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 R5	rpm	2500
Propeller selection range R5	rpm	2500-2550
Dry weight engine BT	kg lb	1145 2524

Performance	**Rating**	**rpm**	**700**	**900**	**1100**	**1300**	**1600**	**1900**	**2100**	**2300**	**2400**	**2500**
Crankshaft power 1), 5)	5	kW	67	118	182	302	398	467	517	533	533	533
		hp	91	160	248	411	541	635	703	725	725	725
Propeller shaft power 1) (At full load)	5	kW	65	114	177	293	386	453	501	517	517	517
With drive Reverse gear		hp	88	156	240	398	525	616	682	703	703	703
Propellershaft power at prop. load $x^{2,5}$	5	kW	21	40	66	101	169	260	334	420	467	517
With drive Reverse gear		hp	29	55	90	137	230	354	455	571	635	703
Propellershaft power at prop. load x^{3}	5	kW	11	24	44	73	136	227	306	403	457	517
With drive Reverse gear		hp	15	33	60	99	184	309	417	548	622	703
Torque at crankshaft 2)	5	Nm	914	1252	1580	2218	2375	2347	2351	2213	2121	2036
		lbf ft	674	923	1165	1636	1752	1731	1734	1632	1564	1502
Mean piston speed		m/s	3,5	4,6	5,6	6,6	8,1	9,6	10,6	11,7	12,2	12,7
		ft/s	11,6	15,0	18,3	21,6	26,6	31,6	34,9	38,2	39,9	41,6
Effective mean pressure 2)	5	MPa	1,06	1,45	1,83	2,57	2,75	2,72	2,73	2,57	2,46	2,36
		psi	153,7	210,6	265,7	373,1	399,5	394,8	395,4	372,2	356,7	342,4
Max combustion pressure 2)	5	MPa	15,6	16,8	18,1	19,4	20	20,2	20,9	21	20,5	20,5
		psi	2263	2437	2625	2814	2901	2930	3031	3046	2973	2973

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	1900	2100	2300	2400	2500
Specific fuel consumption 2)	5	g/kWh	248	240	237	218	200	205	211	218	221	222
		lb/hph	0,402	0,389	0,384	0,353	0,324	0,332	0,342	0,353	0,358	0,36
Fuel consumption, Test cycle E5	5	g/kWh	223									
		lb/hph	0,36									
Fuel consumption at prop. load x [2,5]	5	l/h	6,6	11,9	20,2	26,6	41,7	65,7	86,9	111,6	126,0	140,1
		US gal/h	1,7	3,1	5,3	7,0	11,0	17,3	23,0	29,5	33,3	37,0
Fuel consumption at full load	5	l/h	19,9	33,9	51,6	78,8	95,2	114,6	130,5	139,0	141,0	141,6
		US gal/h	5,3	9,0	13,6	20,8	25,2	30,3	34,5	36,7	37,2	37,4

Intake and exhaust system	Rating	rpm	700	900	1100	1300	1600	1900	2100	2300	2400	2500
Specific exhaust heating effect in percent of crankshaft power	5	%	73	73	85	78	68	73	79	83	84	85
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	5	°C	510	650	675	635	505	505	530	535	535	530
		°F	950	1202	1247	1175	941	941	986	995	995	986
		°C										
		°F										
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	1900	2100	2300	2400	2500
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA and relative humidity 30%.	5	m³/min	4	6,5	9,5	15,5	23,6	29,9	33,9	36,8	37,9	38,5
		cu.ft./min	141,3	229,5	335,5	547,4	833,4	1056	1197	1300	1338	1360
		m³/min										
		cu.ft./min										
Charge air pressure Inlet manifold	5	kPa	19	47	78	146	207	230	241	242	240	235
		psi	2,8	6,8	11,3	21,2	30,0	33,4	35,0	35,1	34,8	34,1
Exhaust gas flow	5	m³/min	12	22	33	51	63	78	88	94	97	97
		cu.ft./min	423,8	776,9	1165	1801	2225	2755	3108	3320	3426	3426

Cooling system	Rating	rpm	700	900	1100	1300	1600	1900	2100	2300	2400	2500
Radiated heat in percent of crankshaft power.	5	%	5,1	4,3	3,4	2,3	1,3	1,2	1,2	1,2	1,2	1,2
Heat rejection to charge air cooler in percent of crankshaft power.	5	%	4	6	8	12	17	19	20	21	22	23
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, in percent of crankshaft power.	5	%	168	134	104	80	49	47	52	58	60	60
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									

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2) At power according to 1).
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4) Acc. to ISO 3744
5) At installed back pressure

