

VOLVO PENTA D13 MP (R3-700)	Document No	Issue Index
	23432751	02

General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in ³	12,78 779,7
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	131 5,16
Stroke	mm in	158 6,22
Compression ratio		16,7
Compression pressure at 240 rpm	MPa psi	N/A
Max. static forward inclination:	°	0
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	5
Max. intermittent backward inclination while running:	°	17
Max. intermittent side inclination while running:	°	30
Idling speed	rpm	600 + 50
Rated speed R3	rpm	2250
Propeller selection range R3	rpm	2200-2300
Dry weight engine BT	kg lb	1560 3439

Performance	Rating	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Crankshaft power 1), 5)	3	kW	82	218	274	330	382	437	496	515	515	515
		hp	112	296	373	449	519	594	675	700	700	700
Propeller shaft power 1) (At full load) With drive IPS	3	kW	77	205	258	310	359	410	466	494	494	494
		hp	105	278	351	422	488	558	634	672	672	672
Torque at crankshaft 2)	3	Nm	1308	2599	2619	2626	2604	2605	2632	2459	2342	2186
		lbf ft	965	1917	1932	1937	1921	1921	1942	1814	1727	1612
Mean piston speed	3	m/s	3,2	4,2	5,3	6,3	7,4	8,4	9,5	10,5	11,1	11,9
		ft/s	10,4	13,8	17,3	20,7	24,2	27,6	31,1	34,6	36,3	38,9
Effective mean pressure 2)	3	MPa	1,29	2,56	2,58	2,58	2,56	2,56	2,59	2,42	2,30	2,15
		psi	186,6	370,7	373,6	374,6	371,5	371,6	375,5	350,8	334,0	311,8
Max combustion pressure 2)	3	MPa	13,5	18,7	18,8	19,7	19,7	19,4	19,6	20,2	20,1	18,8
		psi	1958	2712	2727	2857	2857	2814	2843	2930	2915	2727

Lubricating system

Specific lubricating oil consumption.	g/kWh	0,05
Max. oil volume including filters for all allowed installation inclinations:	litres	45
	US gal	11,89
Max. oil volume excluding filters for all allowed installation inclinations:	litres	40
	US gal	10,57
Min. oil volume excluding filters for all allowed installation inclinations:	litres	32
	US gal	8,45

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	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Specific fuel consumption att full load	3	g/kWh	246	204,4	189,6	187	189,9	195,1	201,1	203,4	203,8	209,8
		lb/hph	0,399	0,331	0,307	0,303	0,308	0,316	0,326	0,33	0,33	0,34
Fuel consumption, Test cycle E3	3	g/kWh	210,4									
		lb/hph	0,34									
Fuel consumption at prop. load x ^{2,5}	3	l/h	6,0	11,0	18,0	27,0	40,0	55,0	75,0	99,0	114,0	130,0
		US gal/h	1,6	2,9	4,8	7,1	10,6	14,5	19,8	26,2	30,1	34,3
Fuel consumption at prop. load x ³	3	l/h	4,0	7,0	13,0	21,0	33,0	47,0	68,0	94,0	111,0	129,0
		US gal/h	1,1	1,8	3,4	5,5	8,7	12,4	18,0	24,8	29,3	34,1
Fuel consumption at full load	3	l/h	24,2	53,2	62,2	73,8	86,8	101,9	119,4	125,3	125,6	129,3
		US gal/h	6,4	14,1	16,4	19,5	22,9	26,9	31,5	33,1	33,2	34,2

