General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in³	10,84 661,3
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	123 4,84
Stroke	mm in	152 5,98
Compression ratio		16,5:1
Compression pressure at 240 rpm	MPa psi	
Max. static forward inclination:	°	0
Max. static backward inclination:	°	7
Max. intermittent forward inclination while running:	°	10
Max. intermittent backward inclination while running:	°	17
Max. intermittent side inclination while running:	°	30
Idling speed	rpm	600 (+50)
Rated speed Crankshaft power 1), 5) R3	rpm	2250
Propeller selection range Crankshaft power 1), 5)	rpm	2250-2300
Dry weight engine BT	kg lb	1145 2524

Performance	**Rating**	**rpm**	**700**	**900**	**1100**	**1300**	**1600**	**1800**	**1900**	**2000**	**2100**	**2250**
Crankshaft power 1), 5)	3	kW	71	120	180	252	310	345	362	371	375	375
		hp	97	163	245	343	422	469	492	505	510	510
Propeller shaft power 1) (At full load) With reverse gear	3	kW	69	116	175	244	301	335	351	360	364	364
		hp	94	158	237	332	409	455	478	489	495	495
Propellershaft power at prop. load $x^{2,5}$ With reverse gear	3	kW	20	37	61	92	155	208	238	271	306	364
		hp	27	50	83	126	211	283	324	369	416	495
Propellershaft power at prop. load x^{3} With reverse gear	3	kW	11	23	43	70	131	186	219	255	296	364
		hp	15	32	58	95	178	253	298	347	402	495
Torque at crankshaft 2)	3	Nm	968,6	1273	1563	1851	1850	1830	1819	1771	1705	1592
		lbf ft	714	939	1153	1365	1365	1350	1342	1307	1258	1174
Mean piston speed		m/s	3,5	4,6	5,6	6,6	8,1	9,1	9,6	10,1	10,6	11,4
		ft/s	11,6	15,0	18,3	21,6	26,6	29,9	31,6	33,2	34,9	37,4
Effective mean pressure 2)	3	MPa	1,12	1,48	1,81	2,15	2,15	2,12	2,11	2,05	1,98	1,85
		psi	162,9	214,1	262,8	311,3	311,2	307,8	306,0	297,9	286,8	267,7
Max combustion pressure 2)	3	MPa	11,1	13,2	16,8	17,1	16,3	16,5	16,6	16,5	16,7	16,5
		psi	1610	1914	2437	2480	2364	2393	2408	2393	2422	2393

Lubricating system

Specific lubricating oil consumption.	g/kWh	0,1
Max. oil volume including filters for all allowed installation inclinations:	litres US gal	30 7,93
Max. oil volume excluding filters for all allowed installation inclinations:	litres US gal	25 6,60
Min. oil volume excluding filters for all allowed installation inclinations:	litres US gal	21 5,55

1) ISO 3046, fuel temp 40°C.
ISO 8665 (=SAE J 1228=ICOMIA 28-83)
2) At power according to 1).
3) If reverse gear is used, 4% in heat rejection will be added for its oil cooler.
4) Acc. to ISO 3744
5) At installed back pressure

Fuel system	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Specific fuel consumption 2)	3	g/kWh	246,4	239,0	248,0	214,1	199,8	200,1	202,3	206,7	207,3	212,7
		lb/hph	0,399	0,387	0,402	0,347	0,324	0,324	0,328	0,335	0,336	0,345
Fuel consumption, Test cycle E5		g/kWh	223									
		lb/hph	0,36									
Fuel consumption, Test cycle E5		g/kWh	222									
		lb/hph	0,36									
Fuel consumption, Test cycle E3	3	g/kWh	217,5									
		lb/hph	0,35									
Fuel consumption at prop. load x [2,5]	3	l/h	6,2	10,6	16,9	24,9	41,3	54,7	62,7	72,4	80,4	95,8
		US gal/h	1,6	2,8	4,5	6,6	10,9	14,5	16,6	19,1	21,2	25,3
Fuel consumption at full load	3	l/h	20,9	34,3	53,4	64,6	74,1	82,6	87,6	91,8	93,0	95,4
		US gal/h	5,5	9,1	14,1	17,1	19,6	21,8	23,1	24,2	24,6	25,2

Intake and exhaust system	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	3	°C	529	637	706	594	490	450	438	428	415	406
		°F	984	1179	1303	1101	914	842	820	802	779	763
Permitted back pressure in the exhaust line at rated speed. (Installed back pressure)		kPa							Max	15		
		psi								2,2		
		kPa							Min			
		psi										

Intake and exhaust system	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA and relative humidity 30%.	3	m³/min	4,2	6,7	9,6	13,3	18,8	23,1	25,6	27,8	28,7	30,7
		cu.ft./min	148,3	236,6	339	469,7	663,9	815,8	904,1	981,7	1014	1084
Charge air pressure Inlet manifold	3	kPa	22	48	76	108	146	172	186	197	195	198
		psi	3,2	7,0	11,0	15,7	21,2	24,9	27,0	28,6	28,3	28,7
Exhaust gas flow	3	m³/min	6,9	9,6	12,4	13,1	18,7	23	25,4	27,6	28,6	30,9
		cu.ft./min	243,7	339	437,9	462,6	660,4	812,2	897	974,7	1010	1091