Raw water circuit	rpm	700	900	1100	1300	1600	1900	2100	2300	2400	2500
Nominal raw water design flow	l/min	76	99	121	141	174	204	227	249	255	261
	cu.ft/min	2,7	3,5	4,3	5,0	6,1	7,2	8,0	8,8	9,0	9,2
Maximum raw water pump suction head	kPa	30									
	psi	4,4									
Maximum raw water temperature entering heat exchanger	°C	32									
	°F	90									

Emissions	Rating	rpm	700	900	1100	1300	1600	1900	2100	2300	2400	2500
Smoke at prop. load $x^{2,5}$	5	*BSU	0,0	0,2	0,3	0,7	0,5	0,2	0,2	0,4	0,4	0,5
Noise at prop. load $x^{2,5}$. 4)	5	dBA	103,1	106,3	109	110,3	111,1	113,8	115,3	116,9	117,8	118,2

***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

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	**Signal**	**Unit**	**Range**	**Warning Initial Delay /**	**Warning Level**	**Derating Level**	**Shutdown Initial Delay /**	**Shutdown Level**
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)	NA	NA
Engine speed cam	Frequency	rpm		Instant	Lost signal	Lost signal**	NA	NA
Engine speed crank	Frequency	rpm		Instant	Lost signal	Lost signal**	NA	NA
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
Reversing gear oil pressure (EVC)	0.5-4.5 V	kPa	0-3000 ± 3%	60 sec from start / 7 sec	700 kPa	NA	NA	NA
Reversing gear temperature (EVC)	50-0 kΩ	°C	-40 - 140 ± 2.5%	NA (IB)	95°C	NA	NA	NA

NA = Not applicable
* 50% remaining torque from 1500 rpm
** 80% remaining torque

Sensors (rpm dependent)	Signal	Unit	Range	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Switches Shutdown System
Fuel pressure	0,5-4,5 V	kPa	0-700 ± 1.5%		**0 rpm**	**600 rpm**	**1000 rpm**	**1500 rpm**	**2500 rpm**	
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%		**0 rpm**	**600 rpm**	**1000 rpm**	**1500 rpm**	**2500 rpm**	
Warning Level		kPa		30 sec from start / 5 sec	NA	136	280	320	330	
Derating Level		kPa		Instant after warning	NA	80	160	300	310	30% remain torque > 1500 rpm
Shutdown Level	NA	kPa	NA	NA	NA	NA	NA	NA	NA	
Piston cooling pressure	0.5-4.5 V	kPa	0-700 ± 1.5%		**0 rpm**	**600 rpm**	**1000 rpm**	**1500 rpm**	**2500 rpm**	
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

Warning = Yellow Lamp active

Derating = Red Lamp active

Remarks

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

	Speed / °C	128°C	130°C	135°C
Soft 2) Soft derate Oil temp				
Remaining torque in %	**600**	100%*	100%*	100%*
	1000	100%*	100%*	100%*
	1500 ->	100%*	50%	30%

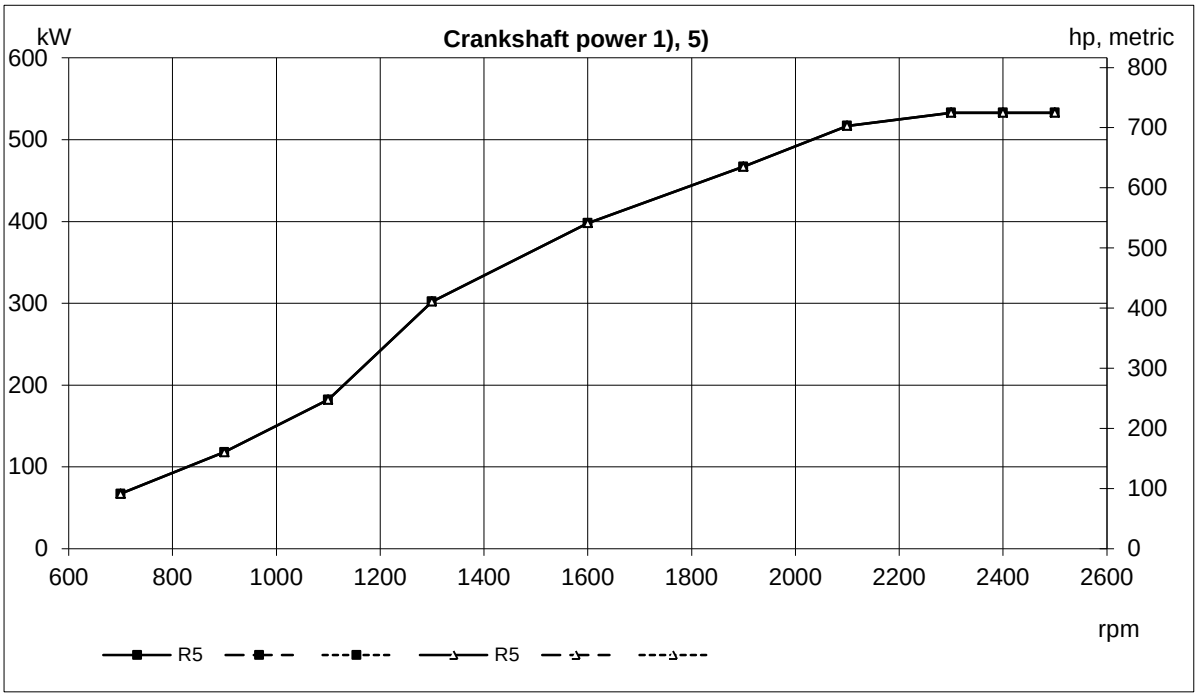
	Speed / °C	90°C	95°C	105°C
Soft 3) Soft derate Charge Air Temp				
Remaining torque in %	**600**	100%*	100%*	100%*
	1000	100%*	100%*	100%*
	1500 ->	100%*	50%	30%