Intake and exhaust system	Rating	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250	
Specific exhaust heating effect in percent of crankshaft power	3	%	60,3	63,2	55,1	52,0	55,4	60,2	64,2	64,8	66,2	71,5	
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	3	°C	489	512	405	341	362	386	398	391	407	432	
		°F	912	954	761	646	684	727	748	736	765	810	
Exhaust back pressure after turbocharger at rated speed during test.		kPa										28	
		psi										4,1	
Permitted exhaust back pressure after turbocharger. (Installed back pressure)		kPa										Max	38
		psi										5,5	
		kPa										Min	0
		psi										0,0	
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA	3	m ³ /min	4,5	12	17,6	24,6	28,3	32,6	38,3	41,1	40,5	40,5	
		cu.ft./min	158,9	423,8	621,5	868,7	999,4	1151	1353	1451	1430	1430	
Charge air pressure Inlet manifold	3	kPa	36	171	222	279	287	302	332	333	312	290	
		psi	5,2	24,8	32,2	40,5	41,6	43,8	48,2	48,3	45,3	42,1	
Exhaust gas flow	3	m ³ /min	12,7	33,5	40,7	49,3	57,2	66,3	75,6	78,7	79,5	82	
		cu.ft./min	448,5	1183	1437	1741	2020	2341	2670	2779	2808	2896	

Cooling system	Rating	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Radiated heat (per engine)	3	kW	4	5	5	5	6	6	6	7	7	8
Heat rejection to charge air coolers	3	kW	3	29	48	77	89	106	132	144	136	130
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air coolers.	3	kW	106	147	147	158	183	211	244	259	266	277
Coolant flow with fully open thermostat and std cooling system		l/min	90	150	252	282	335	380	480	516	528	600
		cu.ft./min	3,2	5,3	8,9	10,0	11,8	13,4	17,0	18,2	18,6	21,2
Max. permissible temperature on coolant in engine outlet		°C	98									
		°F	208									
Coolant volume engine, including heat exchanger and charge air cooler		litres	57									
		US gal.	15,06									
Max. additional coolant for cabin heater etc. with std. Expansion tank		litres	15									
		US gal.	3,96									
Maximum coolant flow to cabin heater etc.		l/min	40									
		cu.ft./min	1,41									
Thermostat, start open at		°C	82									
		°F	180									
Thermostat, fully open at		°C	92									
		°F	198									

1) ISO 3046, fuel temp 40°C.

ISO 8665 (=SAE J 1228=ICOMIA 28-83)

2) At power according to 1).

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5) At installed back pressure

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Raw water circuit	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Nominal raw water design flow	l/min	167	220	276	304	355	398	438	433	428	415
	cu.ft/min	5,9	7,8	9,7	10,7	12,5	14,1	15,5	15,3	15,1	14,7
Nominal raw water pump pressure head at design flow. (measured before and after pump)	kPa	31	45	65	77	101	126	148	146	142	128
	psi	4,5	6,5	9,4	11,2	14,6	18,3	21,5	21,2	20,6	18,6
Maximum raw water pump suction head	kPa	-30									
	psi	-4,4									
Maximum raw water temperature entering heat exchanger	°C	30									
	°F	86									

Emissions	Rating	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Smoke at prop. load x ^{2.5}	3	*BSU	0,15	0,27	0,40	0,17	0,31	0,17	0,17	0,13	0,18	0,2
Smoke at prop. load x ³	3	*BSU	0,14	0,13	0,25	0,24	0,31	0,13	0,17	0,15	0,17	0,2
Noise at prop. load x ^{2.5} . 4)	3	dBA	100,2	107,6	108,4	108	107,8	109,4	111,6	113,6	114,6	115,7
Noise at prop. load x ³ . 4)	3	dBA	100	102,3	108,4	108,7	108,2	109,6	111,4	113,4	114,5	115,9

