General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Engine Rating		5
Number of cylinders		6
No of valves		24
Displacement, total	litres in³	7,70 469,7
Firing order		1-4-2-6-3-5
Rotational direction, viewed from the front		Clockwise
Bore	mm in	110 4,33
Stroke	mm in	135 5,31
Compression ratio		16,5:1
Compression pressure at 240 rpm	MPa psi	3,2 464
Max. static forward inclination:	°	0
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	33
Max. intermittent backward inclination while running:	°	17
Max. intermittent side inclination while running:	°	30
Idling speed	rpm	600 ± 10
Rated speed R5	rpm	3000
Governed speed R5	rpm	3080
Propeller selection range R5	rpm	2950-3050
Dry weight engine BT, in basic configuration	kg lb	840 1852
Dry weight engine BT, in basic configuration incl. exhaust pipe/riser, heat ins, ecxl. rear suspension	kg lb	870 1918

Performance	**rpm**	**600**	**800**	**1200**	**1700**	**2000**	**2400**	**2700**	**2800**	**2900**	**3000**
Crankshaft power 1), 5)	kW	40	59	127	312	368	441	441	441	441	441
	hp	54	80	173	424	500	600	600	600	600	600
Propeller shaft power 1) (At full load)	kW	38	57	123	302	357	428	428	428	428	428
With reverse gear	hp	52	77	167	411	485	582	582	582	582	582
Propellershaft power at prop. load $x^{2,5}$	kW	8	16	43	103	155	245	329	360	393	428
	hp	10	21	59	141	211	333	447	490	535	582
Propellershaft power at prop. load x^3	kW	3	8	27	78	127	219	312	348	386	428
	hp	5	11	37	106	172	298	424	473	526	582
Torque at crankshaft 2)	Nm	629,9	700	1010	1750	1755	1755	1560	1504	1452	1404
	lbf ft	465	516	745	1291	1294	1294	1150	1109	1071	1035
Mean piston speed	m/s	2,7	3,6	5,4	7,7	9,0	10,8	12,2	12,6	13,1	13,5
	ft/s	8,9	11,8	17,7	25,1	29,5	35,4	39,9	41,3	42,8	44,3
Effective mean pressure 2)	MPa	1,03	1,14	1,65	2,86	2,87	2,87	2,55	2,46	2,37	2,29
	psi	149,2	165,7	239,1	414,3	415,5	415,5	369,3	356,1	343,8	332,4
Max combustion pressure 2)	MPa	9,7	9,9	12,5	19,7	18,9	18,5	17	16,9	16,6	16,9
	psi	1407	1436	1813	2857	2741	2683	2466	2451	2408	2451

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

Lubricating system

Specific lubricating oil consumption.	g/kWh	0,1
Max. oil volume including filters for all allowed installation inclinations:	litres	29,4
	US gal	7,8
Max. oil volume excluding filters for all allowed installation inclinations:	litres	28
	US gal	7,4
Min. oil volume excluding filters for all allowed installation inclinations:	litres	22
	US gal	5,8

Fuel system	**rpm**	**600**	**800**	**1200**	**1700**	**2000**	**2400**	**2700**	**2800**	**2900**	**3000**
Specific fuel consumption 2)	g/kWh	231	227	222	199	197	207	217	220	224	226
(max torque)	lb/hph	0,374	0,368	0,36	0,322	0,319	0,335	0,352	0,356	0,363	0,366
Fuel consumption at Test cycle?	g/kWh	NA									
	lb/hph										
Fuel consumption at prop. load x [2,5]	l/h	2,6	4,6	11,2	26,4	39,5	63,7	88,0	97,5	109,6	
	US gal/h	0,7	1,2	3,0	7,0	10,4	16,8	23,2	25,7	28,9	
Fuel consumption at prop. load x [3]	l/h	1,6	3,0	7,7	20,2	32,8	57,9	84,0	94,4	107,7	
	US gal/h	0,4	0,8	2,0	5,3	8,7	15,3	22,2	24,9	28,5	
Fuel consumption at full load	l/h	10,9	15,9	33,7	74,2	86,6	109,3	114,5	116,1	118,2	119,3
	US gal/h	2,9	4,2	8,9	19,6	22,9	28,9	30,3	30,7	31,2	31,5

Full load preformance at rated speed

Fuel inlet temperature	°C	40
	°F	104,0
Fuel return temperature from engine	°C	52
	°F	125,6
Fuel consumption	l/h	109
	US gal/h	28,8
Fuel inlet flow to engine	l/h	184
	US gal/h	48,6
Fuel return flow from engine	l/h	75
	US gal/h	19,8

Intake and exhaust system	**rpm**	**600**	**800**	**1200**	**1700**	**2000**	**2400**	**2700**	**2800**	**2900**	**3000**
Specific exhaust heating effect in percent of crankshaft power	%	51	57	70	64	63	71	79	81	84	84
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	°C	428	499	624	551	468	490	525	527	530	520
	°F	802	930	1155	1024	874	914	977	981	986	968
Permitted back pressure in the exhaust line at rated speed. (Installed back pressure)	kPa							Max	30		
	psi								4,4		
	kPa							Min	10		
	psi								1,5		

Intake and exhaust system	**rpm**	**600**	**800**	**1200**	**1700**	**2000**	**2400**	**2700**	**2800**	**2900**	**3000**
Engine air consumption at 25°C / 77°F	m³/min	2,2	3,2	6,4	16,9	23,3	29,9	30,7	31,6	32,4	33,3
atmospheric pressure 100kPA	cu.ft./min	77,69	113	226	596,8	822,8	1056	1084	1116	1144	1176
Charge air pressure	kPa	108	113	152	285	331	360	336	336	336	336
Inlet manifold	psi	15,7	16,4	22,0	41,3	48,0	52,2	48,7	48,7	48,7	48,7
Exhaust gas flow	m³/min	5,7	8,9	21	47,9	57,4	71,6	76,1	77,9	79,5	80,2
	cu.ft./min	201,3	314,3	741,6	1692	2027	2529	2687	2751	2808	2832

1) ISO 3046, fuel temp 40°C.
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5) At installed back pressure

Cooling system	rpm	600	800	1200	1700	2000	2400	2700	2800	2900	3000
Radiated heat of crankshaft power at full load.	kW	1,9	1,8	1,7	1,6	1,5	1,5	1,5	1,5	1,5	1,5
Heat rejection to charge air cooler of crankshaft power at full load.	kW	2	2	6	15	20	23	22	23	24	25
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, of crankshaft power at full load.	kW	105	96	71	51	46	47	50	50	51	52
Coolant flow with fully open thermostat and std cooling system	l/min	66	88	129	182	212	244	265	269	272	273
	cu.ft./min	2,3	3,1	4,6	6,4	7,5	8,6	9,4	9,5	9,6	9,6
Max. permissible temperature on coolant in engine outlet	°C	NA									
	°F										
Coolant volume engine, including heat exchanger and charge air cooler	litres	25									
	US gal.	6,60									
Max. additional coolant for cabin heater etc. with std. Expansion tank	litres	20									
	US gal.	5,28									
Maximum coolant flow to cabin heater etc.	l/min	34,2									
	cu.ft./min	1,21									
Thermostat, start open at	°C	76									
	°F	169									
Thermostat, fully open at	°C	86									
	°F	187									

Raw water circuit	rpm	600	800	1200	1700	2000	2400	2700	2800	2900	3000
Nominal raw water design flow	l/min	66	88	129	165	200	240	250	255	257	260
	cu.ft/min	2,3	3,1	4,6	5,8	7,1	8,5	8,8	9,0	9,1	9,2
Nominal raw water pump pressure head at design flow.	kPa	5	11	27	50	67	87	101	105	107	107
	psi	0,7	1,6	3,9	7,3	9,7	12,6	14,6	15,2	15,5	15,6
Maximum raw water pump suction head	kPa	-30									
	psi	-4,4									
Maximum additional pressure drop excl. reverse gear oil cooler	kPa	97	93	83	63	50	31	20	16	14	13
	psi	14,1	13,5	12,0	9,1	7,3	4,5	2,9	2,3	2,0	1,9
Pressure drop over reverse gear oil cooler (optional equipment)	kPa	1	1	2	4	5	7	8	9	9	9
	psi	0,1	0,1	0,3	0,6	0,7	1,0	1,2	1,3	1,3	1,3
Maximum raw water temperature entering heat exchanger	°C	32									
	°F	90									