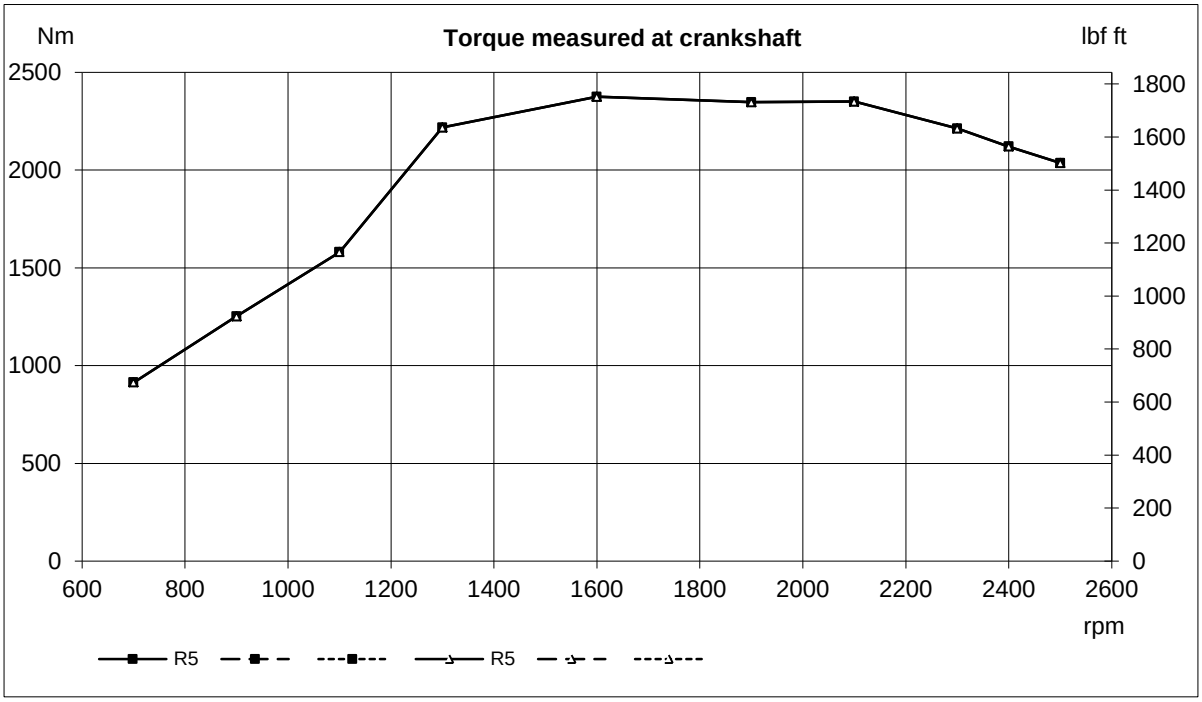
	Speed / °C	665°C	675°C	680°C	685°C
Soft 4) Soft derate Exhaust Temp					
Remaining torque in %	**600**	100%*	100%*	100%*	100%*
	1000	100%*	100%*	100%*	100%*
	1500 ->	100%*	60%	20%	10%