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

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ISO 8665 (=SAE J 1228=ICOMIA 28-83)
- 2) At power according to 1).
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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
AUS/DEF concentration			%	N/A	28	N/A	Warning only
AUS/DEF Tank Empty			%	30 sec	0	N/A	Warning only
AUS/DEF Tank Low level			%	30 sec	15	N/A	Warning only
AUS/DEF tank temp High alarm			°C	1 sec	70	N/A	Warning only
Coolant level switch	Digital	ON/OFF		30 sec from start / 11 sec	Low (ON / Closed)	N/A	Warning only
Coolant temperature	50-0 kΩ	-40 - 140 ±1.5°C	°C	30 sec from start / 2 sec	98	101	See derating map
Engine speed cam	Frequency		rpm	Instant	Lost signal	N/A	Warning only
Engine speed crank	Frequency		rpm	Instant	Lost signal	N/A	Warning only
Exhaust gas temperature	PT200	-40 - 750 ± 2.5%	°C	30 sec from start / 2 sec	542	550	See derating map
Oil level sensor	Digital	± 1.9 mm		30 sec from start / 5 sec	Low level	N/A	Warning only
Oil temperature	50-0 kΩ	-40 - 140 ± 1.5°C	°C	30 sec from start/1.5 sec	125	130	See derating map
SCR temp	PT200	-40 - 750 ± 2.5%	°C	30 sec from start / 2 sec	532	540	Engine derate
Water In fuel switch	Digital	ON/OFF		Instant	Water in fuel	N/A	Warning only
Wet Exhaust temp	PT200	0 - 850	°C	30 sec from start / 5 sec	192	200	See derating map

Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Comment
					600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	
Charge air pressure	0,5-4,5 V	50-600 ±4.2 kPa	kPa		600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	<i>From prop curve 2.5 with IPS drive</i>
Warning Level			kPa	30 sec from start / 2.2sec	540	225	210	325	425	
Derating Level			kPa	10% trq. decr. per sec	550	235	220	335	435	
Charge air temperature	50-0 kΩ	-40 - 130 ±4%	°C		600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	
Warning Level			°C	60 sec from start / 15 sec	80	80	80	76	65	
Derating Level			°C		85	85	85	81	70	See derating map
Coolant pressure	0,5-4,5 V	0-300 ± 3%	kPa		600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	
Warning Level			kPa	30 sec from start /1.5sec	0	25	35	76	116	
Derating Level			kPa	10% trq. decr. per sec	-5	20	30	71	111	
Fuel pressure	0,5-4,5 V	0-700 ±2.5%	kPa		600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	
Warning Level			kPa	60 sec from start / 5 sec	80	80	80	280	280	
Derating Level			kPa	NA	NA	NA	NA	NA	NA	
Oil pressure	0,5-4,5 V	0-700 ±2.5%	kPa		600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	
Warning Level			kPa	30 sec from start / 3 sec	120	200	224	260	260	
Derating Level			kPa	10% trq. decr. per sec	95	175	199	235	235	
Seawater pressure	0,5-4,5 V	0-300 ± 3%	kPa		600 rpm	1000 rpm	1200 rpm	1800 rpm	2250 rpm	
Warning Level			kPa	30 sec from start /5 sec	-5	10	18	45	50	
Derating Level			kPa	10% trq. decr. per sec	-15	0	8	35	40	

Warning = Yellow Lamp active

Derating = Red Lamp active

Remarks

Charge Air Temp [°C]	rpm	90°C	95°C	105°C
Remaining torque in %	600	100%	100%	100%
	1200	100%	82%	74%
	1800	100%	66%	52%

Coolant temp [°C]	rpm	96°C	103°C	106°C
Remaining torque in %	600	100%	100%	100%
	1200	100%	97%	93%
	1800	100%	50%	0%

Exhaust Temp [°C]	rpm	545°C	560°C	575°C	580°C
Remaining torque in %	600	100%	100%	100%	100%
Max 1000 rpm in engine prot map	1200	100%	97%	95%	93%
> 570°C	1800	100%	50%	25%	0%

Oil temp [°C]	rpm	125°C	132°C	134°C
Remaining torque in %	600	100%	100%	100%
	1200	100%	97%	93%
	1800	100%	50%	0%

Wet exhaust temp [°C]	rpm	190°C	200°C	205°C	210°C
Remaining torque in %	600	100%	100%	100%	100%
	1200	100%	96%	93%	89%
	1800	100%	93%	86%	80%

Transmission: Control and Monitoring System						Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning 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/7sec	700	Warning only

