

VOLVO PENTA	Document No	Issue Index
	23609279	01

D6-440 IPS**General**

4-stroke direct injected, turbocharged and aftercooled diesel engine

Engine Rating		5
Number of cylinders		6
No of valves		24
Displacement, total	litres in ³	5.50 335.6
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	103 4.06
Stroke	mm in	110 4.33
Compression ratio		18.0:1
Compression pressure at 240 rpm	MPa psi	
Max. static forward inclination:	°	0
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	10
Max. intermittent backward inclination while running:	°	20
Max. intermittent side inclination while running:	°	20 or 30 for max 30 sec
Idling speed	rpm	600-650
Rated speed R5	rpm	3700
Governed speed R5	rpm	3830
Propeller selection range R5		3650-3830
Dry weight engine BT	kg lb	645 1422
Dry weight with drive IPS10	kg lb	920 2028
	kg lb	
	kg lb	
	kg lb	

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

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Performance	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Crankshaft power 1), 5)	kW	77	144	214	267	299	320	323	324	324	324
	hp	105	196	291	363	407	435	439	440	440	440
Propeller shaft power 1) (At full load)	kW	74	138	205	256	287	307	310	311	311	311
	hp	101	188	279	349	390	418	422	422	422	422
Propellershaft power at prop. load x ^{2.5}	kW	12	32	67	117	155	184	216	270	311	311
	hp	16	44	91	159	210	250	294	368	422	423
Propellershaft power at prop. load x ³	kW	6	21	49	96	135	166	201	263	311	311
	hp	8	28	67	130	183	225	273	358	422	423
Torque at crankshaft 2)	Nm	735.3	916.7	1022	1020	1020	1019	963.9	882.6	834.9	812.9
	lbf ft	542	676	754	752	752	751	711	651	616	600
Mean piston speed	m/s	3.7	5.5	7.3	9.2	10.3	11.0	11.7	12.8	13.6	13.9
	ft/s	12.0	18.0	24.1	30.1	33.7	36.1	38.5	42.1	44.5	45.7
Effective mean pressure 2)	MPa	1.68	2.09	2.33	2.33	2.33	2.33	2.20	2.02	1.91	1.86
	psi	243.7	303.8	338.6	338.0	338.0	337.6	319.5	292.5	276.7	269.4
Max combustion pressure 2)	MPa	16.8	18.3	19.4	19.8	19.2	19.0	18.3	17.7	17.7	18.1
	psi	2441	2659	2818	2875	2789	2763	2653	2560	2571	2632

Lubricating system

Specific lubricating oil consumption.	g/kWh	< 0.2
Max. oil volume including filters for all allowed installation inclinations:	litres	20
	US gal	5.28
Max. oil volume excluding filters for all allowed installation inclinations:	litres	18.5
	US gal	4.89
Min. oil volume excluding filters for all allowed installation inclinations:	litres	15
	US gal	3.96

Fuel system	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Specific fuel consumption 2)	g/kWh	226	215	210	207	203	206	208	217	222	225
	lb/hph	0.366	0.348	0.34	0.335	0.329	0.334	0.337	0.352	0.36	0.365
Fuel consumption, Test cycle E5 EU	g/kWh	220									
	lb/hph	0.36									
Fuel consumption at prop. load x ^{2.5}	l/h	3.7	8.9	17.5	30.5	40.5	49.3	57.4	73.5	85.9	87.2
	US gal/h	1.0	2.3	4.6	8.1	10.7	13.0	15.2	19.4	22.7	23.0

Fuel system	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Fuel consumption at prop. load x ³	l/h	2.7	6.3	13.5	25.8	35.6	44.8	53.3	71.4	85.9	87.2
	US gal/h	0.7	1.7	3.6	6.8	9.4	11.8	14.1	18.9	22.7	23.0
Fuel consumption at full load	l/h	20.8	37.1	53.8	66.1	72.6	78.9	80.4	84.0	85.9	87.1
	US gal/h	5.5	9.8	14.2	17.5	19.2	20.8	21.2	22.2	22.7	23.0

Full load performance at rated speed

Fuel inlet temperature	°C	40
	°F	104
Fuel return temperature from engine	°C	64
	°F	147.2
Fuel consumption	l/h	94.2
	US gal/h	24.89
Fuel inlet flow to engine	l/h	133
	US gal/h	35.13
Fuel return flow from engine	l/h	39
	US gal/h	10.30

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Intake and exhaust system	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Specific exhaust heating effect in percent of crankshaft power	%	26	30	39	57	56	58	58	63	65	67
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	°C	361	402	422	407	405	401	386	381	379	385
	°F	682	756	792	765	761	754	727	718	714	725
Permitted exhaust back pressure after turbocharger at rated speed. (Installed back pressure)	kPa							Max	30		
	psi								4.4		
	kPa							Min	10		
	psi								1.5		

Intake and exhaust system	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPa	m³/min	5.3	9.4	13.7	17.6	19.6	22.0	23.3	25.2	26.3	27.0
	cu.ft./min	187.2	332	483.8	621.5	692.2	776.9	822.8	889.9	928.8	953.5
Charge air pressure Inlet manifold	kPa	112	154	185	197	198	215	214	216	216	220
	psi	16.2	22.3	26.8	28.6	28.7	31.2	31.0	31.3	31.3	31.9
Exhaust gas flow	m³/min	12.1	22.3	32.2	38.7	41.8	45.3	46.0	48.0	49.0	50.1
	cu.ft./min	427.3	787.5	1137	1367	1476	1600	1624	1695	1730	1769

Cooling system	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Radiated heat of crankshaft power at full load.	kW	3.5	6.5	8.4	8.0	8.9	9.6	9.7	9.7	9.7	9.7
Heat rejection to charge air cooler of crankshaft power at full load.	kW	11.7	26.8	42.6	45.4	60.8	73.9	79.1	90.2	96.2	99.9
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, of crankshaft power at full load.	kW	61	103	143	173	188	223	206	231	235	224
Coolant flow with fully open thermostat and std cooling system	l/min	96	144	192	240	269	289	308	334	349	358
	cu.ft./min	3.4	5.1	6.8	8.5	9.5	10.2	10.9	11.8	12.3	12.6
Extra water pump flow through charge air cooler	l/min cu.ft./min										
Max. pump pressure at extra pump pressure side (pressure set system)	kPa psi										
Max. permissible temperature on coolant in engine outlet	°C	55									
	°F	131									
Coolant volume engine, including heat exchanger and charge air cooler	litres	16									
	US gal.	4.23									
Max. additional coolant for cabin heater etc. with std. Expansion tank	litres	5									
	US gal.	1.32									
Maximum coolant flow to cabin heater etc.	l/min	30									
	cu.ft./min	1.06									
Thermostat, start open at	°C	78									
	°F	172									
Thermostat, fully open at	°C	90									
	°F	194									

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Raw water circuit	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Nominal raw water design flow	l/min	77	111	144	174	189	198	207	218	222	225
	cu.ft./min	2.7	3.9	5.1	6.1	6.7	7.0	7.3	7.7	7.8	7.9
Nominal raw water pump pressure head at design flow.	kPa	23	47	77	111	128	137	148	162	174	178
	psi	3.3	6.8	11.2	16.1	18.6	19.9	21.5	23.5	25.2	25.8
Maximum raw water pump suction head	kPa	-30									
	psi	-4.4									
Maximum additional pressure drop excl. reverse gear oil cooler	kPa										
	psi										
Pressure drop over reverse gear oil cooler (optional equipment)	kPa										
	psi										
Maximum raw water temperature entering heat exchanger	°C	32									
	°F	90									

1 circuit keel cooling system	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Design point for keel cooler, engine outlet temperature	°C										
	°F										
Maximum temperature to engine from external cooling system circuit	°C										
	°F										
Maximum temperature to engine inlet from external cooling system circuit	°C										
	°F										
Coolant flow through keel cooler at design point	l/min										
	cu.ft./min										
Maximum coolant flow through keel cooler	l/min										
	cu.ft./min										
Pressure drop in external circuit, including piping	kPa										
	psi										
Coolant volume engine	litres										
	US gal.										