Cooling system	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Radiated heat in percent of crankshaft power.	3	%	5,7	4,2	3,5	2,5	1,4	1,2	1,1	1,1	1,1	1,1
Heat rejection to charge air cooler in percent of crankshaft power.	3	%	4	6	8	10	14	17	19	251	21	23
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, in percent of crankshaft power.		%										
	3		131	133	100	79	51	39	35	33	31	31
Coolant flow with fully open thermostat and std cooling system		l/min	249	342	400	477	591	693	742	750	738	733
		cu.ft./min	8,8	12,1	14,1	16,8	20,9	24,5	26,2	26,5	26,1	25,9
Max. permissible temperature on coolant in engine outlet		°C	98									
		°F	208									
Coolant volume engine, including heat exchanger and charge air cooler		litres	46									
		US gal.	12,15									
Max. additional coolant for cabin heater etc. with std. Expansion tank		litres	40									
		US gal.	10,57									
Maximum coolant flow to cabin heater etc.		l/min	76									
		cu.ft./min	2,68									
Thermostat, start open at		°C	76									
		°F	169									
Thermostat, fully open at		°C	86									
		°F	187									

1) ISO 3046, fuel temp 40°C.
ISO 8665 (=SAE J 1228=ICOMIA 28-83)
2) At power according to 1).
3) If reverse gear is used, 4% in heat rejection will be added for its oil cooler.
4) Acc. to ISO 3744
5) At installed back pressure

Raw water circuit	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Nominal raw water design flow	l/min	91	99	121	141	174	204	227	249	258	266
	cu.ft/min	3,2	3,5	4,3	5,0	6,1	7,2	8,0	8,8	9,1	9,4
Maximum raw water pump suction head	kPa	-10									
	psi	-1,5									
Maximum raw water temperature entering heat exchanger	°C	32									
	°F	90									

2 circuit keel cooling system, LT	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Maximum temperature to charge air cooler from external LT-cooling system circuit	3	°C										32
		°F										90
Coolant flow through keel cooler, LT-cooling system circuit	3	l/min										238
		cu.ft./min										8,4
Pressure drop in external LT-cooling system circuit, including piping		kPa	50									
		psi	7,3									
Coolant volume charge air cooler		litres	5									
		US gal.	1,32									

2 circuit keel cooling system, HT	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Design point for keel cooler, engine outlet temperature	3	°C										83
		°F										181
Maximum temperature to engine from external HT-cooling system circuit	3	°C										65
		°F										149
Coolant flow through keel cooler, HT-cooling system circuit at design point	3	l/min										175
		cu.ft./min										6,2
Maximun coolant flow through keel cooler, HT-cooling system circuit	3	l/min										187
		cu.ft./min										6,6
Pressure drop in external HT-cooling system circuit, including piping		kPa	70									
		psi	10,2									
Coolant volume engine, excl. heat exchangers		litres	33									
		US gal.	8,72									

Emissions	Rating	rpm	700	900	1100	1300	1600	1800	1900	2000	2100	2250
Smoke at prop. load $x^{2,5}$	3	*BSU	0,0	0,0	0,0	0,7	0,2	0,1	0,1	0,1	0,1	0,1
Noise at prop. load $x^{2,5}$. 4)	3	dBA	103,1	106,2	108,8	109,3	111,1	112,4	113,3	113,7	115,2	115,9

***NB.!** BSU are calculated values. Measured values are acc. to ISO 10054 in FSN units

1) ISO 3046, fuel temp 40°C.
ISO 8665 (=SAE J 1228=ICOMIA 28-83)
2) At power according to 1).
3) If reverse gear is used, 4% in heat rejection will be added for its oil cooler.
4) Acc. to ISO 3744
5) At installed back pressure

VOLVO PENTA

D11B3-A (R3-510IB)

Document No	Issue Index
22678596	**06**

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	**Signal**	**Unit**	**Range**	**Warning Initial Delay / Warning Delay**	**Warning Level**	**Derating Level**	**Shutdown Initial Delay / Shutdown Delay**	**Shutdown Level (Tolerance)**
Charge air pressure	0.5-4.5 V	kPa	50 - 400 ± 4.2kPa	30 sec from start / 2 sec	270 kPa (relative)	280 kPa*	NA	NA
Charge air temperaure	50-0 kΩ	°C	-40 - 130 ± 4%	30 sec from start / 2 sec	75°C	80°C (soft 3)	NA	NA
Coolant level switch	Digital		ON / OFF	30 sec from start / 100 sec	Low level / Lost signal	NA	NA	NA
Coolant temperature	50-0 kΩ	°C	-40 - 140 ± 1.5°C	30 sec from start / 2 sec	98°C	101°C (soft 1)	4 sec from start / 1 sec	105 (± 2°C) SDU Ch. S1
Engine speed cam	Frequency	rpm		Instant	Lost signal	Lost signal**	NA	NA
Engine speed crank	Frequency	rpm		Instant	Lost signal	Lost signal**	NA	NA
Eng. overspeed SDU 2250 +15%	Frequency	rpm / Hz	54 puls./rev.	Instant	Lost signal	NA	Instant	2588 / 2329 Hz (-1 to 0%)
Eng. overspeed SDU 2400+15%	Frequency	rpm / Hz	54 puls./rev.	Instant	Lost signal	NA	Instant	2760 / 2484 Hz (-1 to 0%)
Eng. overspeed SDU 2450+15%	Frequency	rpm / Hz	54 puls./rev.	Instant	Lost signal	NA	Instant	2818 / 2536 Hz (-1 to 0%)
Exhaust gas dry temperature	PT200	°C	-40 - 750 ± 2.5%	30 sec from start / 5 sec	Fault Limit table 1	655°C (soft 4)	NA	NA
Exhaust gas wet temperature	PT200	°C	-40 - 750 ± 2.5%	30 sec from start / 5 sec	200°C	NA	NA	NA
Oil level switch	Digital		ON / OFF	30 sec from start / 5 sec	Low level / Lost signal	NA	NA	NA
Oil temperature	50-0 kΩ	°C	-40 - 140 ± 3.5%	30 sec from start / 2 sec	120°C	122°C (soft 2)	NA	NA
Water in fuel switch	Digital		ON / OFF	All the time	Water in fuel	NA	NA	NA
Gear oil pressure (EVC)	0.5-4.5 V	kPa	0-3000 ± 3%	60 sec from start / 7 sec	700 kPa	NA	NA	NA
Gear oil temperature (EVC)	50-0 kΩ	°C	-40 - 140 ± 2.5%	NA (IB) 2s (IPS)	95°C Lost signal during slip	NA	NA	NA
Gear oil pressure (SDU) (Shutdown Unit Channel S2)	Digital	kPa	ON / OFF	NA	NA	NA	11 sec ± 20% from start / 1 sec	400 ± 20 Shutdown Unit Setting S2.S3: 510 rpm ± 2% 459 Hz ± 2% 54 pulses / revolution