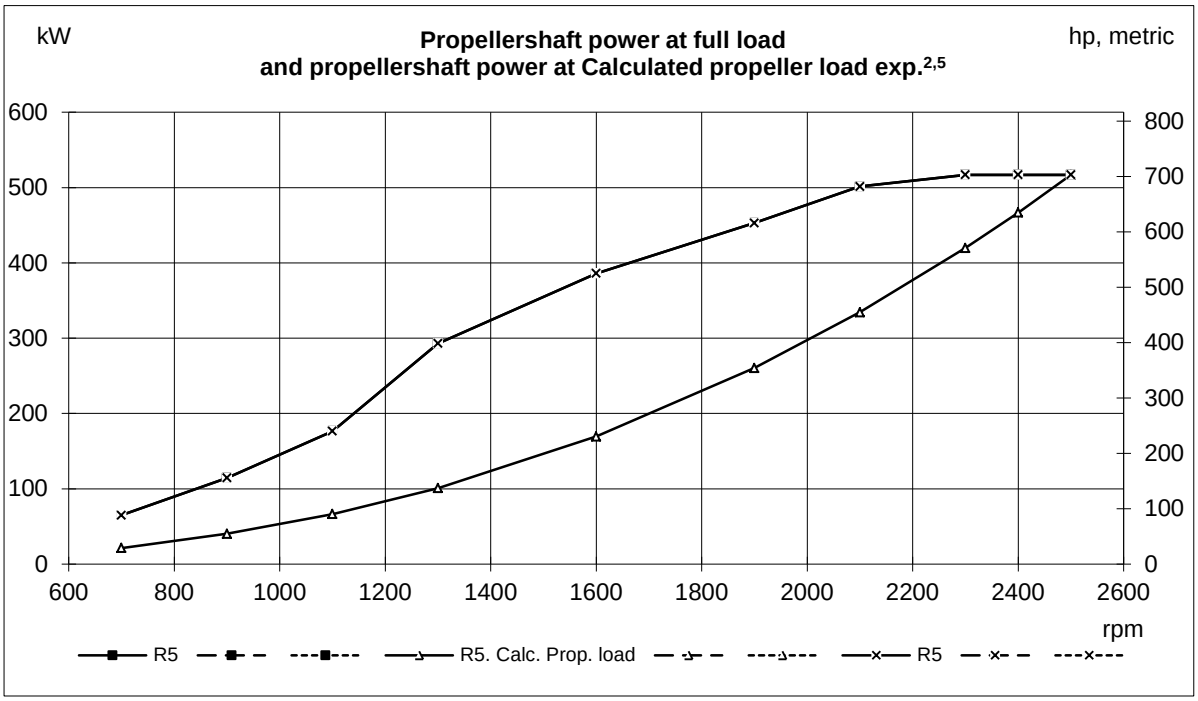
* = Alarm but no derate

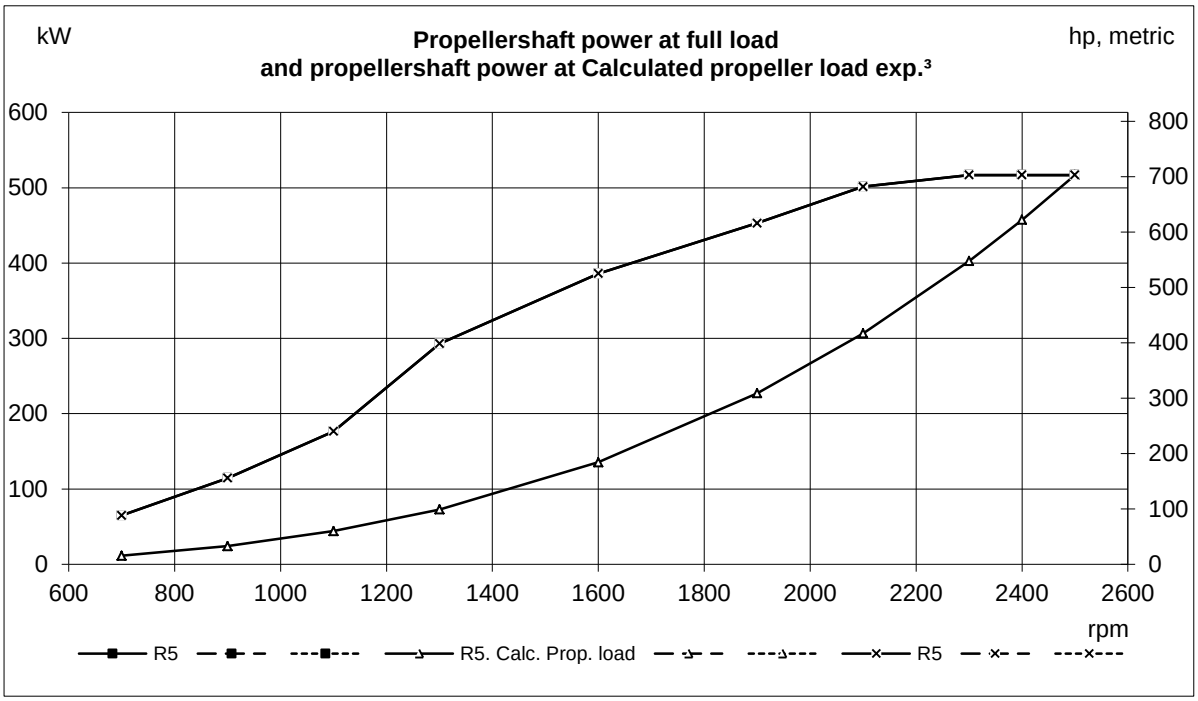
Fault Limit table Exhaust Dry Temp.