1 1/2 circuit keel cooling system (Two circuit	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Design point for keel cooler, engine outlet temperature	°C										
	°F										
Maximum temperature to charge air cooler from external cooling system circuit	°C										
	°F										
Coolant flow through keel cooler at design point	l/min										
	cu.ft./min										
Maximum coolant flow through keel cooler	l/min										
	cu.ft./min										
Pressure drop in external circuit, including piping	kPa										
	psi										
Coolant volume engine	litres										
	US gal.										

2 circuit keel cooling system, LT	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Maximum temperature to charge air cooler from external LT-cooling system	°C										27
	°F										81
Coolant flow through keel cooler, LT-cooling system circuit	l/min										225
	cu.ft./min										7.9
Pressure drop in external LT-cooling system circuit, including piping	kPa	50									
	psi	7.3									
Coolant volume charge air cooler	litres	2									
	US gal.	0.53									

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2 circuit keel cooling system, HT	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Design point for keel cooler, engine outlet temperature	°C										83
	°F										181
Maximum temperature to engine from external HT-cooling system circuit	°C										62
	°F										144
Coolant flow through keel cooler, HT-cooling system circuit at design point	l/min										160
	cu.ft./min										5.7
Maximum coolant flow through keel cooler, HT-cooling system circuit	l/min										358
	cu.ft./min										12.6
Pressure drop in external HT-cooling system circuit, including piping	kPa	70									
	psi	10.2									
Coolant volume engine	litres	16									
	US gal.	4.23									

Emissions	rpm	1000	1500	2000	2500	2800	3000	3200	3500	3700	3800
Smoke at prop. load $x^{2.5}$	*BSU	0.1	0.1	0.2	0.3	0.2	0.2	0.3	0.3	0.6	0.6
Smoke at prop. load x^3	*BSU	0.1	0.1	0.2	0.3	0.3	0.3	0.2	0.3	0.4	0.6
Noise at prop. load $x^{2.5}$. 4)	dBA	99.5	102.8	105.3	108.6	109.6	111.5	112.1	114.8	115.5	115.3
Noise at prop. load x^3 . 4)	dBA	98.5	102.9	104.5	107.9	109.3	110.6	112.1	114.4	115.5	115.3

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

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Sensors : Control and Monitoring System							
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	Engine protection action
Coolant level switch	Digital	ON/OFF		30 sec from start / 5 sec	Low (ON / Closed)	NA	Warning only
Coolant temperature	50-0 kΩ	-40 - 140	°C	30 sec from start / 5 sec	96	99	See derating map
Fuel temperature	50-0 kΩ	-40 - 140	°C		60	NA	Warning only
Engine speed cam	Frequency		rpm	Instant	Lost signal	NA	Warning only
Engine speed crank	Frequency		rpm	Instant	Lost signal	NA	Warning only
Oil level sensor	Digital	ON/OFF		30 sec from start / 5 sec	Low level	NA	Warning only
Oil temperature	PT1000	-40 - 150	°C	30 sec from start / 5 sec	132	135	See derating map
Water In fuel switch	Digital	ON/OFF		All the time	Water in fuel	NA	Warning only
Wet Exhaust temp	PT200	0 - 850	°C	30 sec from start / 5 sec	90	95	See derating map

Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Comment
					0 rpm	1200 rpm	2000 rpm	2500 rpm	3600 rpm	
Charge air temperature	50-0 kΩ	-40 - 130	°C		0 rpm	1200 rpm	2000 rpm	2500 rpm	3600 rpm	
Warning Level			°C	30 sec from start / 5 sec	100	100	70	70	70	
Derating Level			°C							See derating map
Fuel pressure	0,5-4,5 V	0-200	kPa		0 rpm	600 rpm	1600 rpm	2600 rpm	3600 rpm	
Warning Level			kPa	30 sec from start / 5 sec	50	50	50	50	50	
Derating Level			kPa	NA	NA	NA	NA	NA	NA	
Oil pressure	0,5-4,5 V	0-700	kPa		0 rpm	600 rpm	1200 rpm	2000 rpm	3600 rpm	
Warning Level			kPa	30 sec from start / 5 sec	-50	75	150	200	230	
Derating Level (30% remain trq.)			kPa	10% trq. decr. per sec	-50	70	120	170	200	

Warning = Yellow Lamp active

Derating = Red Lamp active

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Remarks

Charge Air Temp [°C]	rpm	75°C	80°C	85°C
Remaining torque in %	600	100%	100%	100%
	1600	100%	100%	100%
	2200	100%	75%	50%

Coolant temp [°C]	rpm	99°C	104°C	108°C
Remaining torque in %	600	100%	100%	100%
	1600	100%	85%	75%
	2200	100%	75%	50%

Oil temp [°C]	rpm	135°C	137.5°C	140°C
Remaining torque in %	600	100%	100%	100%
	1600	100%	85%	75%
	2200	100%	75%	50%

Oil pressure [kPa]	rpm	
Remaining torque in %	600	85%
	1600	70%
	2200	50%

Wet exhaust temp [°C]	rpm	95°C	105°C	115°C	125°C
Remaining torque in %	600	100%	100%	100%	100%
	1600	100%	85%	80%	75%
	2200	100%	75%	65%	50%

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Transmission: Control and Monitoring System: DPI Drive							Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	
Gear oil temperature (EVC)	50-0 kΩ	-30 - 130±4%	°C	N/A	95		Warning only
Gear oil pressure (EVC)	Frequency	0-3000±3%	kPa	60 sec from start / 7 sec	700		Warning only

Transmission: Control and Monitoring System: Reverse Gear							Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	
Gear oil temperature (EVC)	50-0 kΩ	-30 - 130±4%	°C	N/A	95		Warning only

Transmission: Control and Monitoring System: IPS Drive							Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	
Gear oil temperature (EVC)	50-0 kΩ	-30 - 130±4%	°C	N/A	95		Warning only
Gear oil pressure (EVC)	Frequency	0-3000±3%	kPa	60 sec from start / 7 sec	700		Warning only

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Technical data - Drive unit

Drive line		D6-IPS400-IPS650
Transmission type		IPS 10
Gear ratio (total)		1,853:1
Steering angle, max.		+/- 26°
Total weight of drive unit (1)	kg	257
Oil capacity, approx.	litres	15
Oil volume difference MIN-MAX	litres	0.5
Oil type		Mobil Mobilube 75W90
Propeller range		T series + TS series

(1) Including oil, exhaust pipe and elbow, clamping ring and various installation components. Propellers are not included in total weight

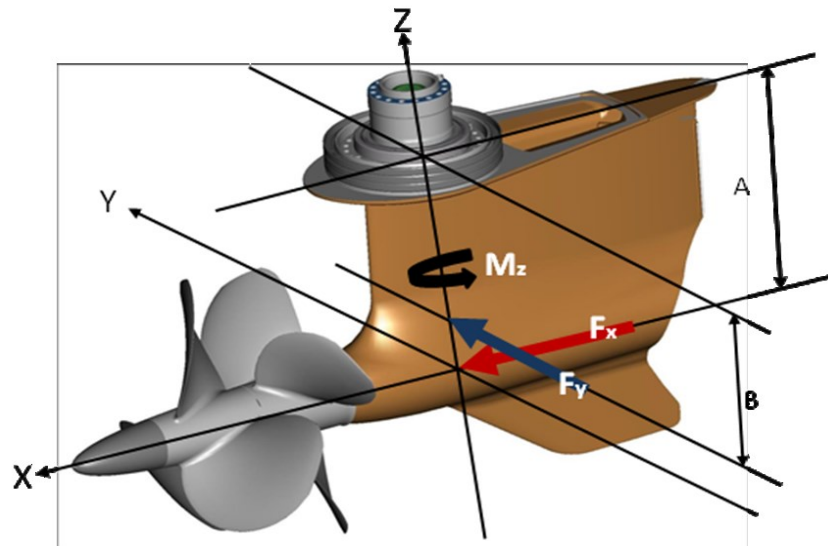
"Generalized maximum load document"for IPS10

Valid products	Drive Unit	Gear Ratio
IPS10	IPS10	1,853:1

Loads provided in chart are single maximum loads i.e. not to be used for fatigue calculations

Speed range (top speed)	Load vektor	Maximum load
14-50 kn	F _x	xx kN
	F _y (+/-)	xx kN
	M _z (+/-)	xx kNm
28-42 kn	F _x	xx kN
	F _y (+/-)	xx kN
	M _z (+/-)	xx kNm

A	xxx mm
B	xxx mm



Important Note!