NA = Not applicable

* 50% remaining torque from 1500 rpm

** 80% remaining torque

Run detection S4 should be set to same value as S2, S3

Sensors (rpm dependent)	Signal	Unit	Range	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Notes
					0 rpm	600 rpm	1000 rpm	1500 rpm	2250/2400/2450 rpm	
Coolant pressure	0.5-4.5 V	kPa	0-300 ± 3%							
Warning Level		kPa		30 sec from start / 2 sec	NA	3	20	50	70	
Derating Level		kPa		Instant after warning	NA	NA	10	40	60	50% remain torque >1500 rpm
Shutdown Level (Shutdown Unit Channel S4)	NA	kPa	NA	NA	NA	NA	NA	NA	NA	Run detection S4 = S2, S3
Fuel pressure	0.5-4.5 V	kPa	0-700 ±1.5%							
Warning Level		kPa		30 sec from start / 2 sec	NA	125	200	260	270	
Derating Level		kPa		NA	NA	NA	NA	NA	NA	
Oil pressure	0.5-4.5 V	kPa	0-700 ±1.5%							
Warning Level		kPa		30 sec from start / 1 sec	NA	136	280	320	330	
Derating Level		kPa		Instant after warning	NA	80	260	300	310	30% remain torque > 1500 rpm
Shutdown Level (Shutdown Unit Channel S3)	Digital	kPa	ON/OFF	11 sec ±20% from start / 1 sec	NA	120 ± 20	120 ± 20	120 ± 20	120 ± 20	Shutdown Unit Setting S2.S3: 510 rpm ± 2% 459 Hz ± 2% 54 pulses / revolution
Piston cooling pressure	0.5-4.5 V	kPa	0-700 ±1.5%							
Warning Level		kPa		30 sec from start / 4 sec	NA	NA	75	230	250	
Derating Level		kPa		Instant after warning	NA	NA	65	220	240	30% remain torque > 1500 rpm
Seawater pressure	0.5-4.5 V	kPa	0-300 ± 3%							
Warning Level		kPa		30 sec from start / 5 sec	NA	1	8	17	30	
Derating Level		kPa		Instant after warning	NA	NA	NA	7	20	Derate active >1500 rpm

Warning = Yellow Lamp active
Derating = Red Lamp active

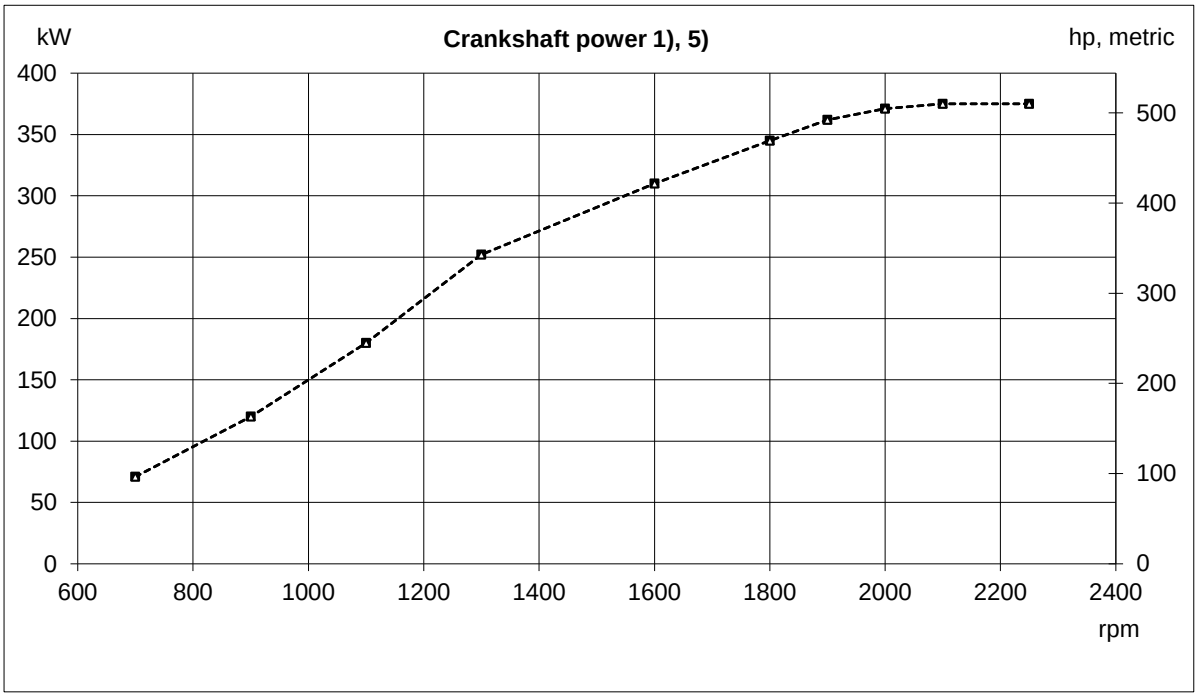
	Speed / °C	101°C	103°C	106°C
Soft 1) Soft derate Coolant Temp.	**600**	100%*	100%*	100%*
Remaining torque in %	**1000**	100%*	100%*	100%*
	1500 ->	100%*	75%	50%