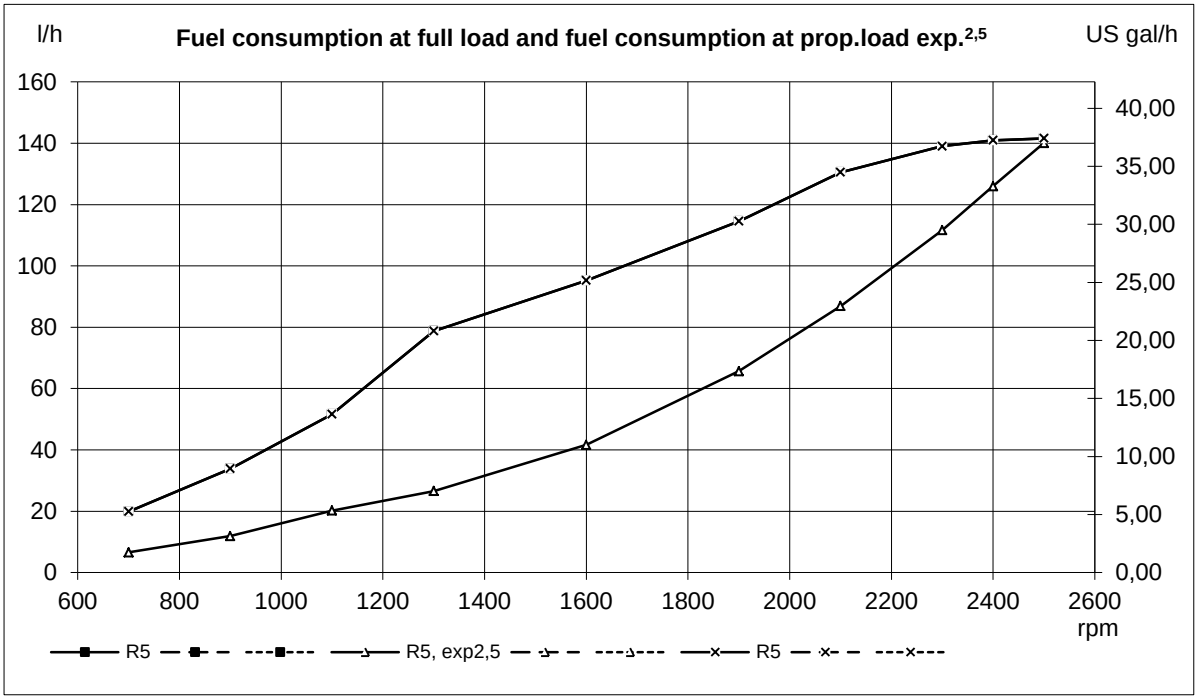
Nm \ rpm	1000 rpm	1200 rpm	1300 rpm	1400 rpm	1500 rpm	1600 rpm	2000 rpm	2500 rpm
600	575	620	650	620	580	560	560	560
1000	575	620	650	620	580	560	560	560
1400	575	620	650	620	580	560	560	560
1600	575	620	650	620	580	560	560	560
2000	575	620	650	620	580	560	560	560
2200	575	620	650	620	580	560	560	560
2400	575	620	650	620	580	560	560	560
2600	575	620	650	620	580	560	560	560