The above forces and torque are to be used as the base for maximum load in normal operations. Volvo Penta requires however that the detailed guidelines for the structure around the IPS unit are followed in order to ensure structural strength in case of grounding.

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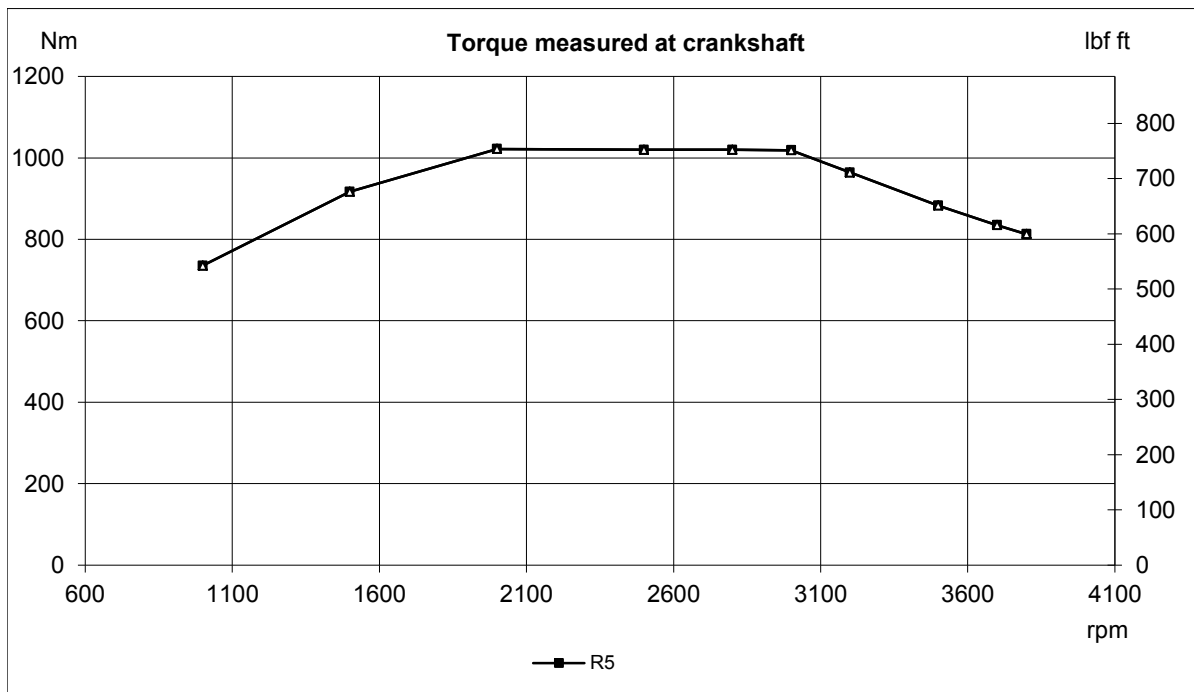