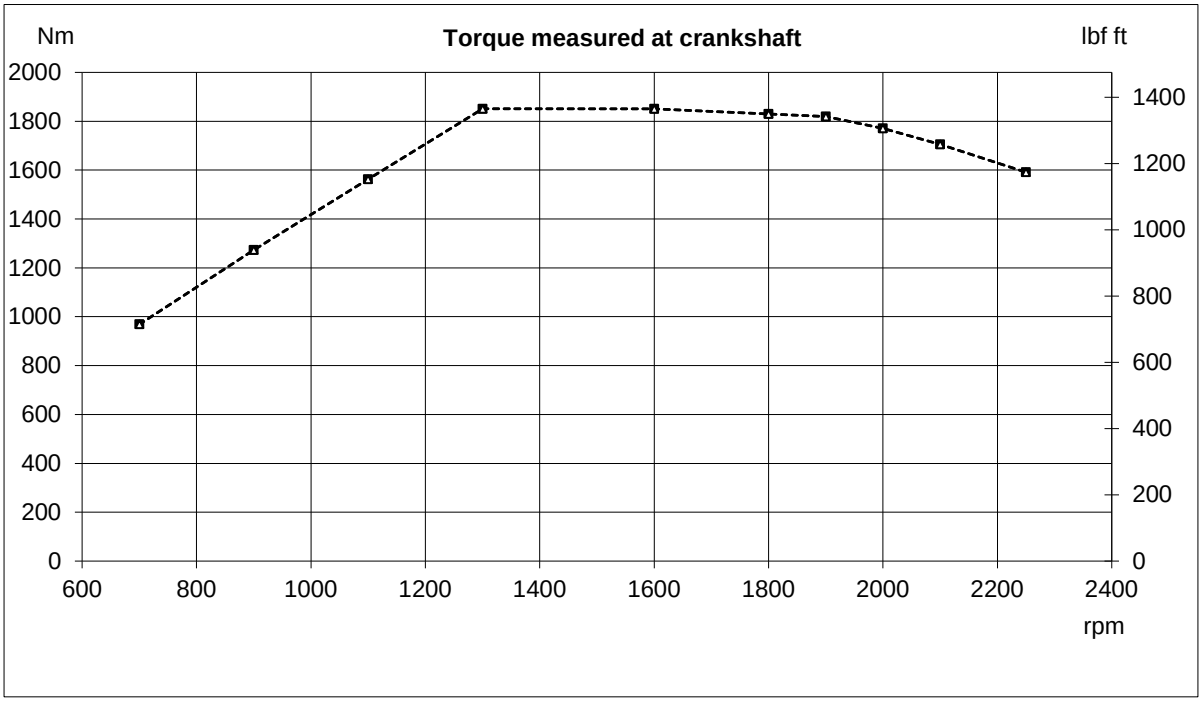
	Speed / °C	122°C	124°C	126°C
Soft 2) Soft derate Oil Temp.	**600**	100%*	100%*	100%*
Remaining torque in %	**1000**	100%*	100%*	100%*
	1500 ->	100%*	50%	30%

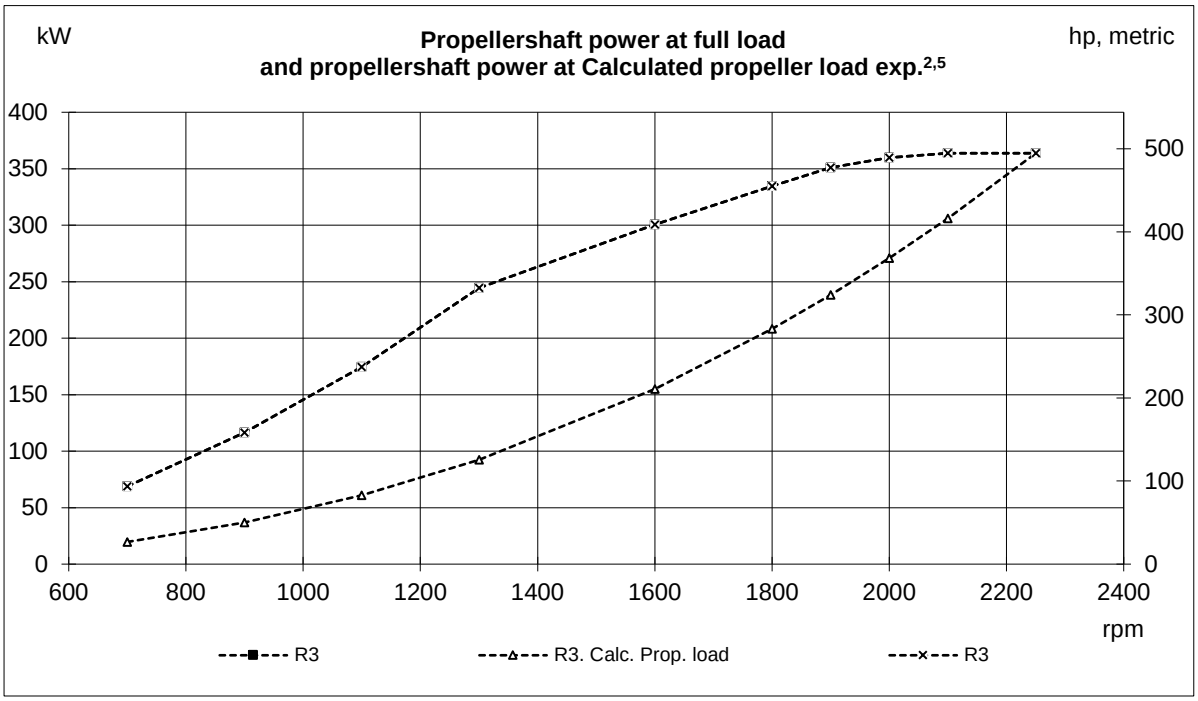
	Speed / °C	80°C	85°C	90°C
Soft 3) Soft derate Charge Air Temp.	**600**	100%*	100%*	100%*
Remaining torque in %	**1000**	100%*	100%*	100%*
	1500 ->	100%*	50%	30%