Emissions	rpm	600	800	1200	1700	2000	2400	2700	2800	2900	3000
Smoke at prop. load $x^{2,5}$	*BSU	0,1	0,1	0,1	0,5	0,4	0,2	0,2	0,2	0,3	
Smoke at prop. load x^3	*BSU	0,1	0,1	0,1	0,3	0,3	0,3	0,2	0,2	0,3	
Noise at prop. load $x^{2,5}$. 4)	dBA	97,2	99,1	100,6	103,7	107,1	108,9	111,9	112,1	112,2	112,5
Noise at prop. load x^3. 4)	dBA	95,6	98,5	101,3	102,9	107	109	111,9	112,1	112,3	112,9

***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

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	**Signal**	**Unit**	**Range**	**Warning Initial Delay / Fault detection time 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 (150-500	30 sec from start / 3 sec	300 (400 absoulte)	310 (410 abs.) *	NA	NA
Charge air temperaure	50-0 kΩ	°C	-40 - 130	30 sec from start / 3 sec	80	90 (soft 3)	NA	NA
Coolant level switch	Digital		ON/OFF	30 sec from start / 5 sec	Low (ON / Closed)	NA	NA	NA
Coolant temperature	50-0 kΩ	°C	-40 - 140	30 sec from start / 3 sec	98	103 (soft 1)	NA	NA
Engine speed cam	Frequency	rpm		Instant	Lost signal	NA	NA	NA
Engine speed crank	Frequency	rpm		Instant	Lost signal	NA	NA	NA
Exhaust gas temperature wet	PT200	°C	0 - 850	30 sec from start / 3 sec	200	225(soft 4)	NA	NA
Exhaust gas temperature dry	PT200	°C	0 - 850	30 sec from start / 3 sec	650	665(soft 5)**	NA	NA
Oil level sensor	Digital		ON/OFF	30 sec from start / 5 sec	Low level	NA	NA	NA
Oil temperature	50-0 kΩ	°C	-40 - 140	30 sec from start / 5 sec	125	127 (soft 2)	NA	NA
Water In fuel switch	Digital		ON/OFF	All the time	Water in fuel	NA	NA	NA

NA = Not applicable

** Yes, 50% of engine prot. map.*

*** Max 1200 rpm at 675°C*

Sensors (rpm dependent)	Signal	Unit	Range	Initial Delay / Fault detection time Delay	Warning Level / Derating Level rpm Map					Switches Shutdown System
Fuel pressure	0,5-4,5 V	kPa	0-700		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**3000 rpm**	
Warning Level		kPa		30 sec from start / 5 sec	300	335	370	420	450	
Derating Level		kPa		NA	NA	NA	NA	NA	NA	
Oil pressure	0,5-4,5 V	kPa	0-700		**550 rpm**	**600 rpm**	**1000 rpm**	**2000 rpm**	**3000 rpm**	
Warning Level		kPa		30 sec from start / 2 sec	-50	100	150	200	300	
Derating Level (100% derate)		kPa		10% trq. decr. per sec	-10	75	125	175	275	
Engine speed		kPa		Max 1000 rpm	0	70	120	170	270	

Warning = Yellow Lamp active
Derating = Red Lamp active

Remarks

	Speed / °C	103°C	105.5°C	108°C
Soft 1) Soft derate Coolant temp				
Remaining torque in %	600	100%	100%	100%
	1200	100%	85%	70%
	1800	100%	50%	0%

	Speed / °C	127°C	129°C	131°C
Soft 2) Soft derate Oil temp				
Remaining torque in %	600	100%	100%	100%
	1200	100%	85%	70%
	1800	100%	50%	0%

	Speed / °C	90°C	95°C	100°C
Soft 3) Soft derate Charge Air Temp				
Remaining torque in %	600	100%	100%	100%
	1200	100%	85%	70%
	1800	100%	50%	0%

	Speed / °C	225°C	235°C	245°C	255°C
Soft 4) Soft derate Exhaust Temp wet					
Remaining torque in %	600	100%	100%	100%	100%
	1200	100%	85%	78%	70%
	1800	100%	50%	25%	0%

	Speed / °C	665°C	675°C	680°C	685°C	690°C
Soft 5) Soft derate Exhaust Temp dry						max 1000rpm
Remaining torque in %	600	100%	100%	100%	100%	100%
	1200	100%	85%	78%	0%	NA
	1800	100%	50%	25%	0%	NA