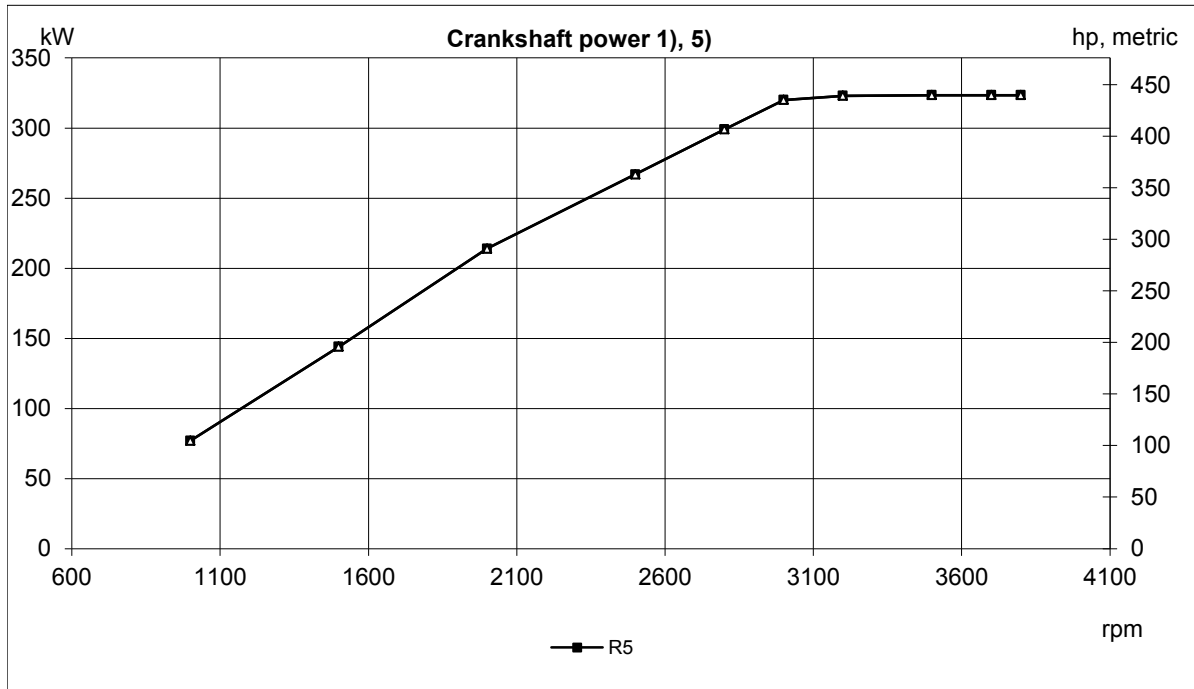
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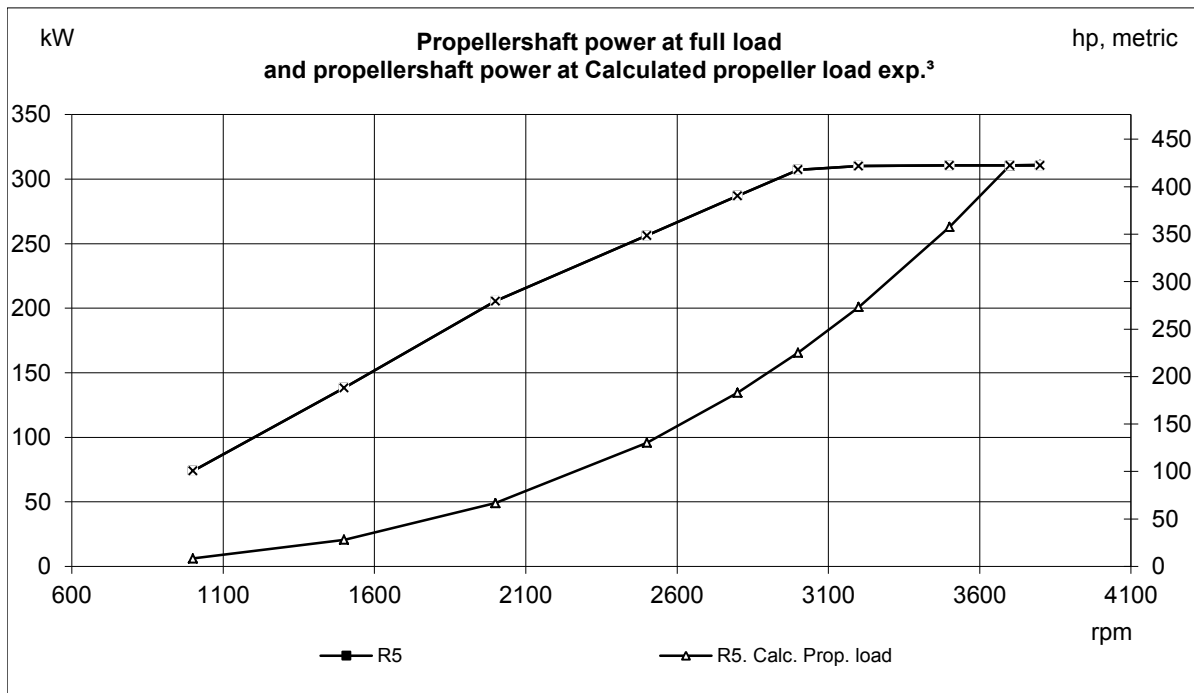
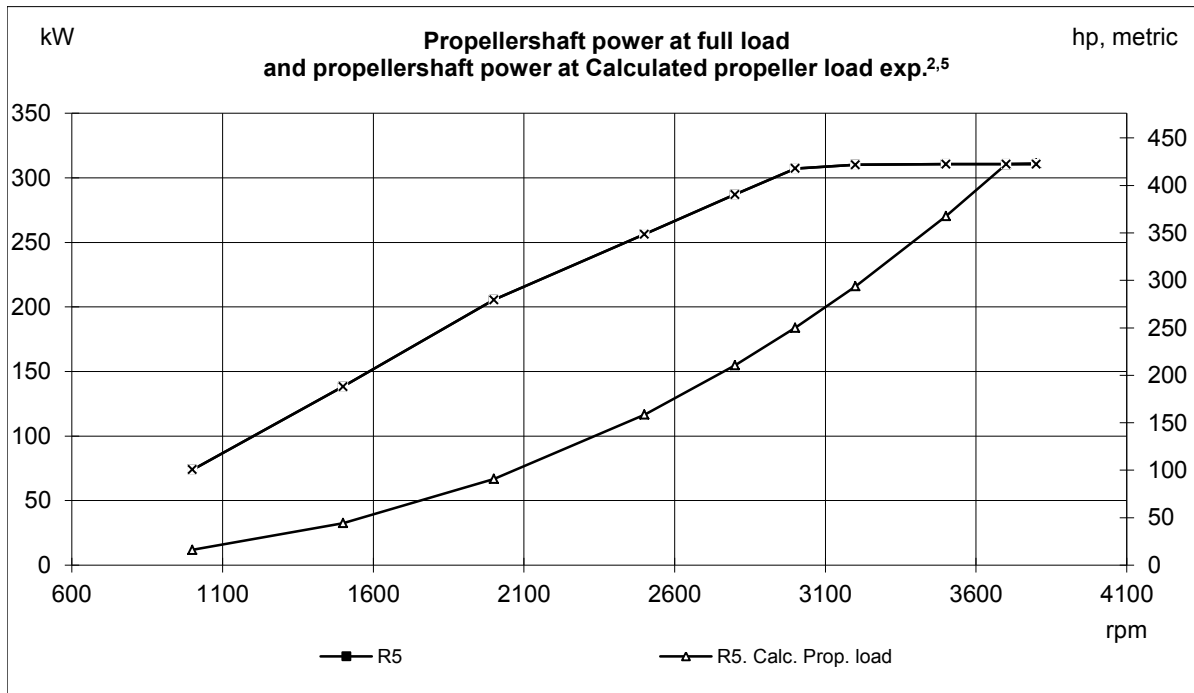
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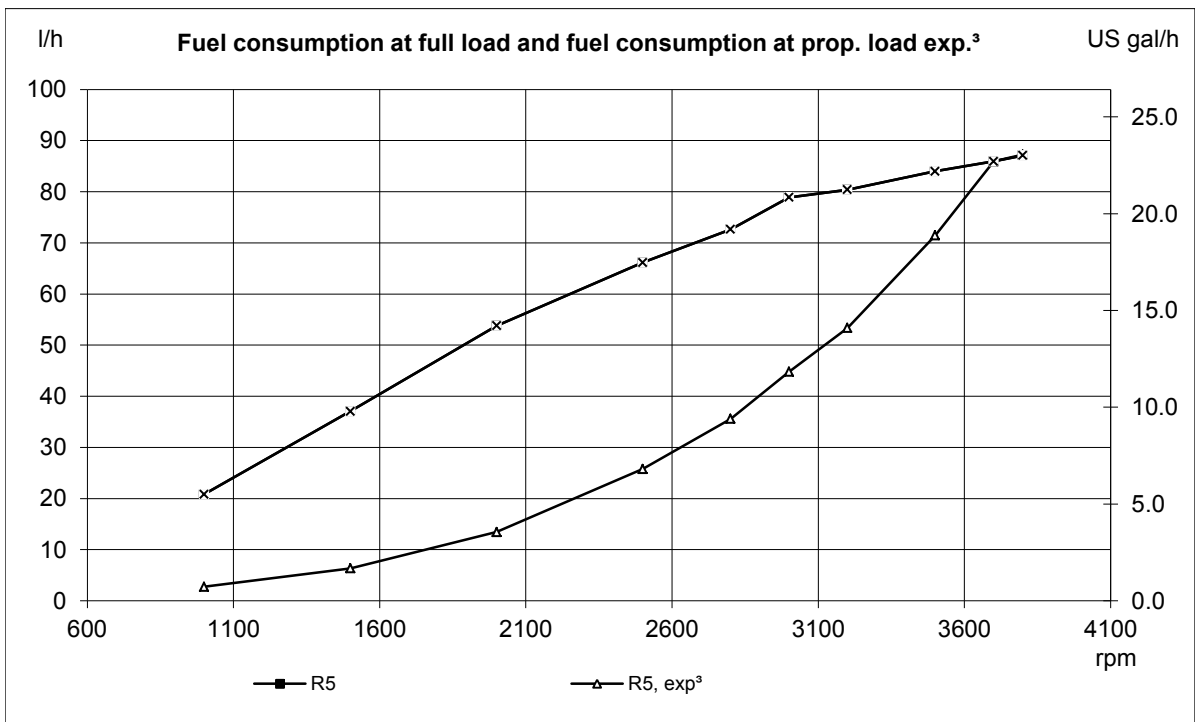