For SDM only

Sensors Control and Monitoring System						Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Shutdown level	
Coolant temperature	Digital	ON/OFF	°C	12sec from start/1 sec	105	Shutdown
Eng. overspeed SDM 2250+15%	Frequency	153 puls./rev	rpm / Hz	Instant	2588 rpm / 6598 Hz	Shutdown

Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Engine protection action
					0 rpm	600 rpm	1000 rpm	1500 rpm	1800 rpm	
Oil pressure	Digital	ON/OFF	kPa	12 sec from start / 1 sec	NA	120 ±20	120 ±20	120 ±20	120 ±20	Shutdown
Gear oil pressure (IPS)	Digital	ON/OFF	kPa	12 sec from start / 1 sec	NA	400 ±20	400 ±20	400 ±20	400 ±20	Shutdown
Gear oil pressure (Reverse gear ZF)	Digital	500-3000	kPa	12 sec from start / 1 sec	NA	2100±20	2100±20	2100±20	2100±20	Shutdown
Gear oil pressure (Reverse gear Other)	Digital	500-3000	kPa	12 sec from start / 1 sec	NA	X±20	X±20	X±20	X±20	Shutdown Level depending on type of gearbox

Technical data - Drive unit

Drive line		IPS900 & IPS1050
Transmission type		IPS3-C
Gear ratio (total)		1,99:1 and 1,88:1 for IPS 1050 >37 knots
Steering angle, max.		+/- 27
Total weight of drive unit (1)	kg	691
Oil capacity, approx.	litres	30
Oil volume difference MIN-MAX	litres	0,5
Oil type		Volvo Penta API GL5 75W/90
Propeller range		QS5, Q1-Q7, QE1-QE4

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

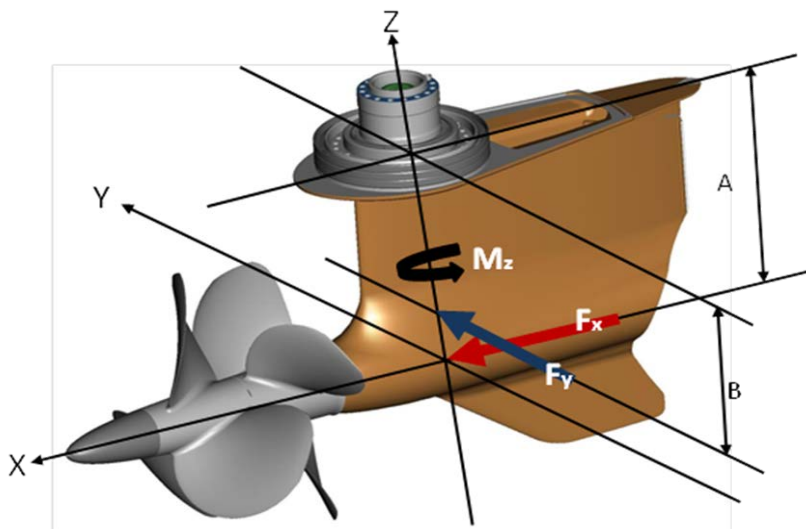
"Generalized maximum load document"for IPS3

Valid products	Drive Unit	Gear Ratio
IPS900	IPSx	1,99:1
IPS1050	IPSx	1,99:1
IPS1050	IPSx	1,88:1

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
20-28 kn	F _x	47 kN
	F _y (+/-)	32 kN
	M _z (+/-)	12 kNm
28-42 kn	F _x	32 kN
	F _y (+/-)	65kN
	M _z (+/-)	12 kNm

A	530 mm
B	442 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.