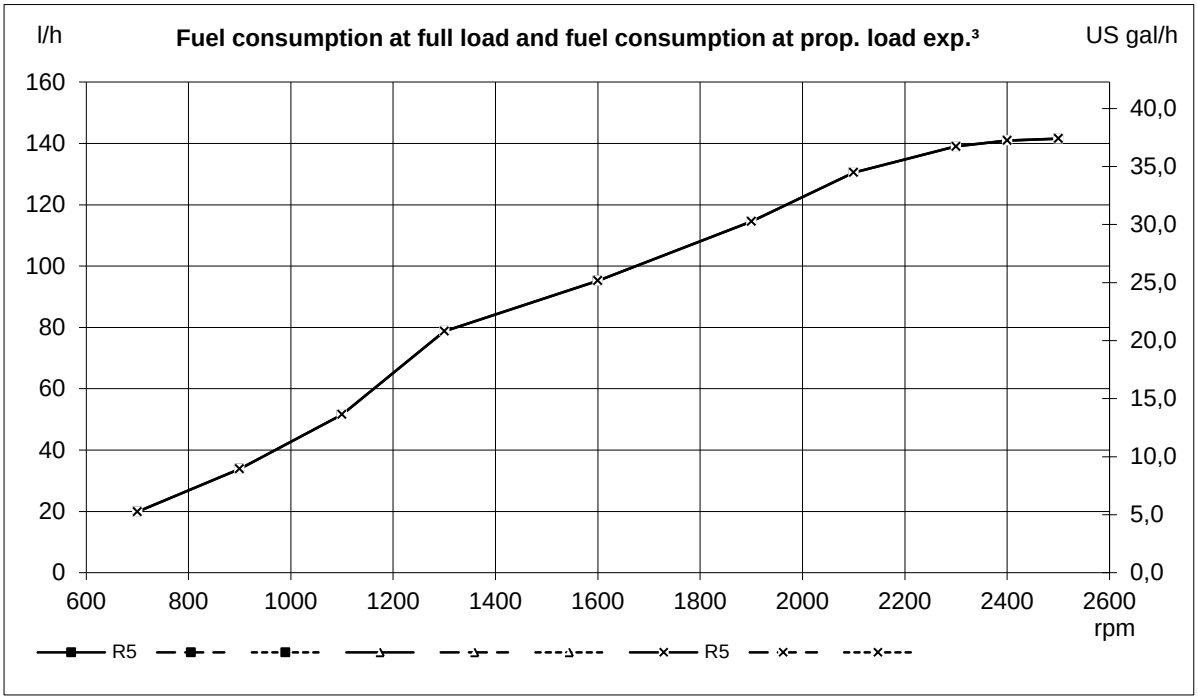

kW
Crankshaft power 1), 5)
hp, metric
600
500
400
300
200
100
0
800
700
600
500
400
300
200
100
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
rpm
R5
R5

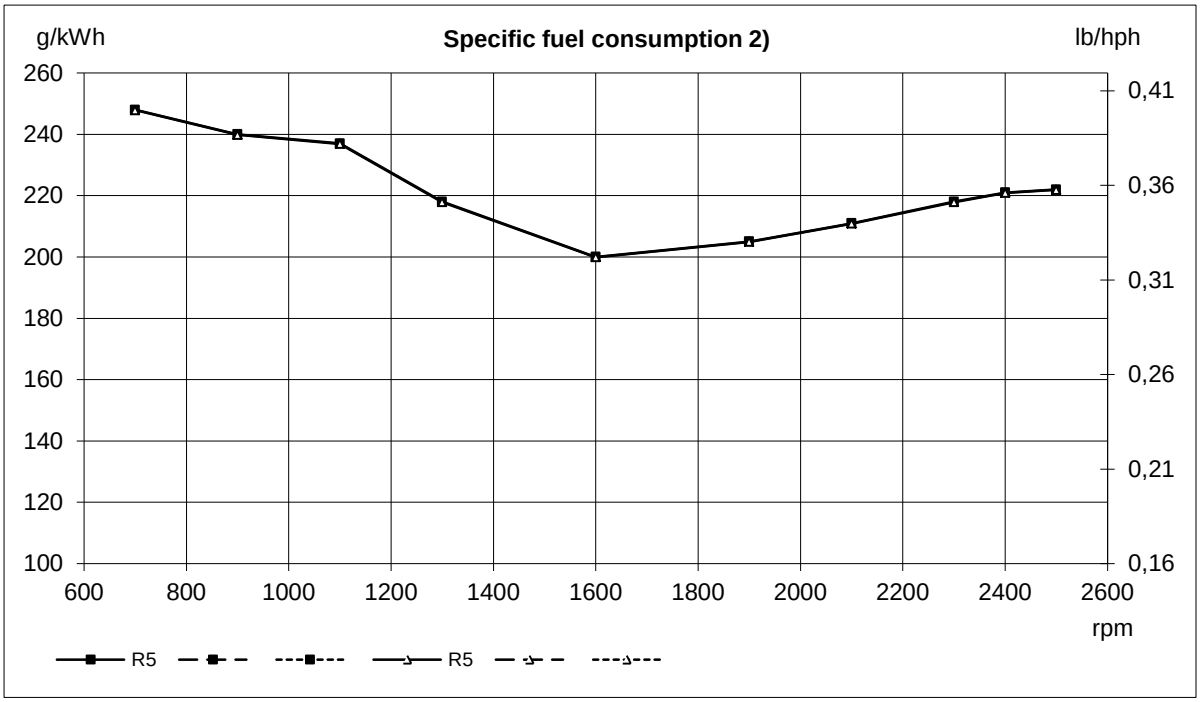

Nm
Torque measured at crankshaft
lbf ft
2500
2000
1500
1000
500
0
1800
1600
1400
1200
1000
800
600
400
200
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
rpm
R5
R5