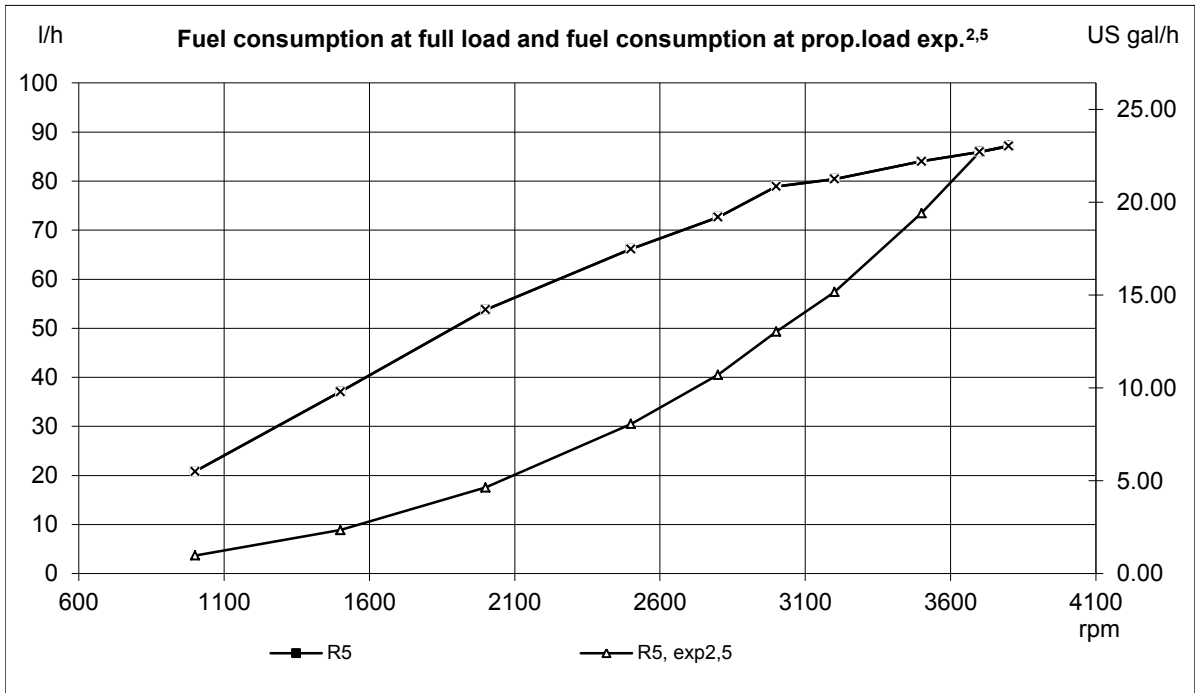
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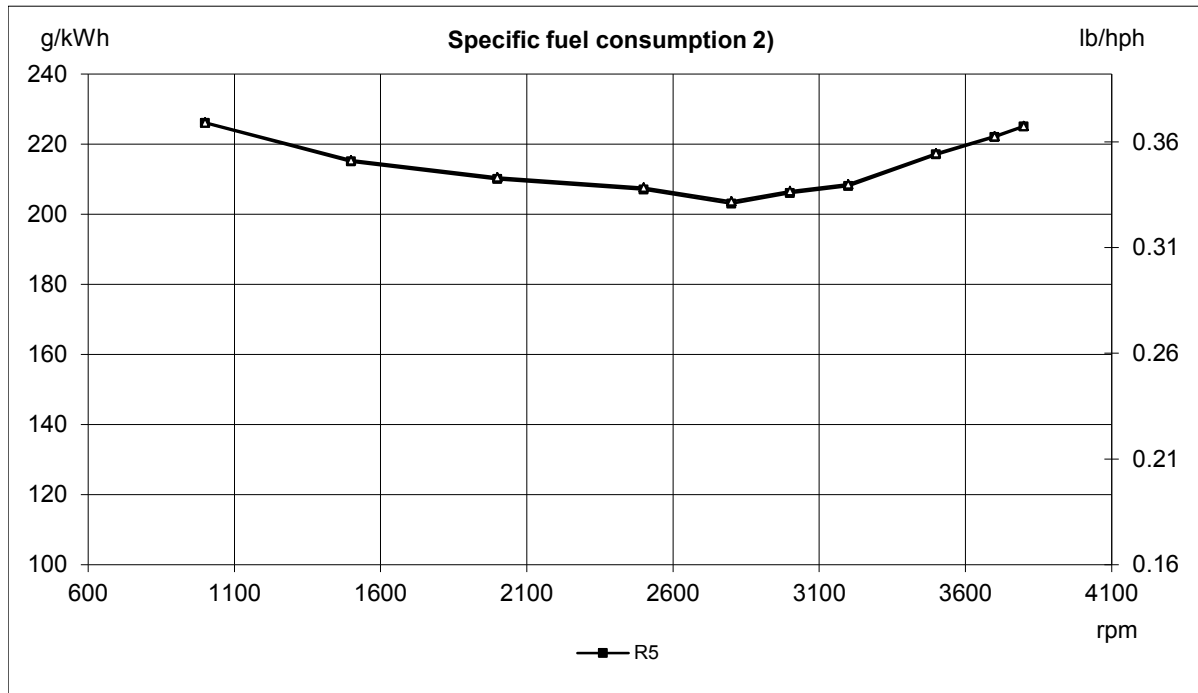
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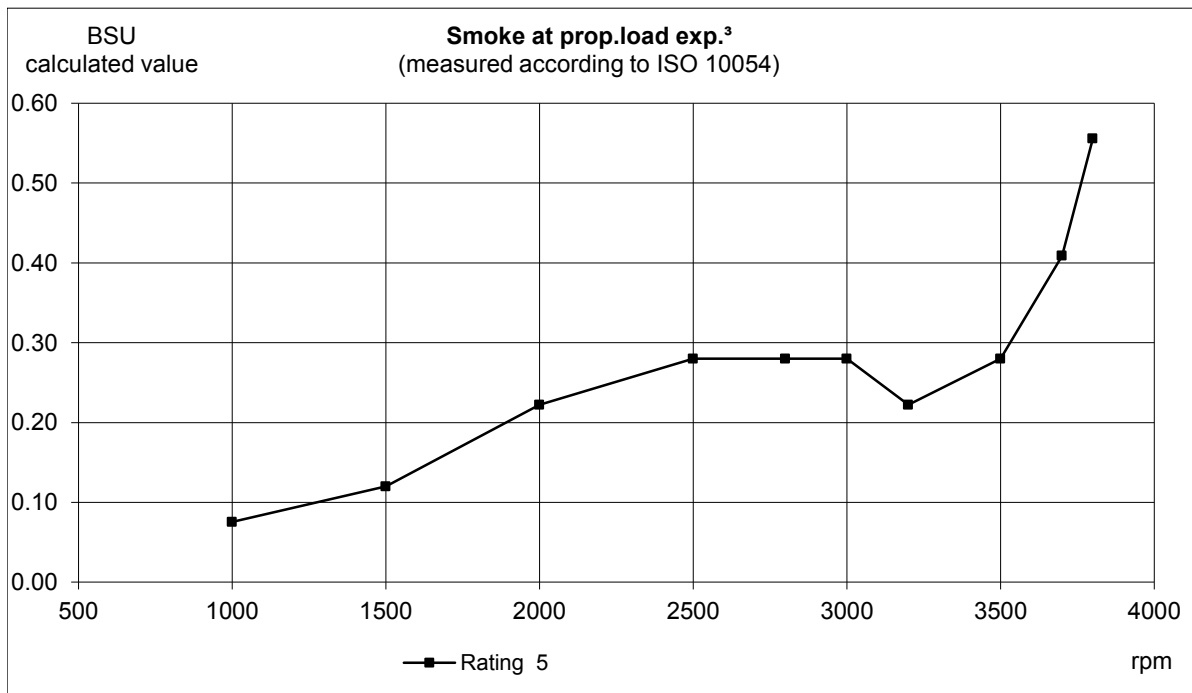
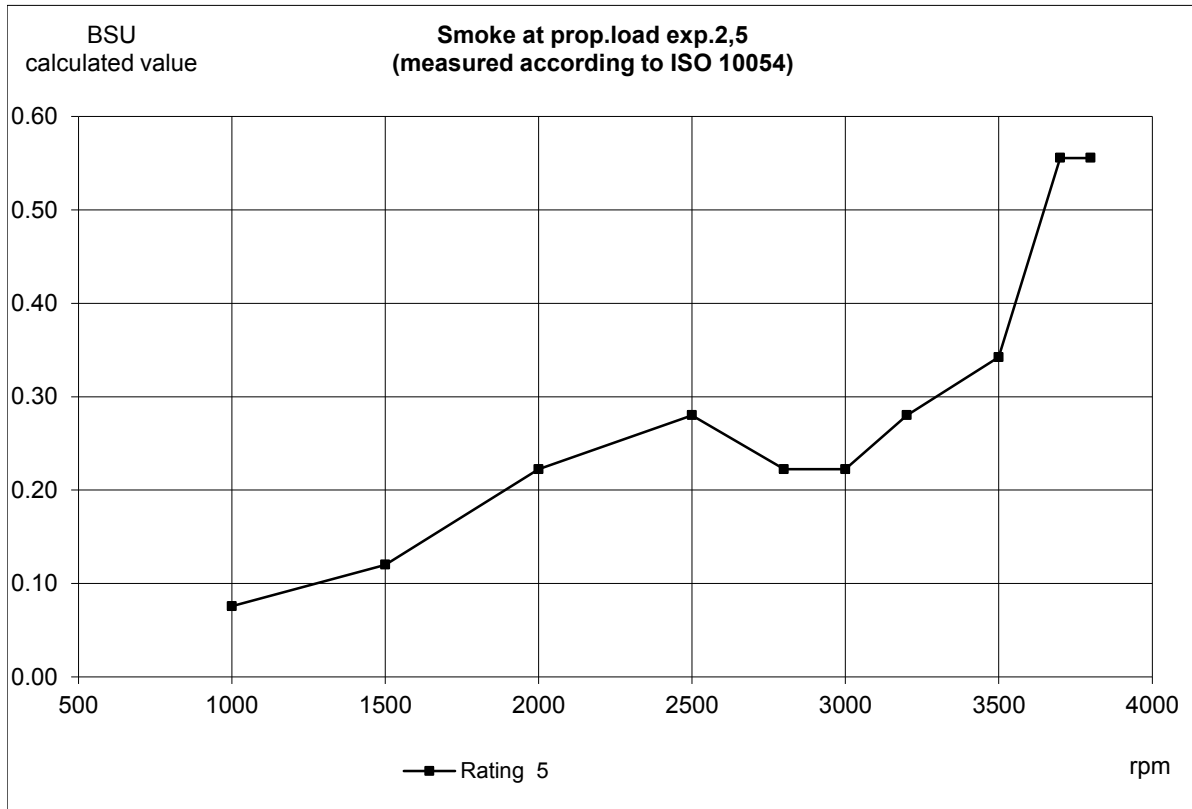
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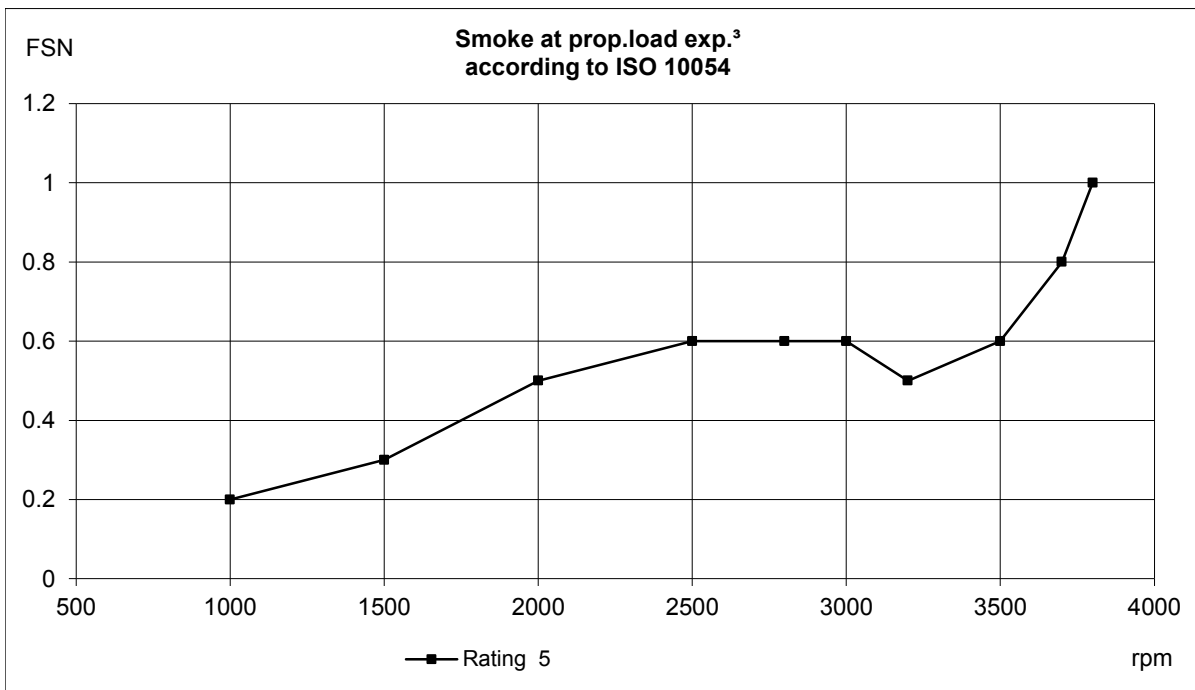