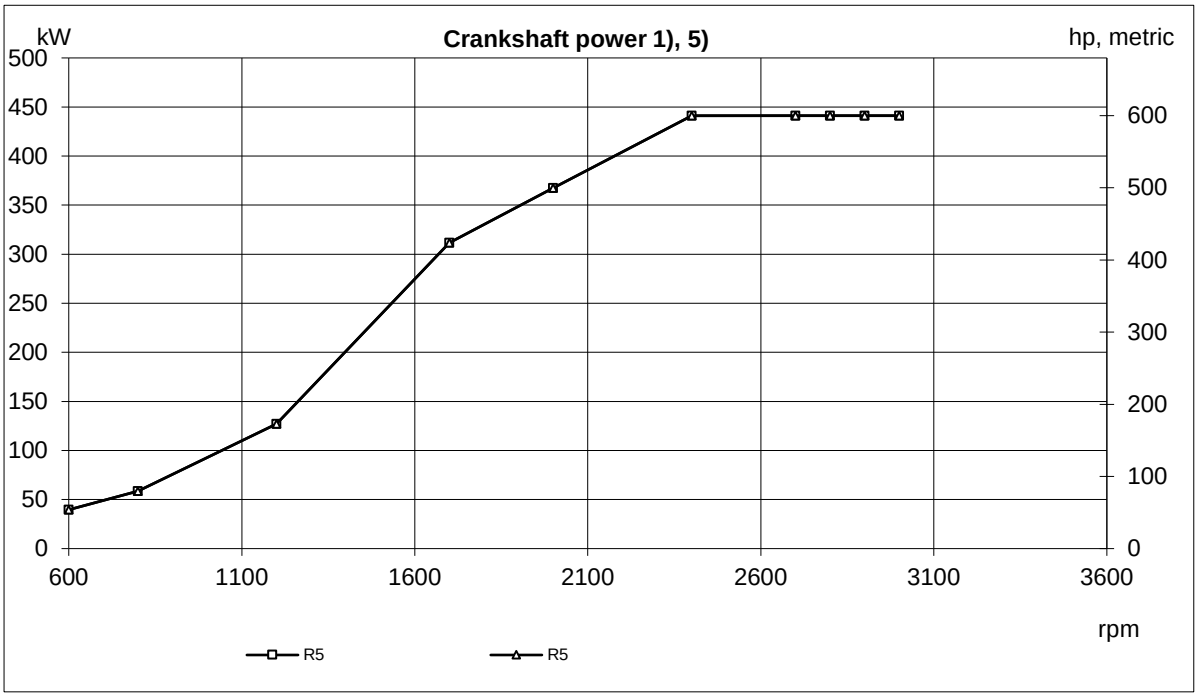
Technical data - Drive unit

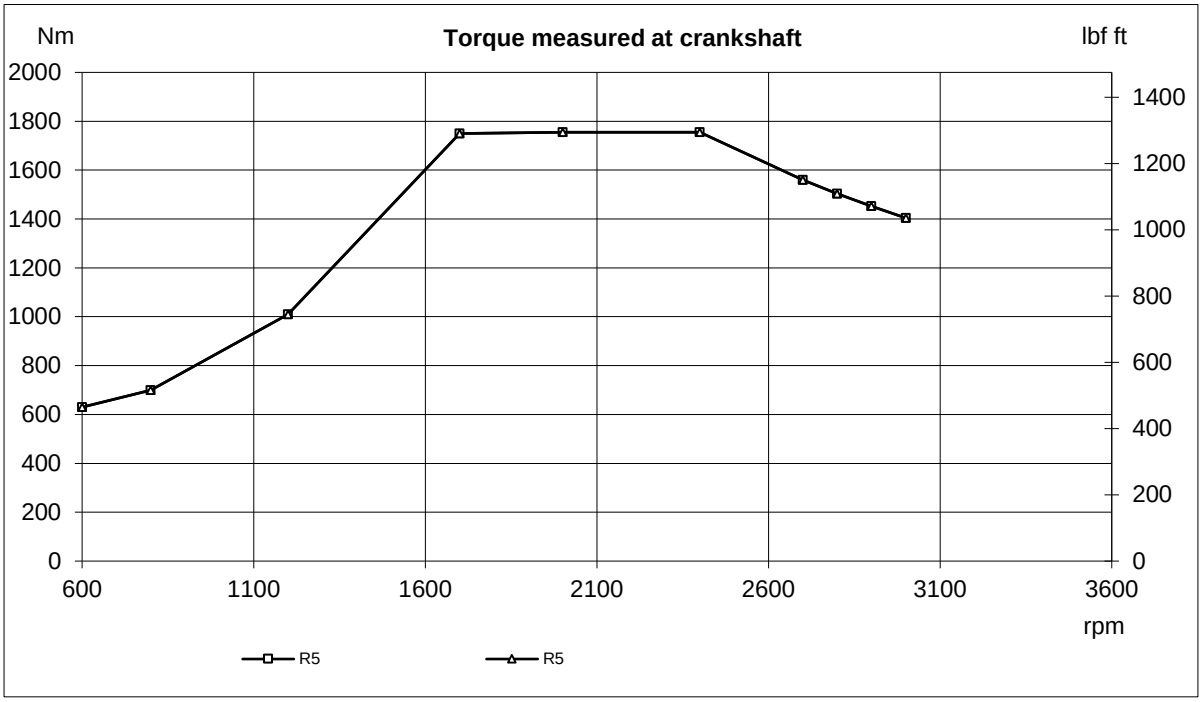
Drive line		D8 IB
Transmission type		ZF286A
Gear ratio (total)		1,75:1, 1,99:1, 2,21:1
Steering angle, max.		N/A
Total weight of drive unit (1)	kg	99
Oil capacity, approx.	litres	5,3-6
Oil volume difference MIN-MAX	litres	0,7
Oil type		See ZF manual
Propeller range		N/A (2)

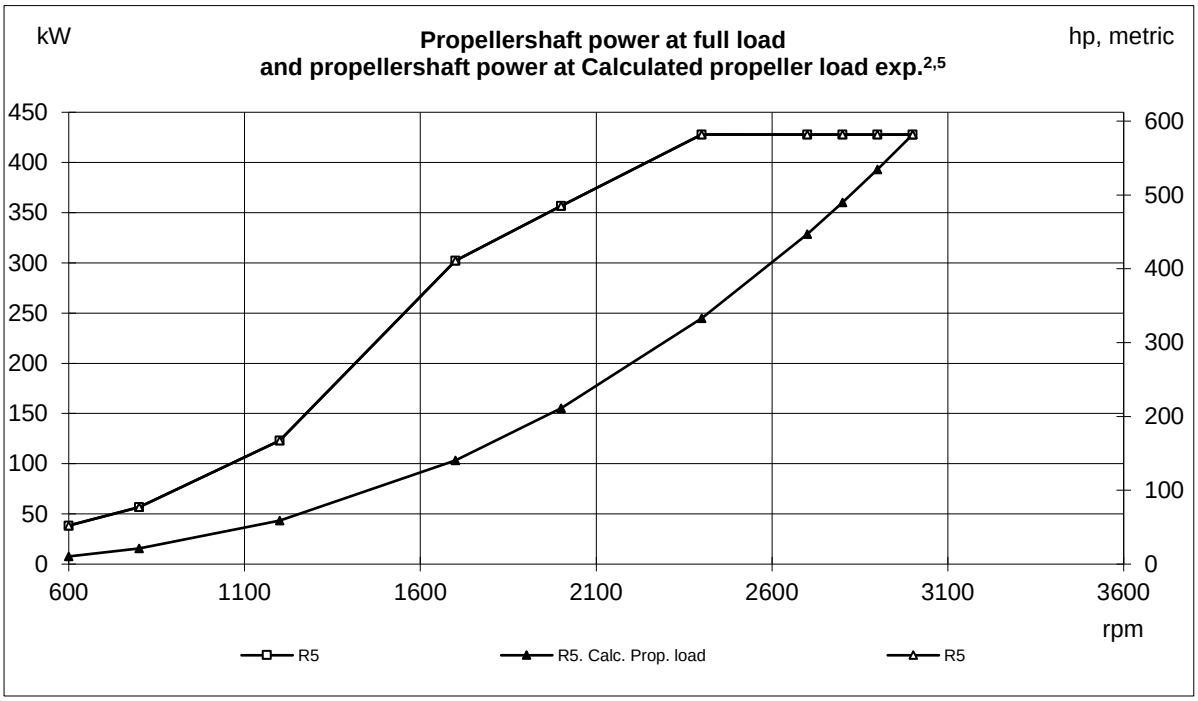
(1) Dry
(2) use Marine Propulsion SW

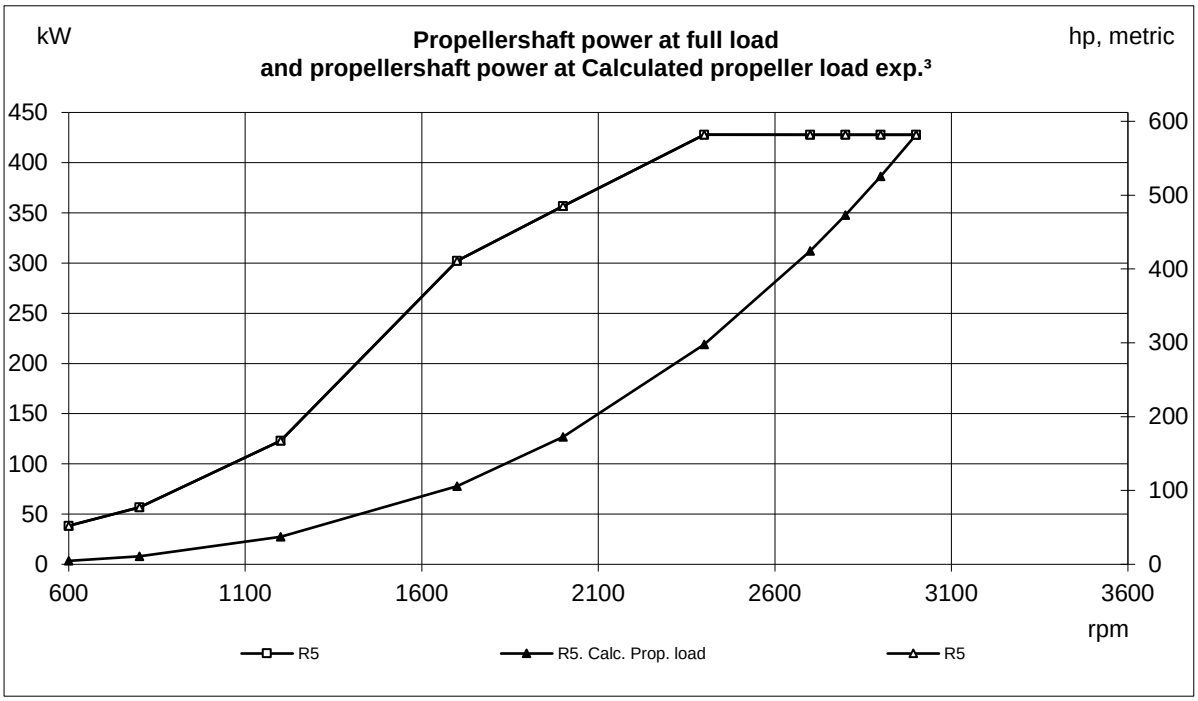
Drive line		D8 IB
Transmission type		ZF286IV
Gear ratio (total)		2,01:1, 2,32:1, 2,54:1
Steering angle, max.		N/A
Total weight of drive unit (1)	kg	162
Oil capacity, approx.	litres	4,4-5
Oil volume difference MIN-MAX	litres	0,6
Oil type		See ZF manual
Propeller range		N/A (2)