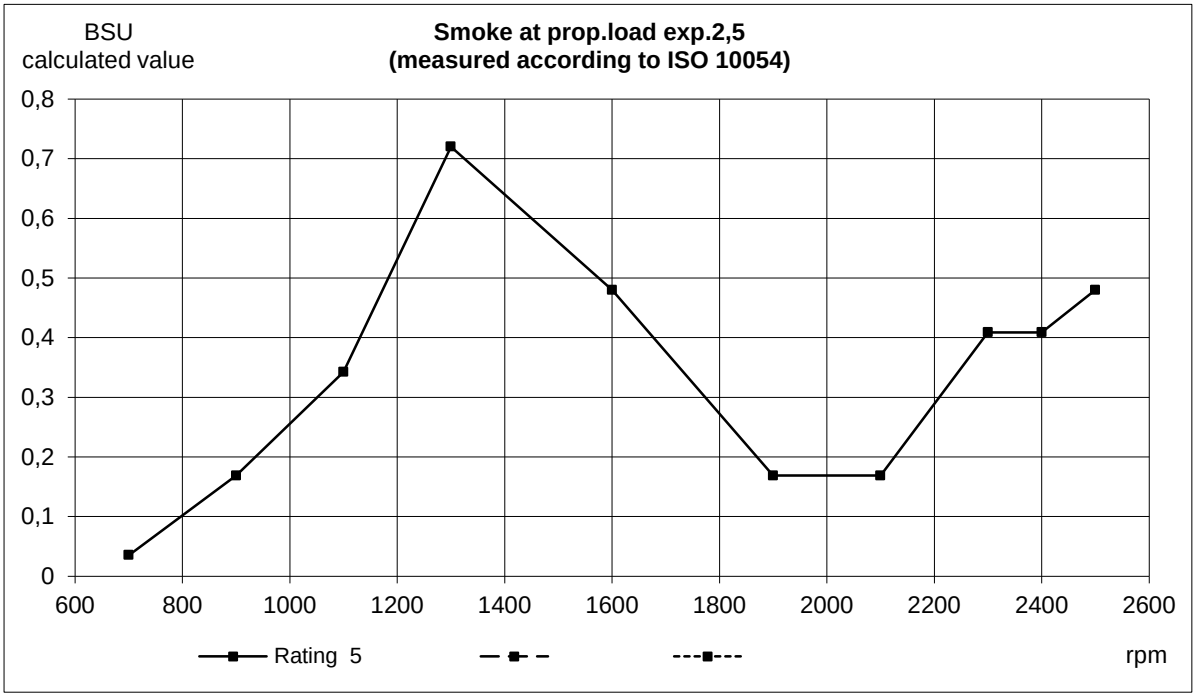

kW
Propellershaft power at full load
and propellershaft power at Calculated propeller load exp.2,5
hp, metric
600
500
400
300
200
100
0
800
700
600
500
400
300
200
100
0
600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600
rpm
R5
R5. Calc. Prop. load
R5