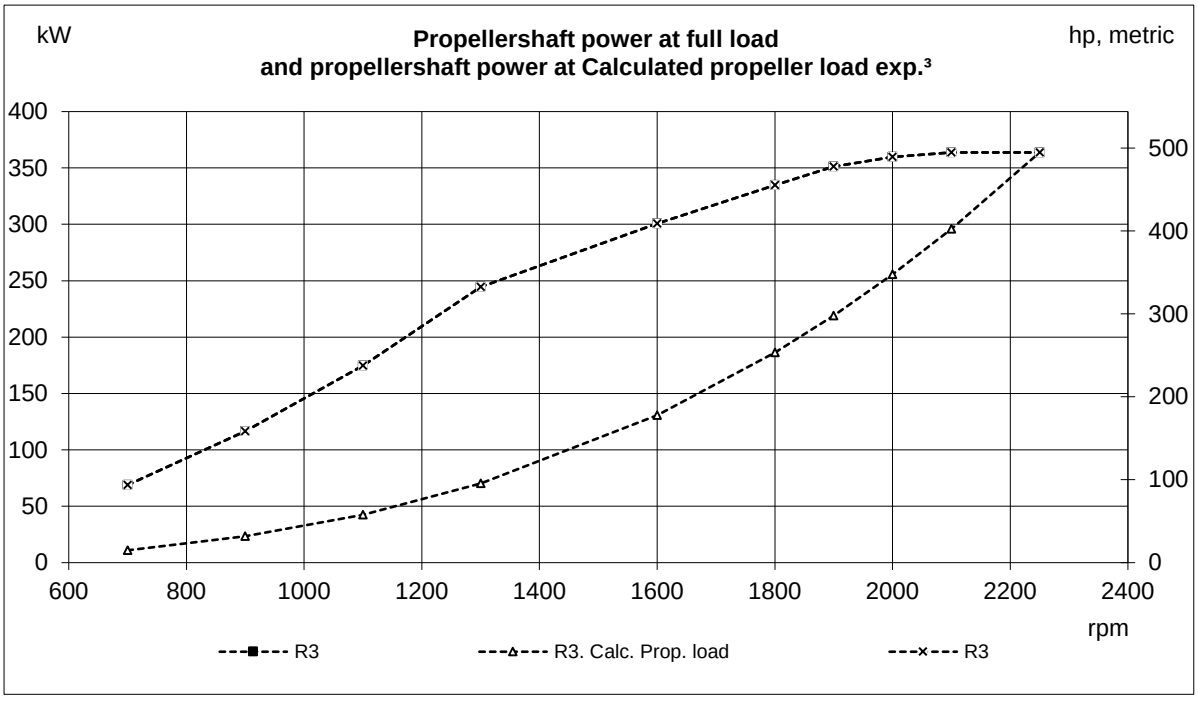
	Speed / °C	655°C	665°C	670°C	675°C
Soft 4) Soft derate Exhaust Temp.	**600**	100%*	100%*	100%*	100%*
Remaining torque in %	**1000**	100%*	100%*	100%*	100%*
	1500 ->	100%*	60%	20%	10%