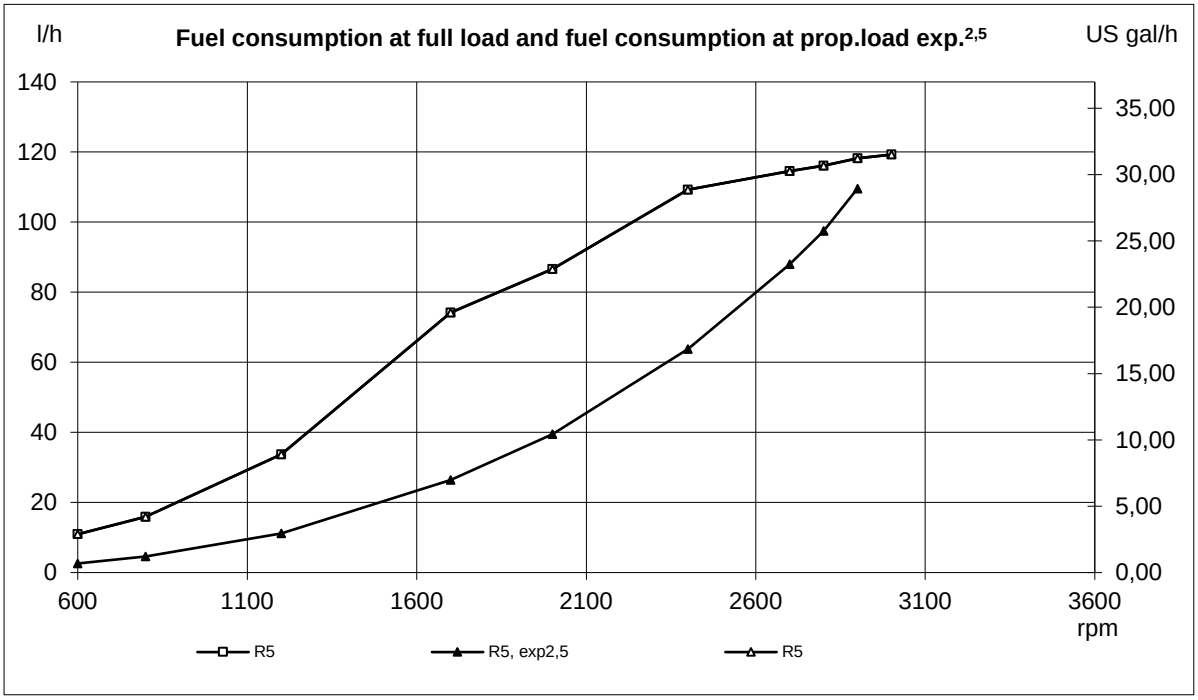
Drive line		D8 IB
Transmission type		ZF305A
Gear ratio (total)		1,73:1, 2,04:1, 2,18:1
Steering angle, max.		N/A
Total weight of drive unit (1)	kg	122
Oil capacity, approx.	litres	5-6
Oil volume difference MIN-MAX	litres	1
Oil type		See ZF manual
Propeller range		N/A (2)

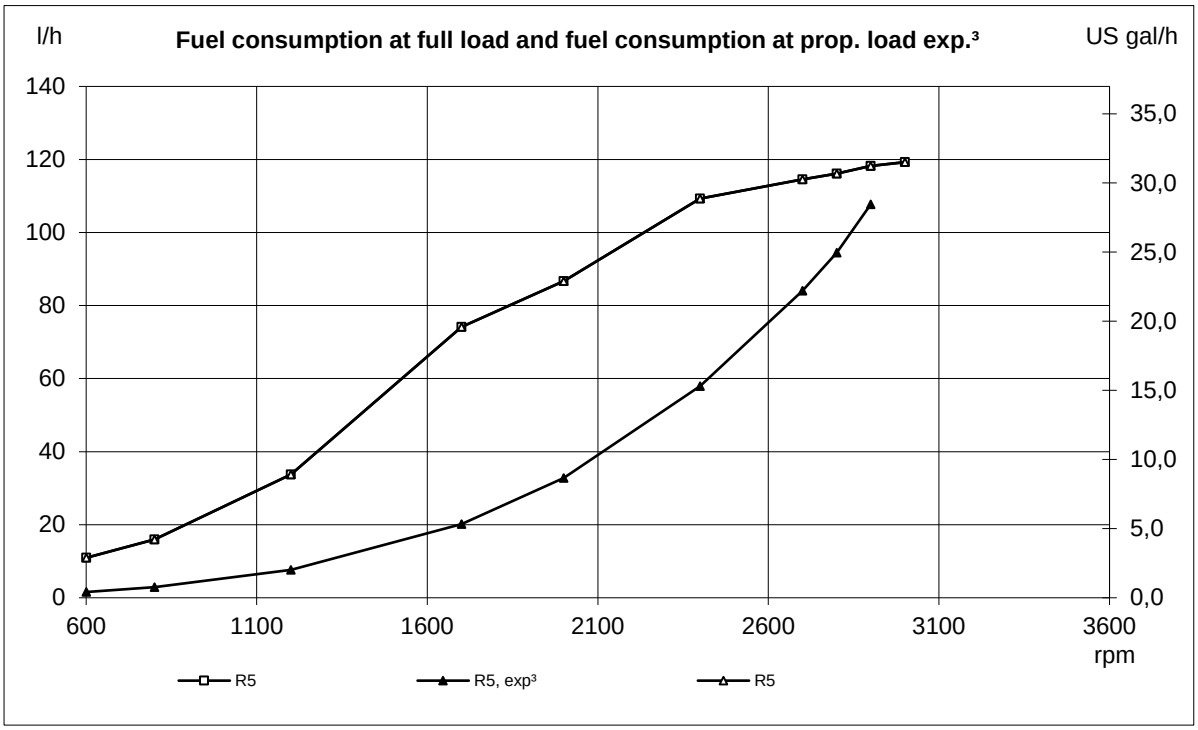

kW
Crankshaft power 1), 5)
hp, metric
500
450
400
350
300
250
200
150
100
50
0
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5