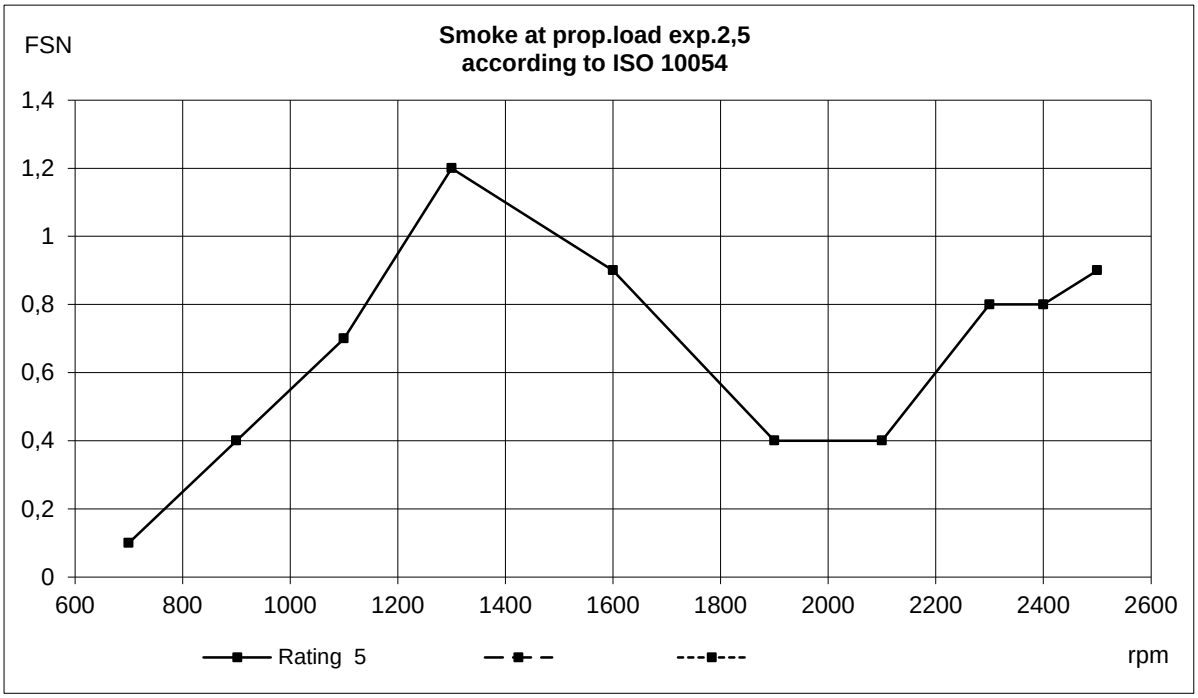

kW
Propellershaft power at full load
and propellershaft power at Calculated propeller load exp.3
hp, metric
600
500
400
300
200
100
0
800
700
600
500
400
300
200
100
0
600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600
rpm
R5
R5. Calc. Prop. load
R5

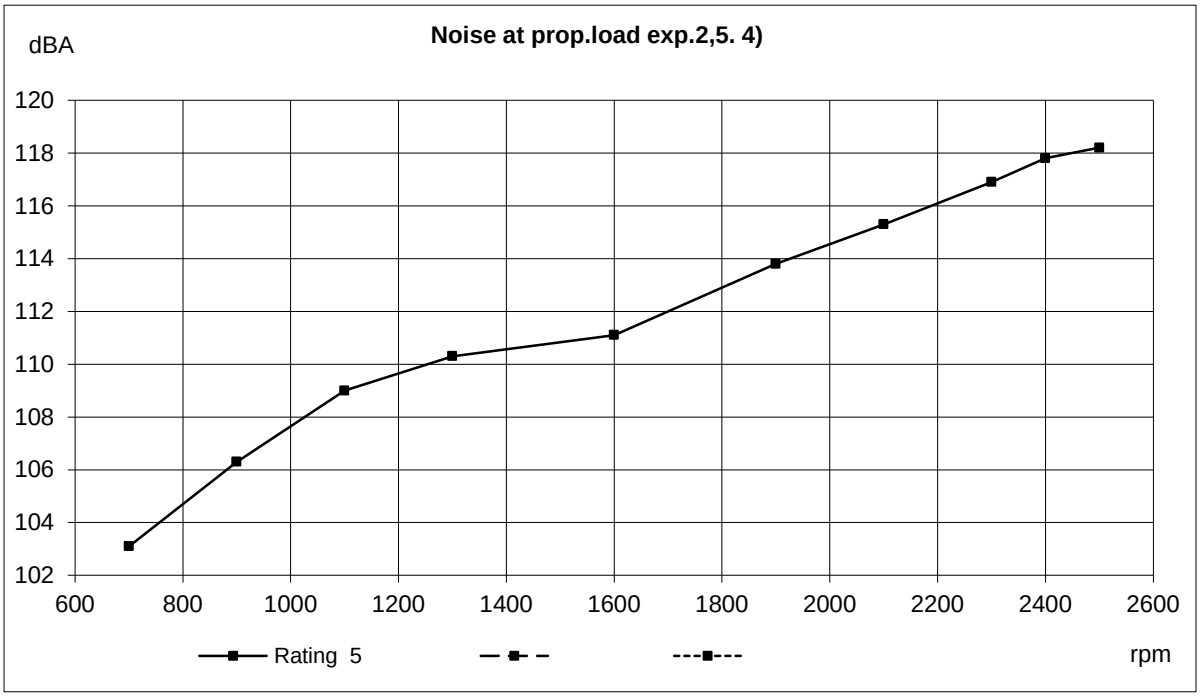

l/h
Fuel consumption at full load and fuel consumption at prop.load exp.2,5
US gal/h
160
140
120
100
80
60
40
20
0
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
rpm
R5
R5, exp2,5
R5


l/h
Fuel consumption at full load and fuel consumption at prop. load exp.3
US gal/h
160
140
120
100
80
60
40
20
0
40,0
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
rpm
R5
R5


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
2600
rpm
R5
R5


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
2600
Rating 5
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
2600
Rating 5
rpm


Noise at prop.load exp.2,5. 4)
dBA
120
118
116
114
112
110
108
106
104
102
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Rating 5
rpm