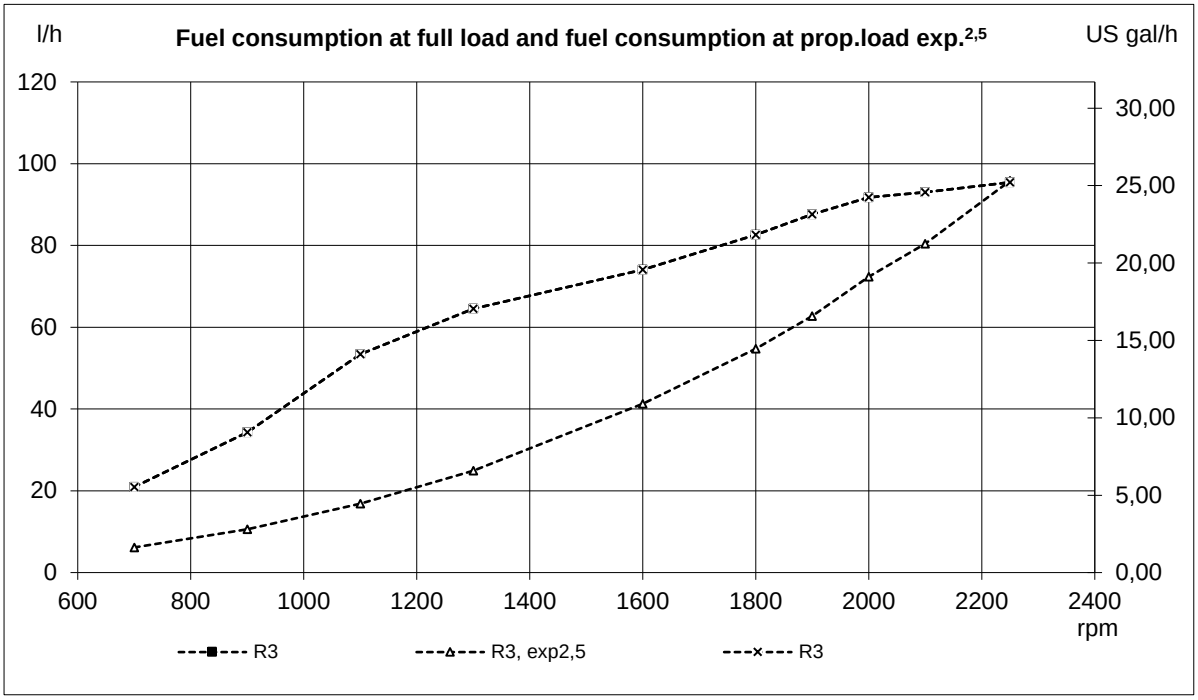
* = Alarm but no derate

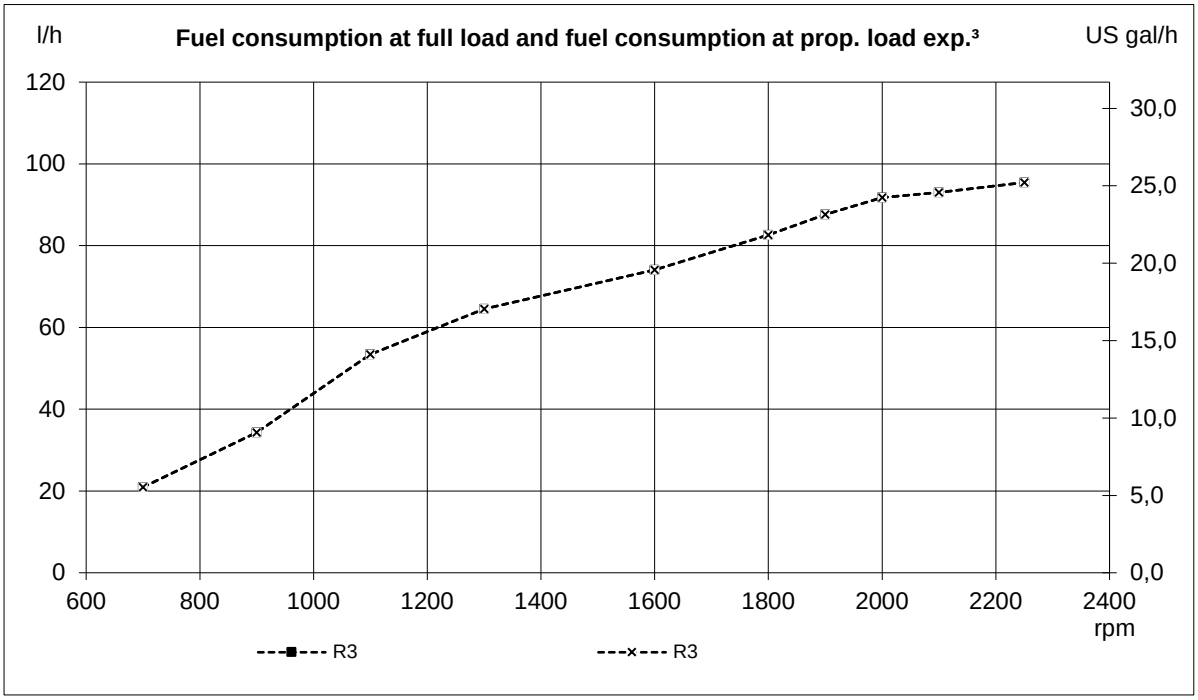

kW
Crankshaft power 1), 5)
hp, metric
400
350
300
250
200
150
100
50
0
500
400
300
200
100
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm