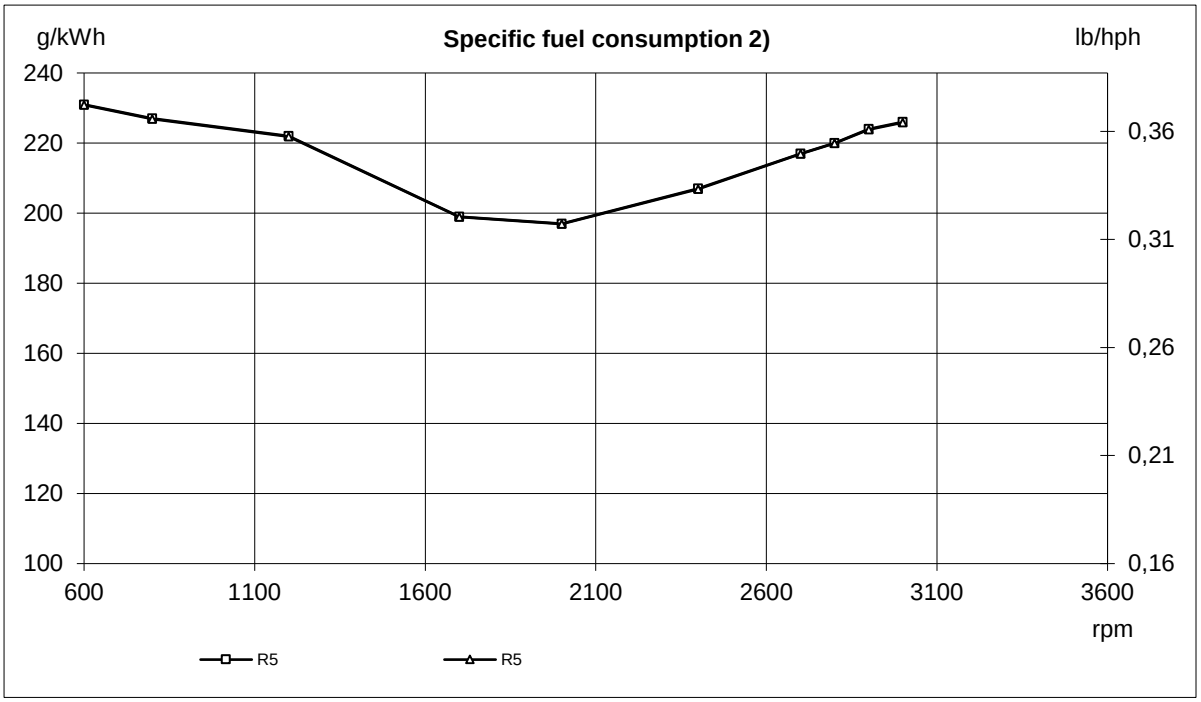

Nm
Torque measured at crankshaft
lbf ft
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1400
1200
1000
800
600
400
200
0
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5

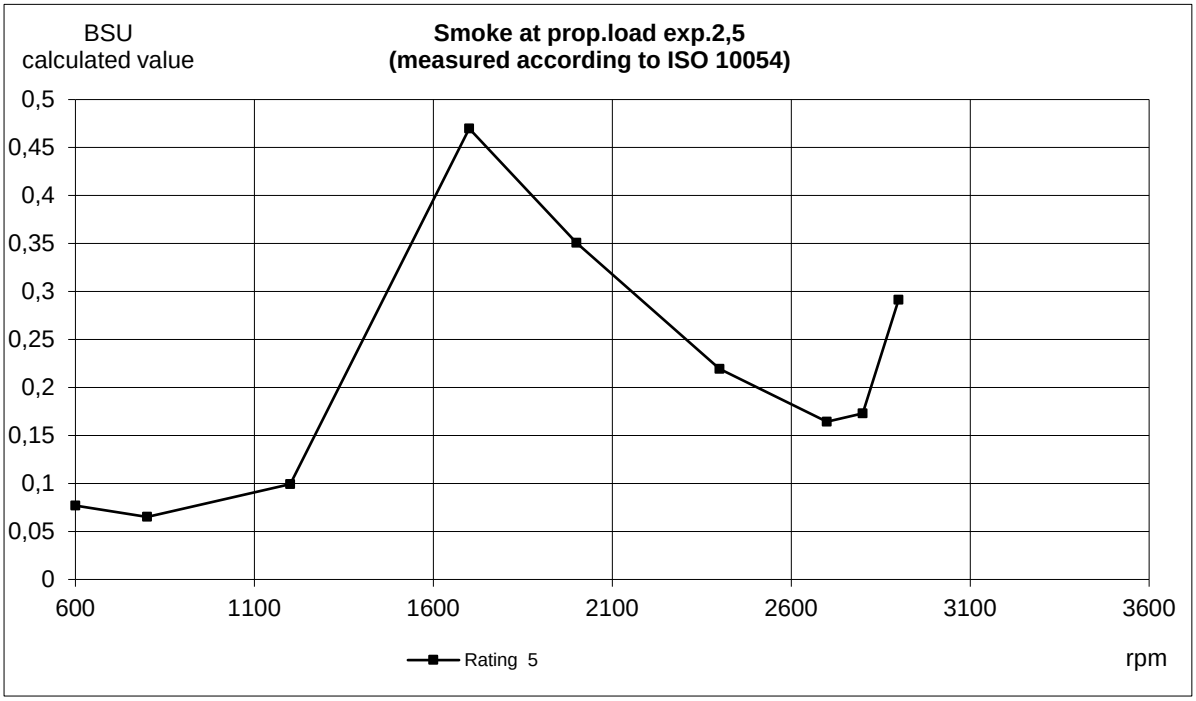

kW
Propellershaft power at full load
and propellershaft power at Calculated propeller load exp.2,5
hp, metric
450
400
350
300
250
200
150
100
50
0
600
500
400
300
200
100
0
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5. Calc. Prop. load
R5

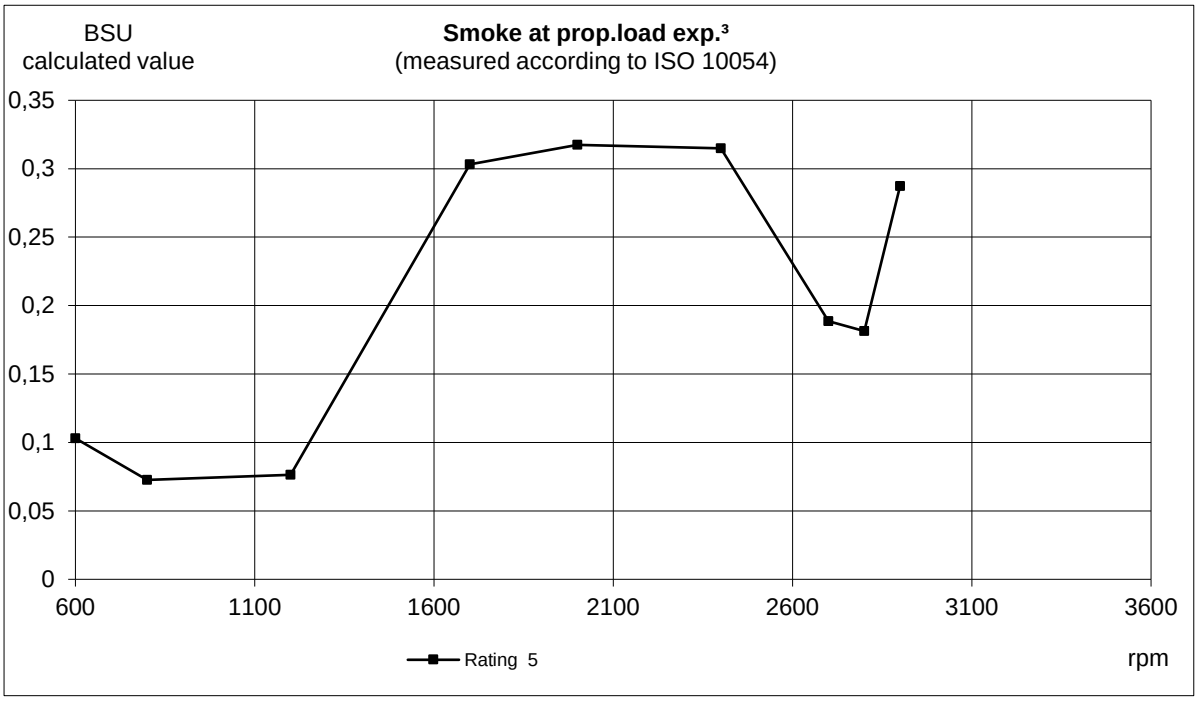

kW
Propellershaft power at full load
and propellershaft power at Calculated propeller load exp.3
hp, metric
450
400
350
300
250
200
150
100
50
0
600
500
400
300
200
100
0
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5. Calc. Prop. load
R5