Technical data - Exhaust AfterTreatment System data (EATS)**Weight data:**

SCR system weight: (incl SCR unit, AUS injector pipe, AUS sensor and bracket)			kg	115,7
			lb	255,1
Total SCR system weight for IPS: (incl SCR unit, AUS injector pipe, AUS sensor and bracket, exhaust piping)			kg	115,7
			lb	255,1
AUS pump			kg	3,1
			lb	6,8
AUS cabinet 20l weight: (incl tank, pump,UQS, ACM)			kg	36,4
			lb	80,2
AUS tank 160l weight:			kg	45,0
			lb	99,2
UQS - Lenght/Weight	mm	439,0	kg	1,2
	in	17,3	lb	2,6
UQS - Lenght/Weight	mm	597,0	kg	1,2
	in	23,5	lb	2,6
UQS - Lenght/Weight	mm	715,0	kg	1,3
	in	28,1	lb	2,9

Dimension data:

SCR Surface area		m2/ft2	2.2 / 23.7
SCR Flange:	Standard type		
	Diameter:	in/mm	6 / 152
	Number of Inlet / Outlet:	1 inlet / 2 outlet	

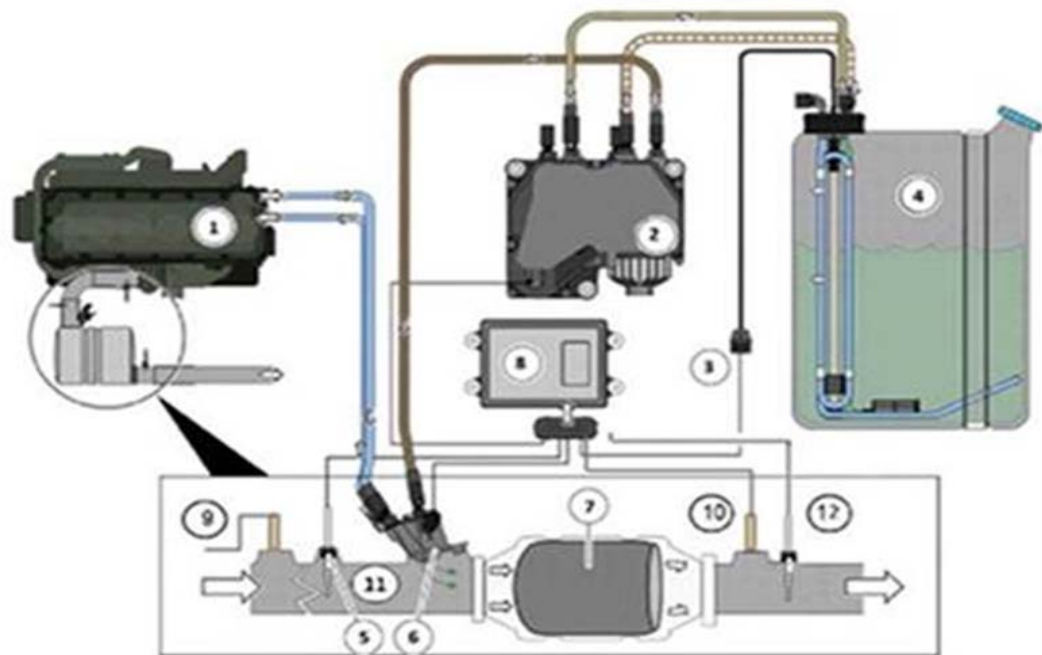
Flow data:

Max AUS flow to injector	l/h	7,9
	US gal/h	2,1
Max collant flow to AUS injector	l/h	6,7
	US gal/h	1,8

Exhaust system	Rating	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Max allowable temperature drop between turbine and SCR muffler inlet.		°C	10	10	10	10	10	10	10	10	10	10
		°F	50	50	50	50	50	50	50	50	50	50
SCR muffler pressure drop at prop. load x ³		kPa	0	0	1	1	2	3	5	8	9	11
		psi			0,1	0,1	0,3	0,4	0,7	1,2	1,3	1,6
SCR muffler pressure drop at Full load		kPa	1	3	4	5	6	8	10	11	11	11
		psi	0,1	0,4	0,6	0,7	0,9	1,2	1,5	1,6	1,6	1,6