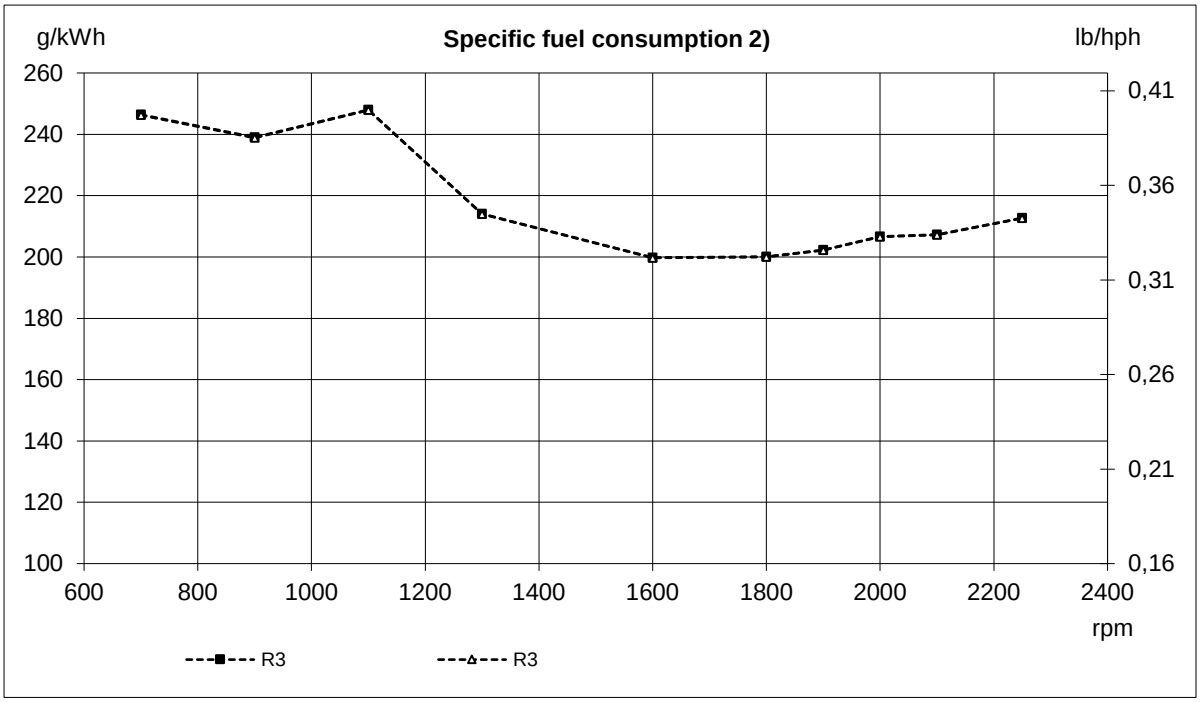

Nm
Torque measured at crankshaft
lbf ft
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1400
1200
1000
800
600
400
200
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm

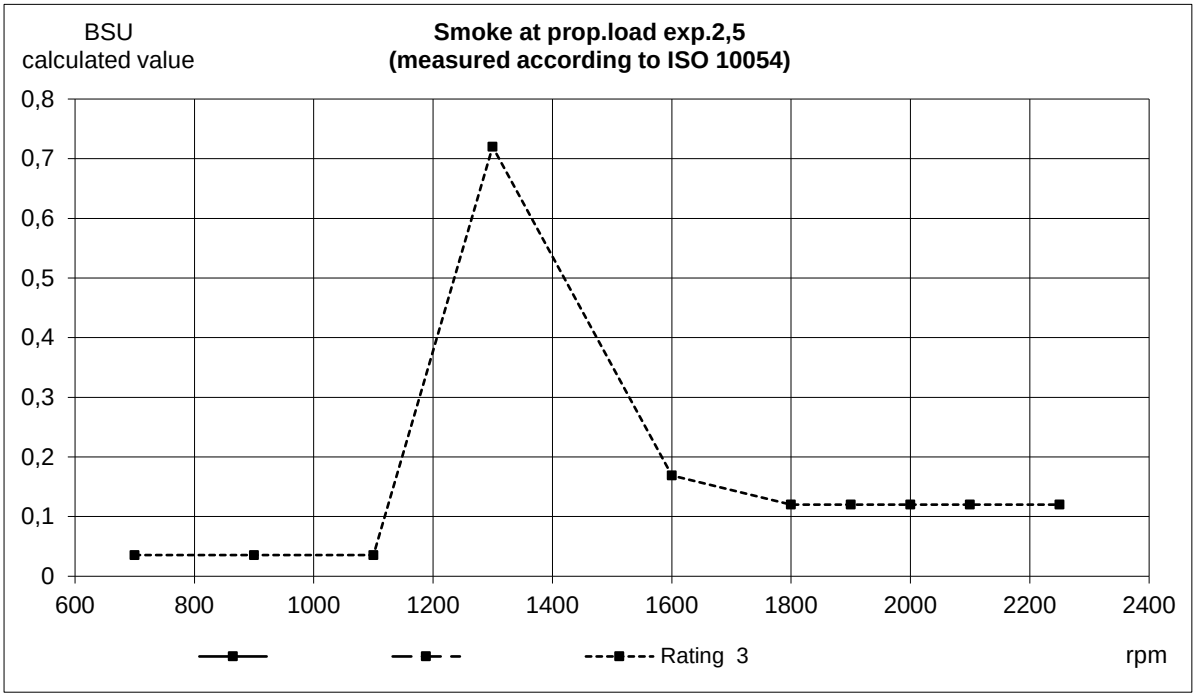

kW
Propellershaft power at full load
and propellershaft power at Calculated propeller load exp.2,5
hp, metric
400
350
300
250
200
150
100
50
0
500
400
300
200
100
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm
R3
R3. Calc. Prop. load
R3