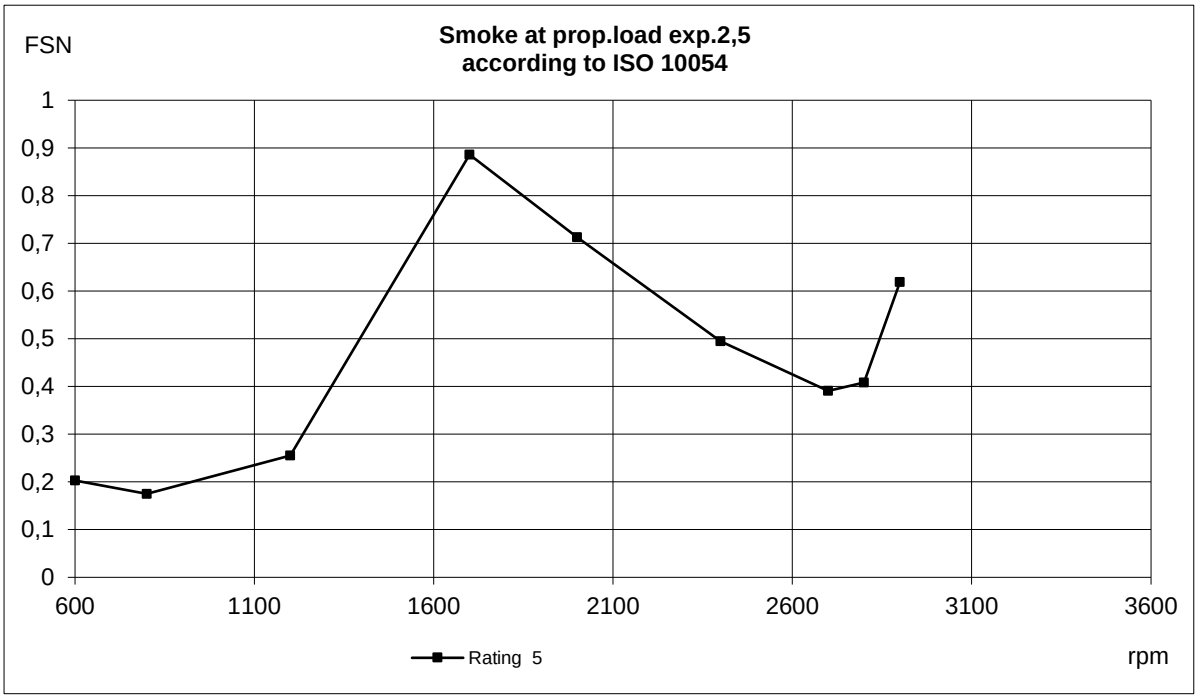

l/h
Fuel consumption at full load and fuel consumption at prop.load exp.2,5
US gal/h
140
120
100
80
60
40
20
0
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5, exp2,5
R5

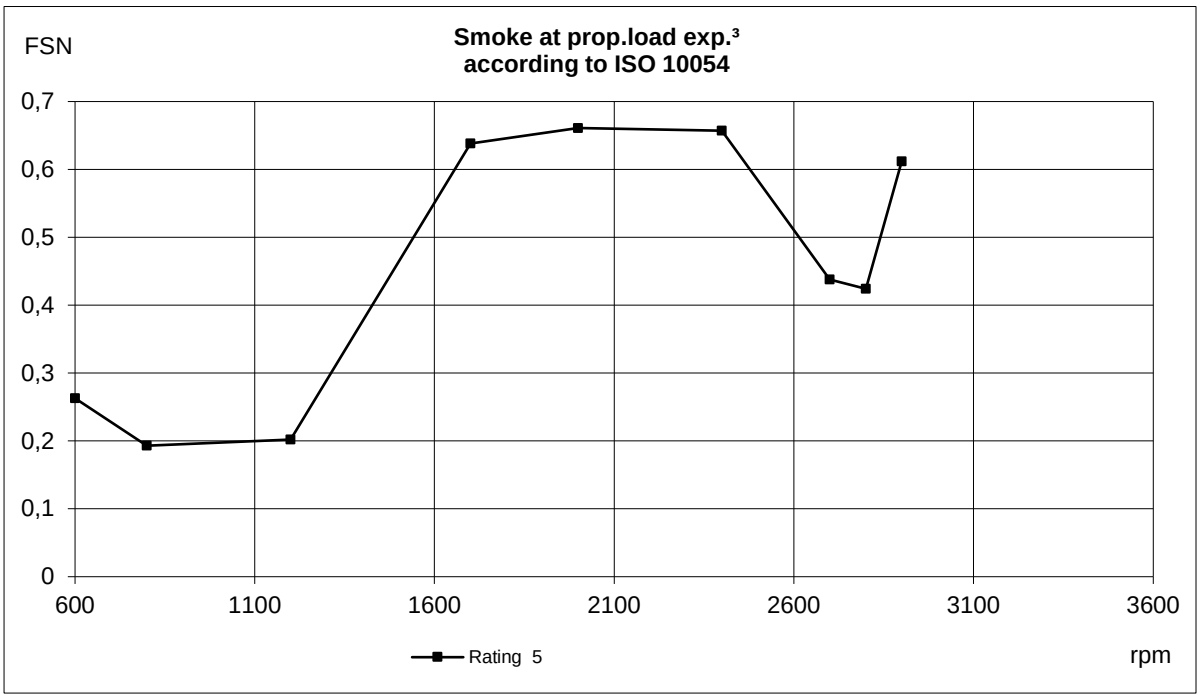

l/h
Fuel consumption at full load and fuel consumption at prop. load exp.3
US gal/h
140
120
100
80
60
40
20
0
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5, exp3
R5

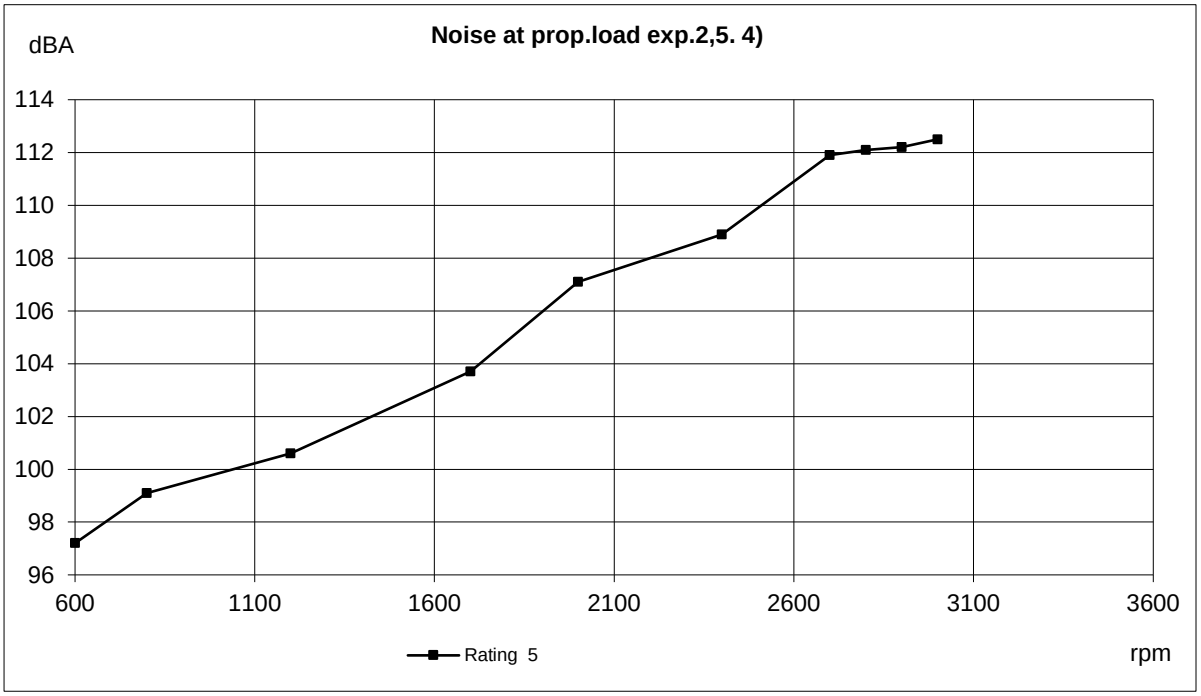

g/kWh
Specific fuel consumption 2)
lb/hph
240
220
200
180
160
140
120
100
0,36
0,31
0,26
0,21
0,16
600
1100
1600
2100
2600
3100
3600
rpm
R5
R5