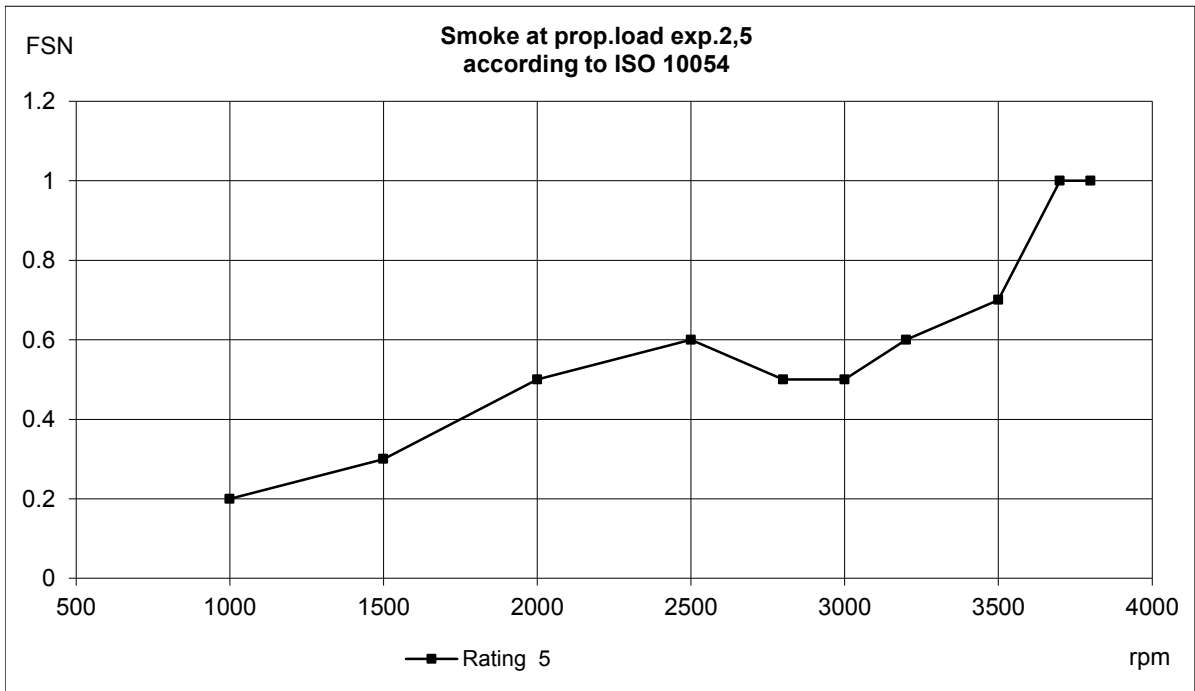
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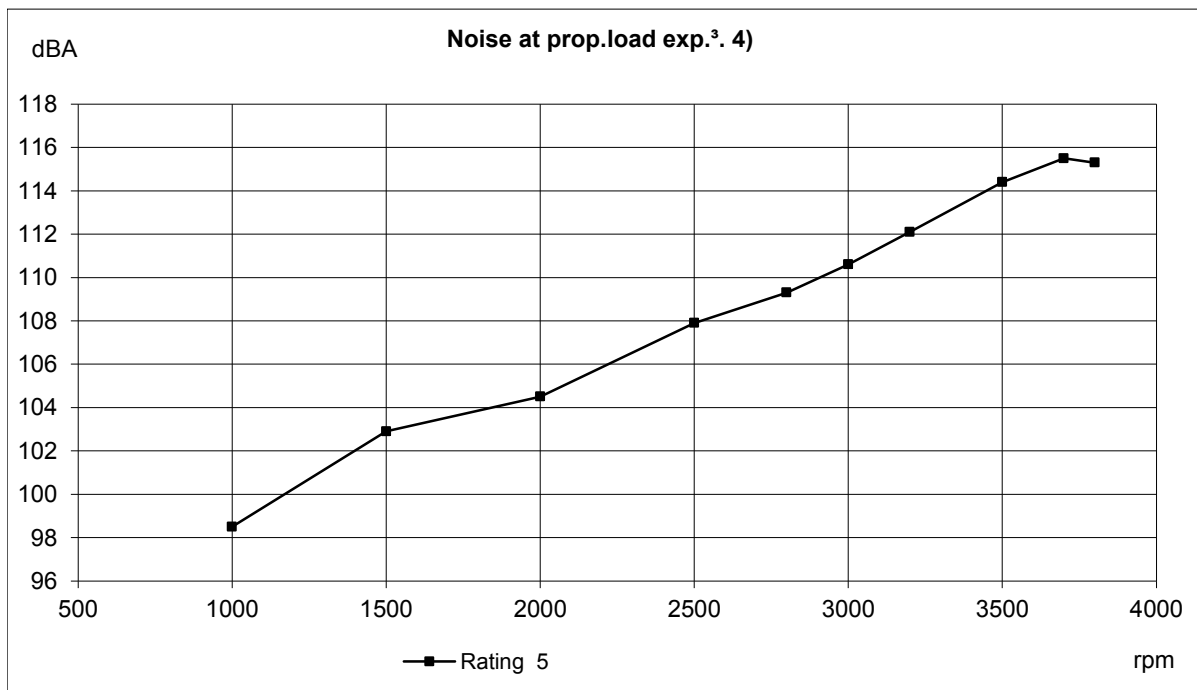
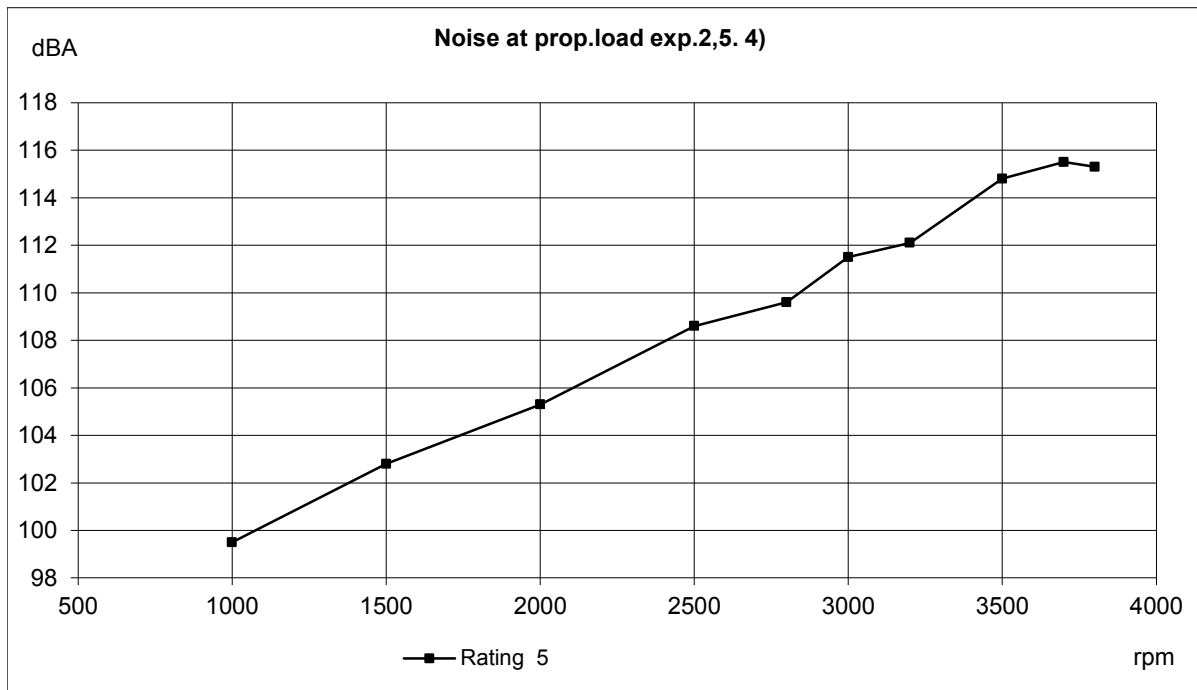
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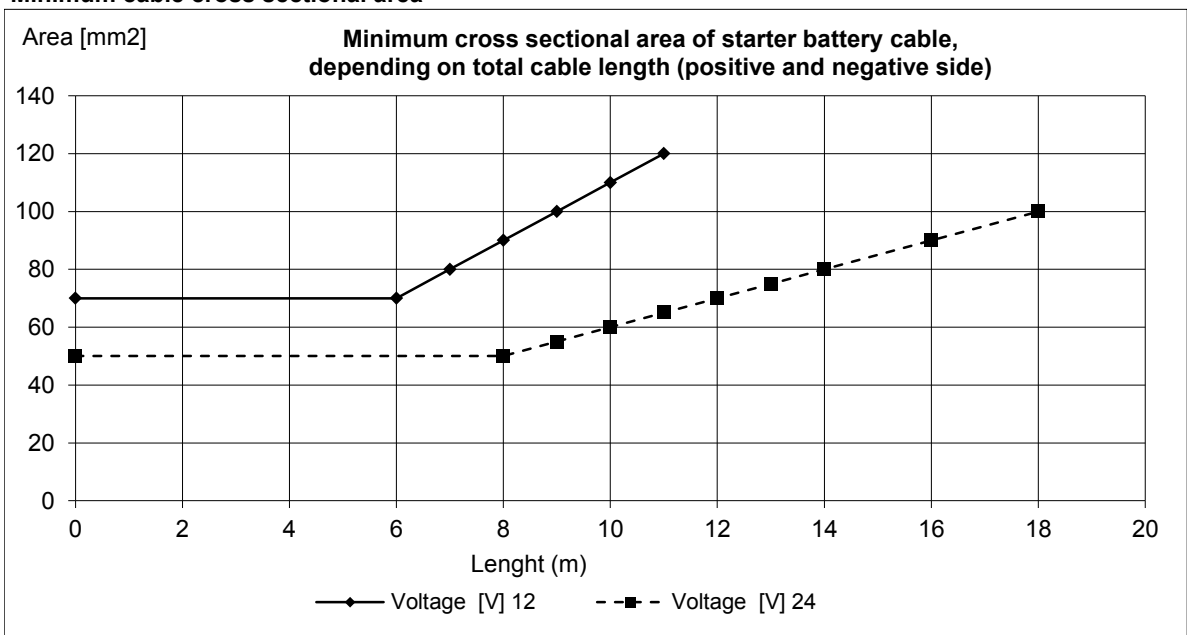
Battery capacity 12V