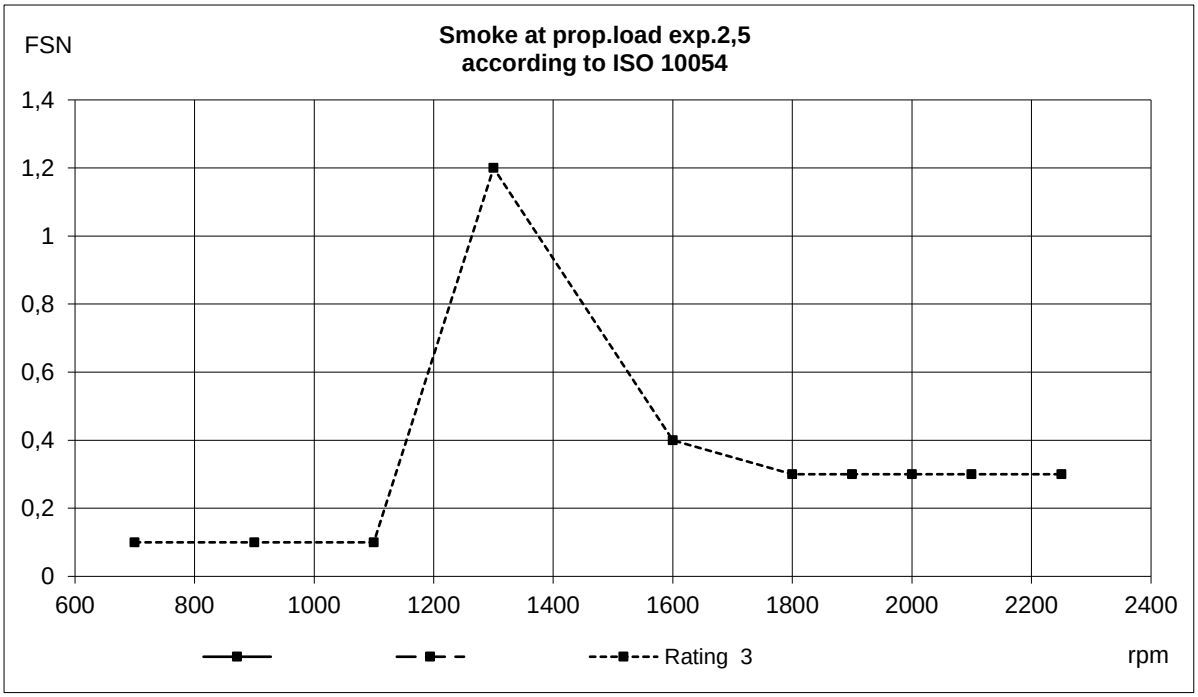

kW
Propellershaft power at full load
and propellershaft power at Calculated propeller load exp.3
hp, metric
400
350
300
250
200
150
100
50
0
500
400
300
200
100
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm
R3
R3. Calc. Prop. load
R3

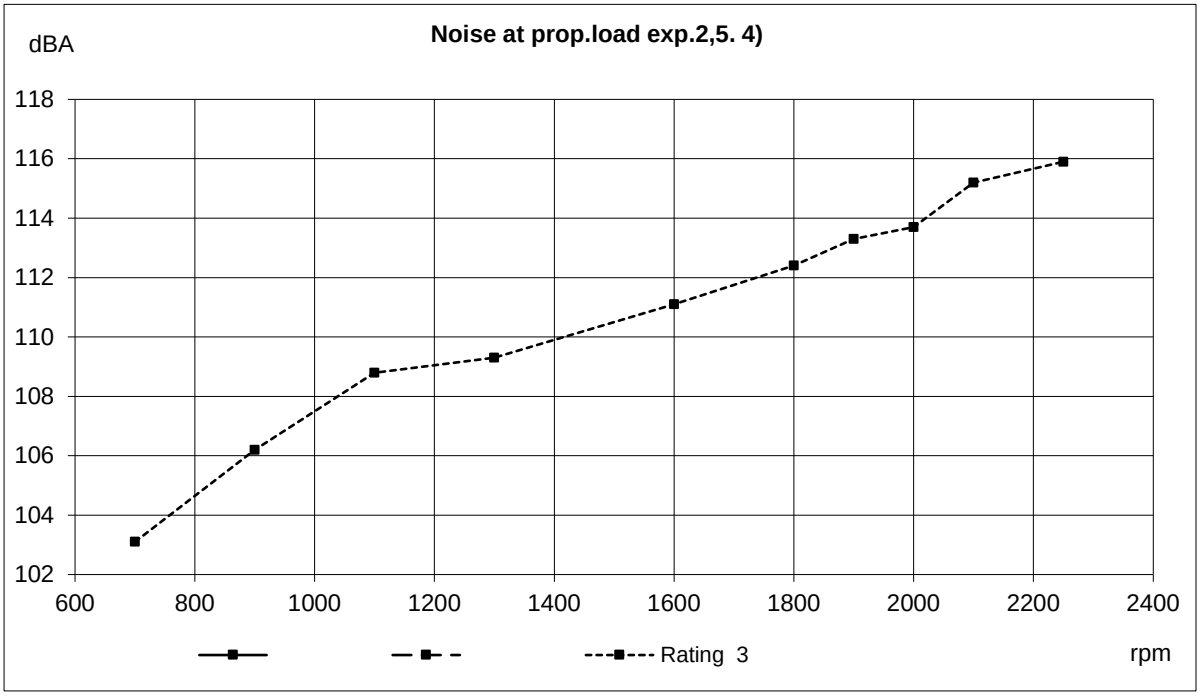

l/h
Fuel consumption at full load and fuel consumption at prop.load exp.2,5
US gal/h
120
100
80
60
40
20
0
30,00
25,00
20,00
15,00
10,00
5,00
0,00
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm
R3
R3, exp2,5
R3


l/h
Fuel consumption at full load and fuel consumption at prop. load exp.3
US gal/h
120
100
80
60
40
20
0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm
R3
R3


g/kWh
Specific fuel consumption 2)
lb/hph
260
240
220
200
180
160
140
120
100
0,41
0,36
0,31
0,26
0,21
0,16
600
800
1000
1200
1400
1600
1800
2000
2200
2400
rpm
R3
R3


BSU
calculated value
Smoke at prop.load exp.2,5
(measured according to ISO 10054)
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Rating 3
rpm


FSN
Smoke at prop.load exp.2,5
according to ISO 10054
1,4
1,2
1
0,8
0,6
0,4
0,2
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Rating 3
rpm


Noise at prop.load exp.2,5. 4)
dBA
118
116
114
112
110
108
106
104
102
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Rating 3
rpm