A) Sound pressure levels from exhaust gas system.

The expected sound pressure level at 1 metre from the edge of the exhaust gas pipe opening at an angle of 30 degrees to the direction of the gas flow and valid for a normal exhaust gas system - but without a boiler and silencer.

B) Airborne sound pressure levels - with standard noise reduction countermeasures.

Expected mean sound pressure octave spectrum levels, i.e. the average spatial noise values at a distance of 1 metre from the engine.
Prescribed measuring surface area is 103.2 m².

C) Air-borne sound pressure levels - with additional noise reduction countermeasures.

Expected mean sound pressure octave spectrum levels, i.e. the average spatial noise values at a distance of 1 metre from the engine.
Prescribed measuring surface area is 103.2 m².

Additional noise reduction countermeasures, e.g.:

1. Extra good turbocharger air intake silencer(s)
2. External sound insulation of scavenge air receiver
3. External sound insulation of scavenge air cooler(s).

Other additional noise reduction countermeasures are also available. The noise figures given are in accordance with the CIMAC recommendations for measurements of the overall noise for reciprocating engines. The average levels will, depending on the actual engine room configuration, be 1-5 dB higher when the engine is installed in the engine room.

D) Structureborne vibration levels












Expected mean velocity octave spectrum levels at the engine base plate as installed on board the ship. Based on an average engine foundation of a ship, and may only be used as a rough estimate as the velocity levels will depend on the actual foundation used. If the vibration velocity levels are referred to 10-9 m/s instead of 5×10^{-8} m/s, the calculated dB figures will be 34.0 dB higher than above stated.

Further reading: www.mandieselturbo.com/Papers/Diesel_Engines_And_the_Environment_Noise

Alternative Engines and Turbochargers, Further Reading

Alternative Tier II engines

SMCR: 5,220 kW at 167.0 rpm.

	Nominal MCR		Specified MCR		Engine room				
	Power	RPM		SFOC (ISO)	Overhaul height H ₁	Overhaul height H ₃	Length _{min}	Width	Weight
	[kW]			[g/kWh]	[mm]	[mm]	[mm]	[mm]	[t]
6S35ME-B9.1-TII	5,220	167.0		176.0	6,875	▲ 6,325	▼ 4,990	2,265	▼ 81
6S35ME-B9.1-GI-TII	5,220	167.0		176.0	6,875	▲ 6,325	▼ 4,990	2,265	▼ 81
▶ 6S35ME-B9.2-TII	5,220	167.0		175.0	6,875	▲ 6,325	▼ 4,990	2,265	▼ 81
6S35ME-B9.2-GI-TII	5,220	167.0		175.0	6,875	▲ 6,325	▼ 4,990	2,265	▼ 81
7S35ME-B9.1-GI-TII	6,090	167.0		173.1	6,875	▲ 6,325	▼ 5,602	2,265	91
7S35ME-B9.2-GI-TII	6,090	167.0		▼ 172.1	6,875	▲ 6,325	▼ 5,602	2,265	91
7S35ME-B9.2-TII	6,090	167.0		▼ 172.1	6,875	▲ 6,325	▼ 5,602	2,265	91
7S35ME-B9.1-TII	6,090	167.0		173.1	6,875	▲ 6,325	▼ 5,602	2,265	91
8S35MC7.1-TII	5,920	173.0		▲ 177.3	6,425	▼ 6,050	5,920	2,200	93
9S35MC7.1-TII	6,660	173.0		175.2	6,425	▼ 6,050	▲ 6,520	2,200	▲ 103

▶ = selected engine ▼ = lowest value ▲ = highest value

Alternative Turbochargers

	Central cool. water pump	Seawater pump flow	Lub. oil flow	Lub. oil cooler			Jacket water cooler flow, c.w.	Central cooler			Min. motor rating for aux blowers
				heat diss.	oil flow	c.w. flow		heat diss.	c.w. flow	s.w. flow	
	[m³/h]	[m³/h]	[m³/h]	[kW]	[m³/h]	[m³/h]	[m³/h]	[kW]	[m³/h]	[m³/h]	[kW]
▶ 1 x TCR22-24	140	170	110	550	110	67	67	3,410	140	170	2 x 20.0
1 x TCA44-24	135	165	110	475	110	62	62	3,340	135	165	2 x 20.0
1 x A165-L32	135	165	110	495	110	62	62	3,360	135	165	2 x 20.0
1 x MET42MB	135	165	110	485	110	62	62	3,350	135	165	2 x 20.0

▶ = selected turbocharger s.w. = seawater c.w. = central water

References and Further Reading

www.mandieselturbo.com/Papers/Basic_Principles_Of_Ship_Propulsion

Layout/load diagrams, running points, combinator curves, propeller propulsion, propeller types/dimensions, flow and operating conditions, ship types, hull resistance/forms, load lines.

www.mandieselturbo.com/Papers/Influence_Of_Ambient_Temperature_Conditions

Influence of ambient temperature conditions on engine operation, engine room ventilation, special high/low temperature precautions, adjustable bypass system.

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