AUS system	Rating	rpm	600	800	1000	1200	1400	1600	1800	2000	2100	2250
Specific AUS consumption		g/kWh	9,02	8,98	14,00	11,50	12,30	12,05	10,95	11,31	12,46	11,20
		lb/hph	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
AUS consumption at prop. load x ^{2.5}		l/h	0,00	0,19	0,50	1,23	1,75	2,89	5,02	6,05	6,61	6,17
		US gal/h		0,05	0,13	0,32	0,46	0,76	1,33	1,60	1,75	1,63
AUS consumption at prop. load x ³		l/h	0,00	0,00	0,00	0,63	1,24	2,28	4,15	5,74	6,54	6,21
		US gal/h				0,17	0,33	0,60	1,10	1,52	1,73	1,64
AUS consumption at Full load		l/h	0,81	2,13	4,19	4,14	5,12	5,73	5,92	6,38	7,09	6,32
		US gal/h	0,21	0,56	1,11	1,09	1,35	1,51	1,56	1,69	1,87	1,67

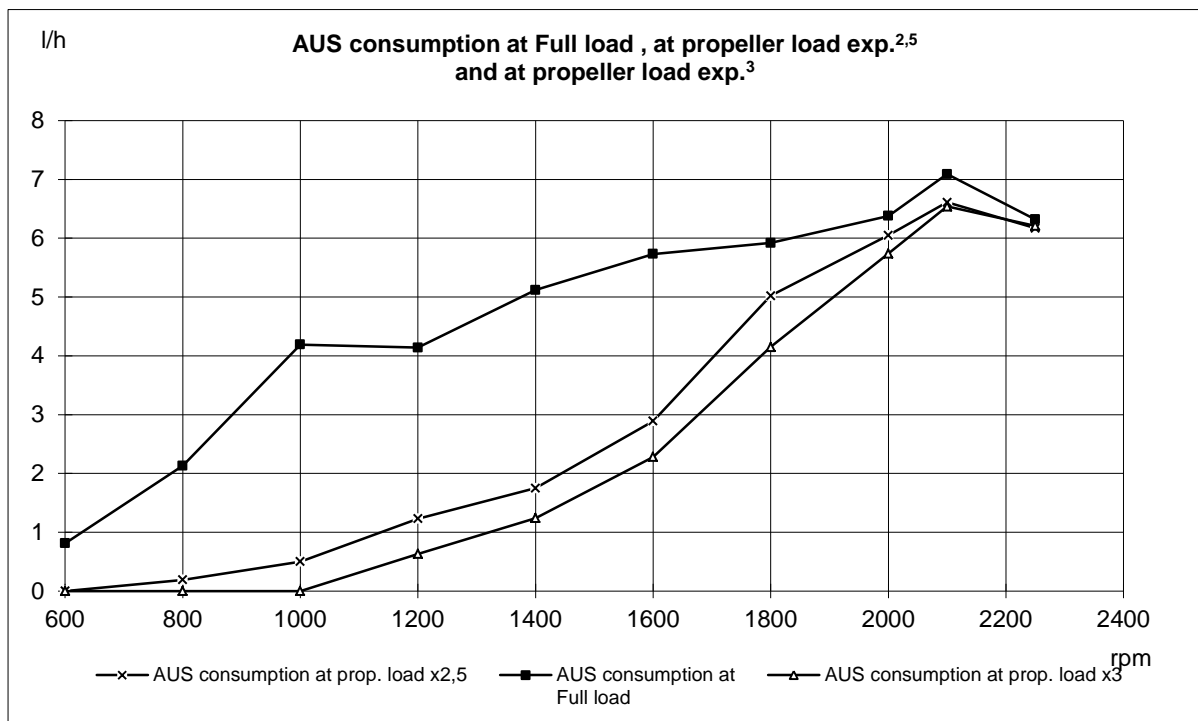
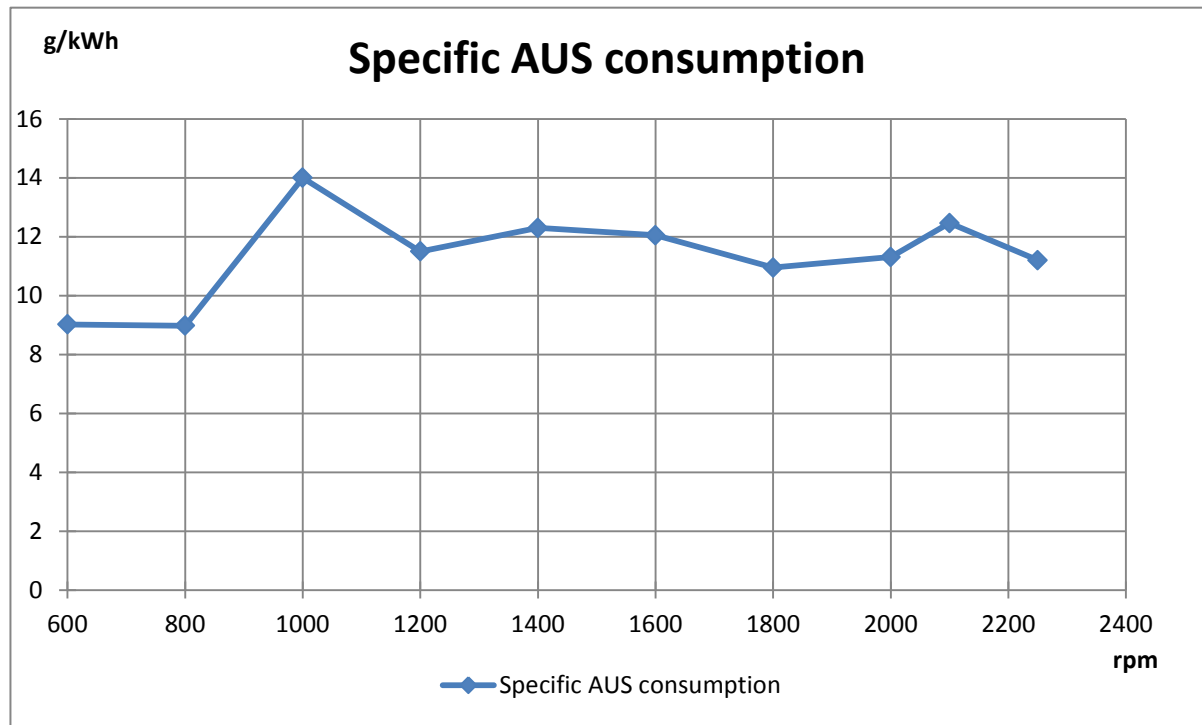
AUS concentration 32.5%