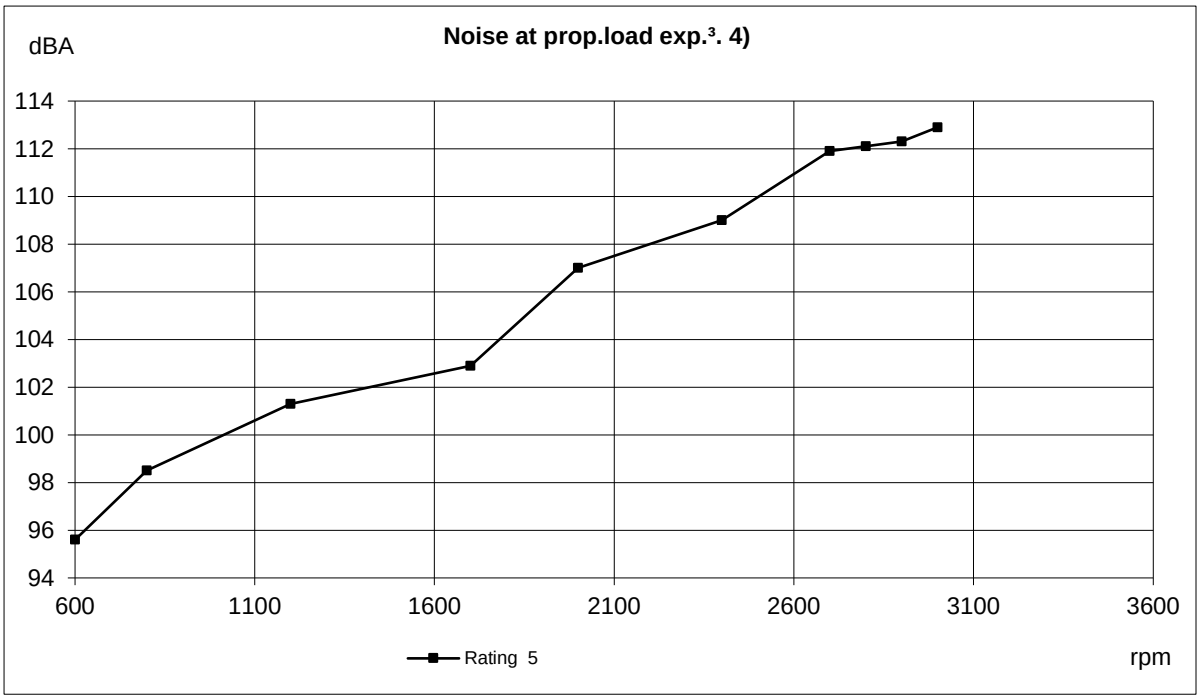

BSU
calculated value
Smoke at prop.load exp.2,5
(measured according to ISO 10054)
0,5
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
600
1100
1600
2100
2600
3100
3600
Rating 5
rpm


BSU
calculated value
Smoke at prop.load exp.3
(measured according to ISO 10054)
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
600
1100
1600
2100
2600
3100
3600
Rating 5
rpm


Smoke at prop.load exp.2,5
according to ISO 10054
FSN
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
600
1100
1600
2100
2600
3100
3600
Rating 5
rpm


Smoke at prop.load exp.³
according to ISO 10054
FSN
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
600
1100
1600
2100
2600
3100
3600
Rating 5
rpm

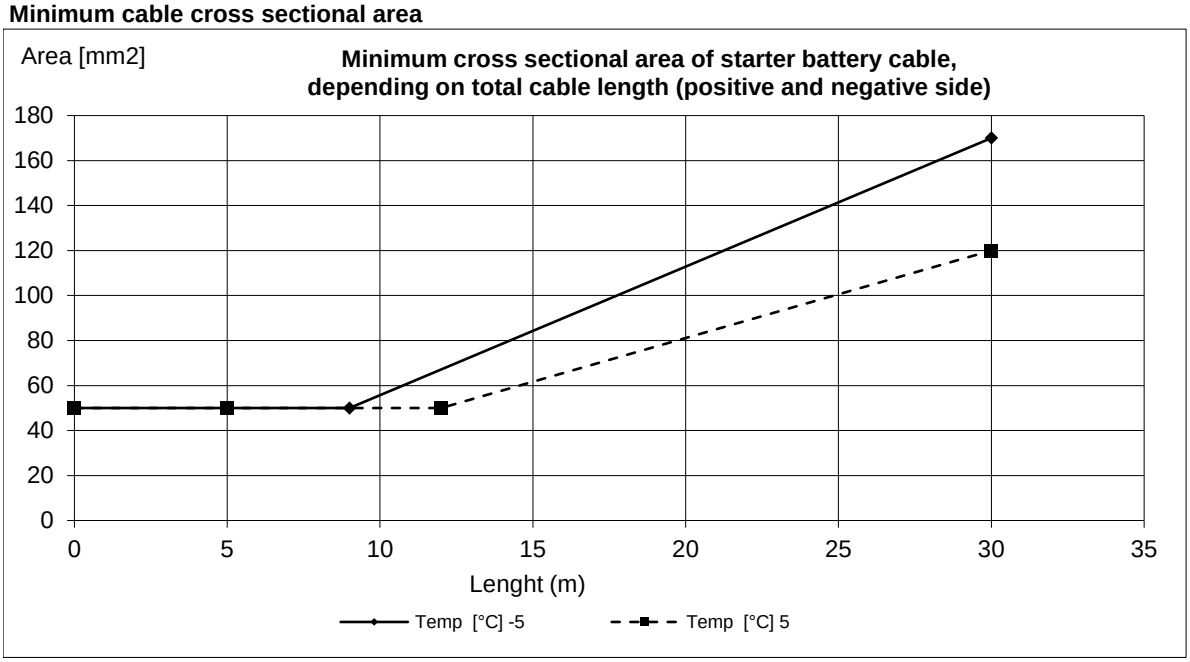

Noise at prop.load exp.2,5. 4)
dBA
114
112
110
108
106
104
102
100
98
96
600
1100
1600
2100
2600
3100
3600
Rating 5
rpm


Noise at prop.load exp.³. 4)
dBA
114
112
110
108
106
104
102
100
98
96
94
600
1100
1600
2100
2600
3100
3600
Rating 5
rpm

Battery capacity

Temp [°C]	Min battery size [Ah]	CCA EN (Cold cranking Amps) [A]	Max line resistance @ 20°C [mΩ]	Recommended max cable resistance @ 20°C [mΩ]	Min cross sectional area (due to heat increase) [mm²]
5	90	670 EN	5	4	50
-5	100	720 EN	4	3	50

Minimum cable cross sectional area



Fuses size:

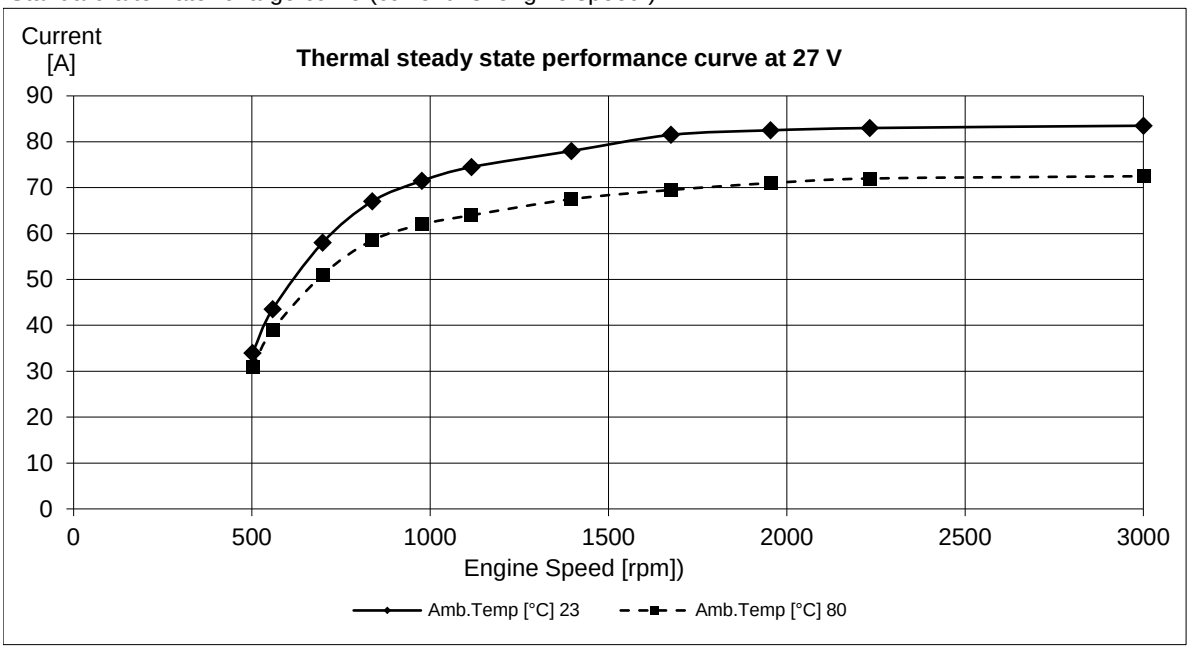
	[A]
Engine:	10
Control system:	10

Max current consumption during normal operation:

	[A]
Engine :	4,5

Alternator data:

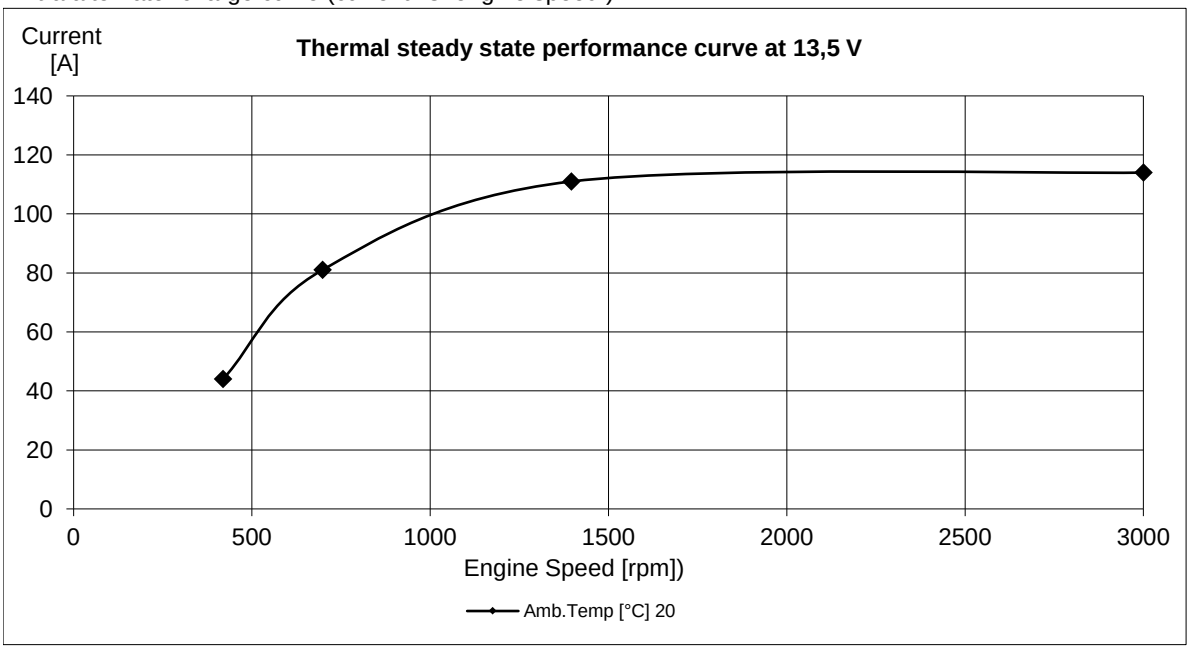
Standard alternator charge curve (current vs. engine speed.)



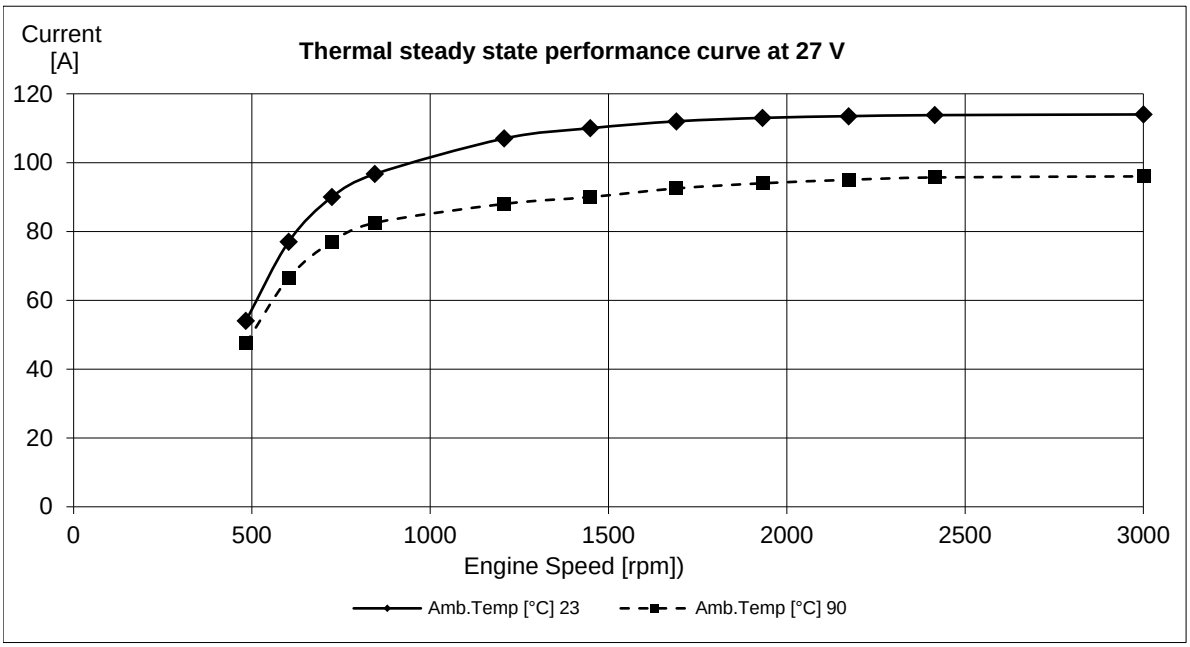
Constant charge voltage: [V]	28,3	+/- 0,3

Alternator data:

Extra alternator charge curve (current vs. engine speed.)



Constant charge voltage: [V]	14,3	+/- 0,3



Constant charge voltage: [V]	28,3	+/- 0,3