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	95	850 (EN)	2	1.8	70
-5	120	1150 (EN)	2	1.8	70

Battery capacity 24V

5	75	750(EN)	2	1.8	50
-5	95	850 (EN)	2	1.8	50

Minimum cable cross sectional area



Fuses size:

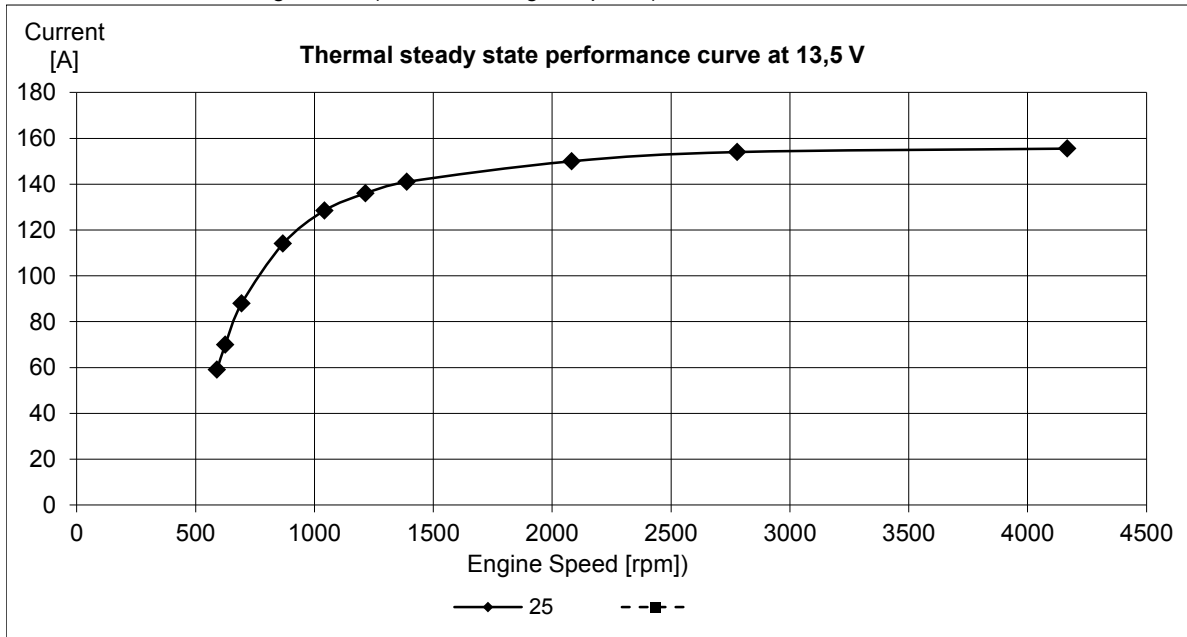
	[A]
Engine:	10
Control system:	10

Max current consumption during normal operation:

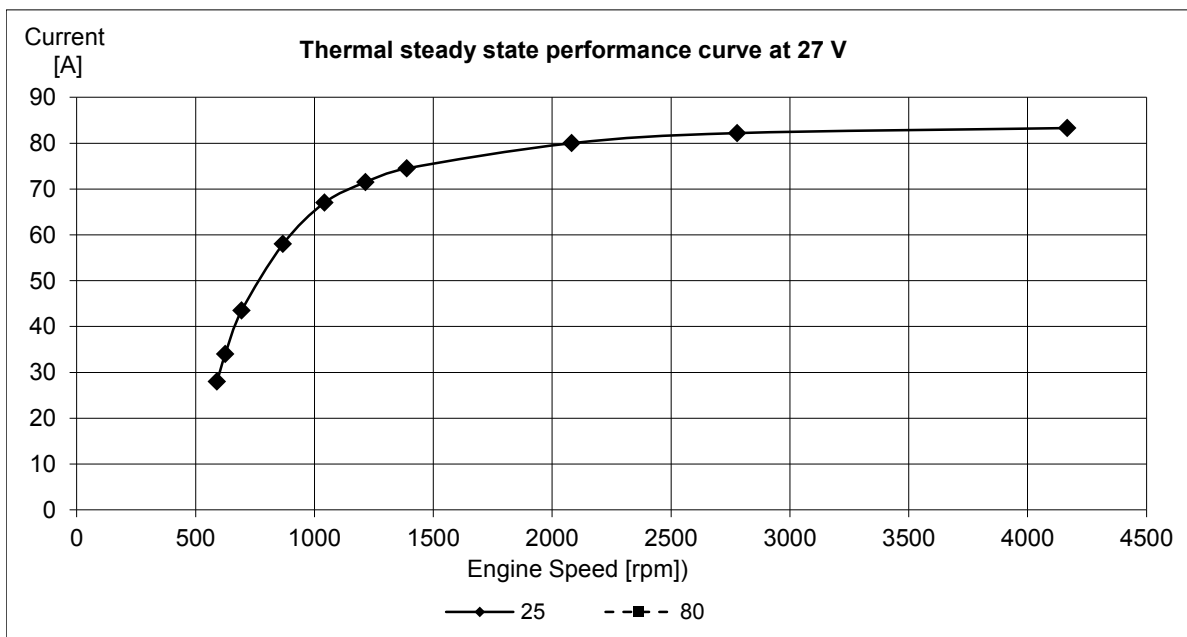
	[A]
Engine :	2 - 4

Alternator data:

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



Constant charge voltage: [V]	14.3	+/- 0,3
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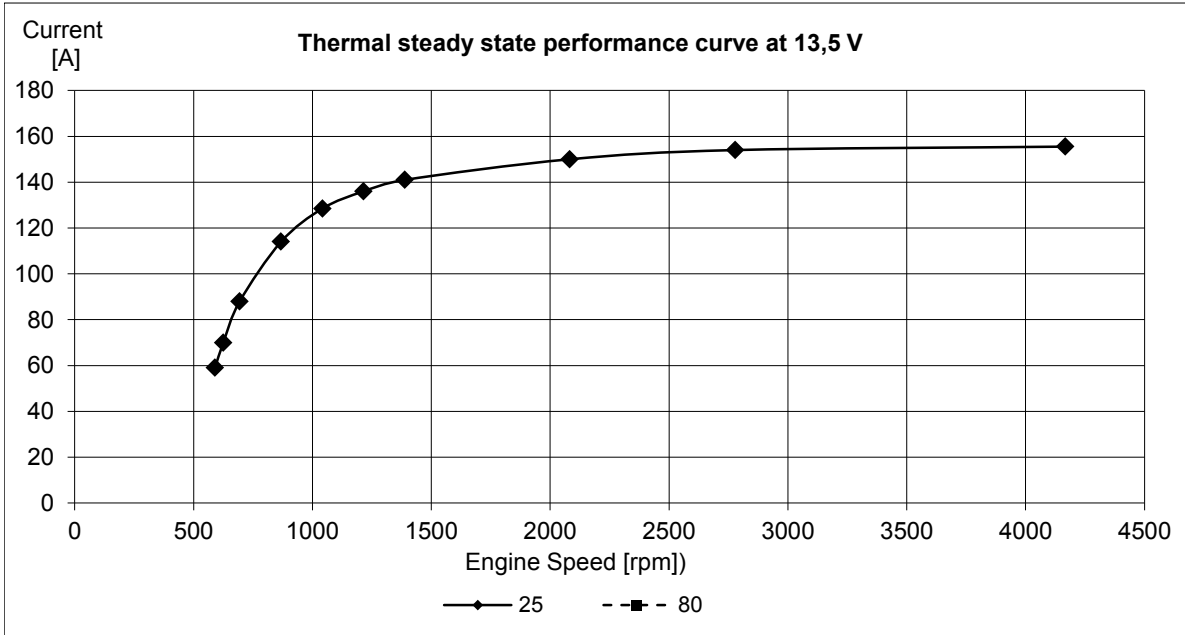


Constant charge voltage: [V]	28.3	+/- 0,3
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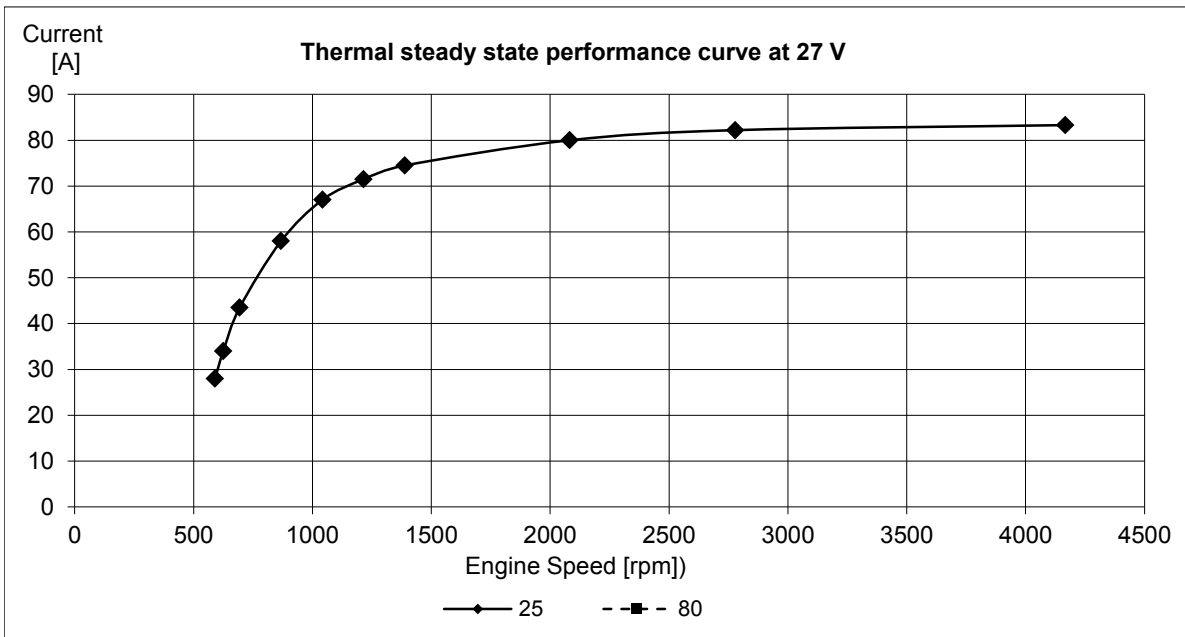
D6-440 IPS

Alternator data:

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



Constant charge voltage: [V]	14.3	+/- 0,3
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Constant charge voltage: [V]	28.3	+/- 0,3
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