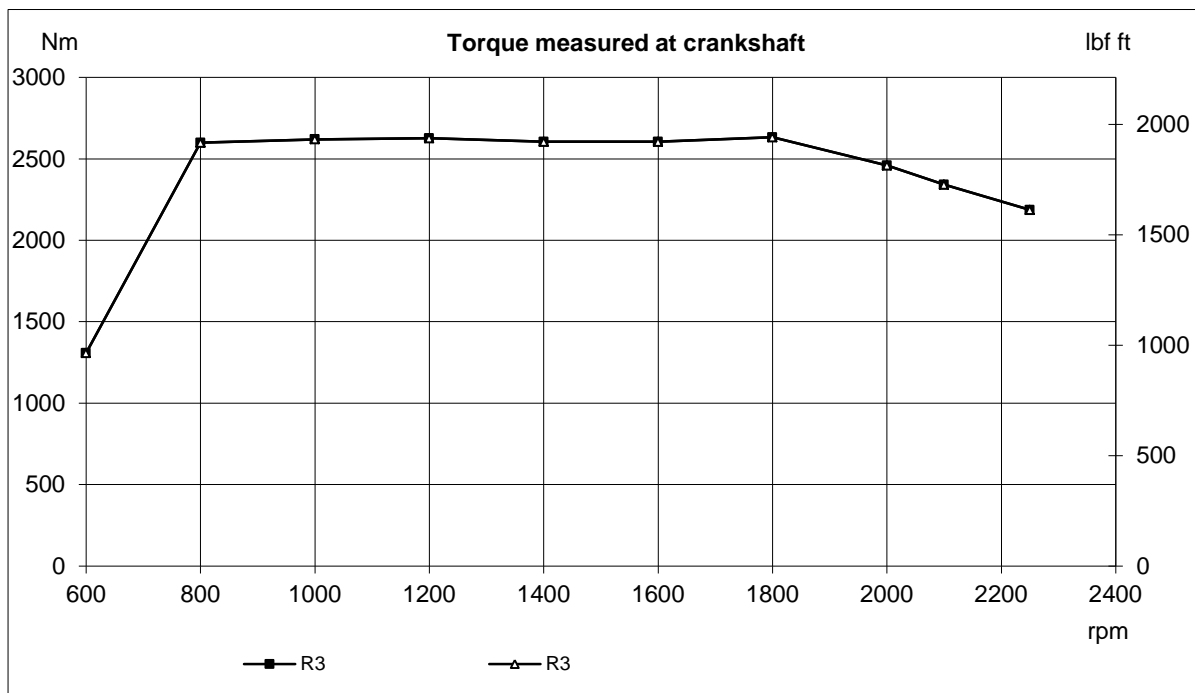
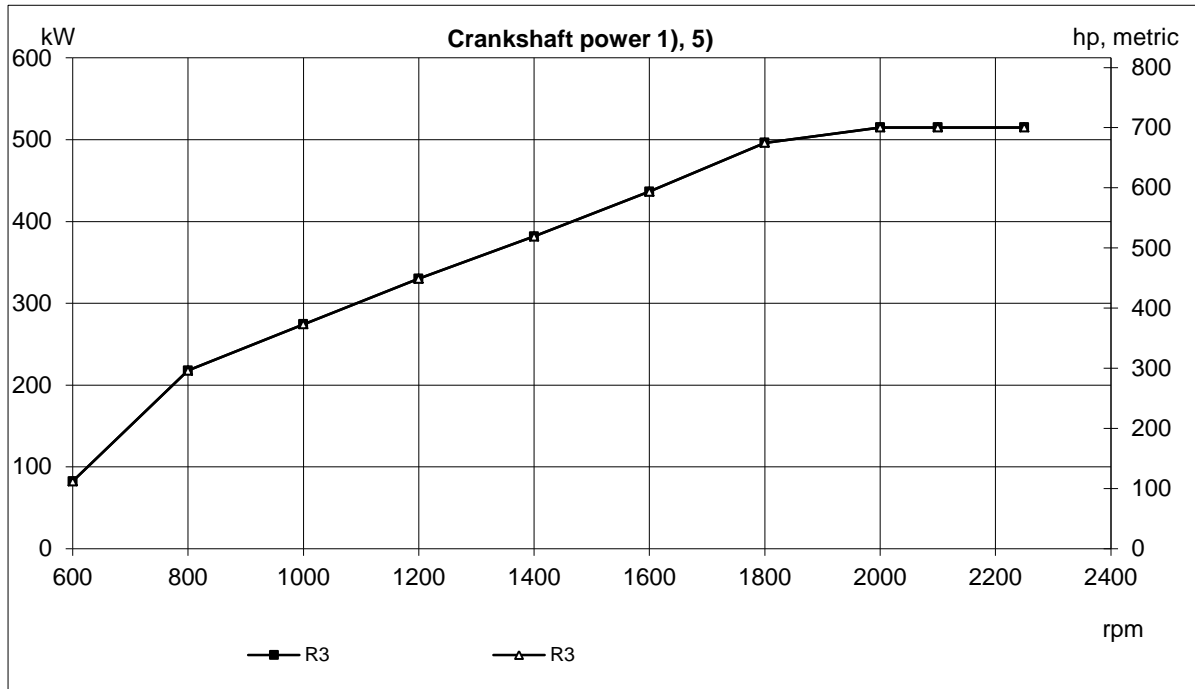


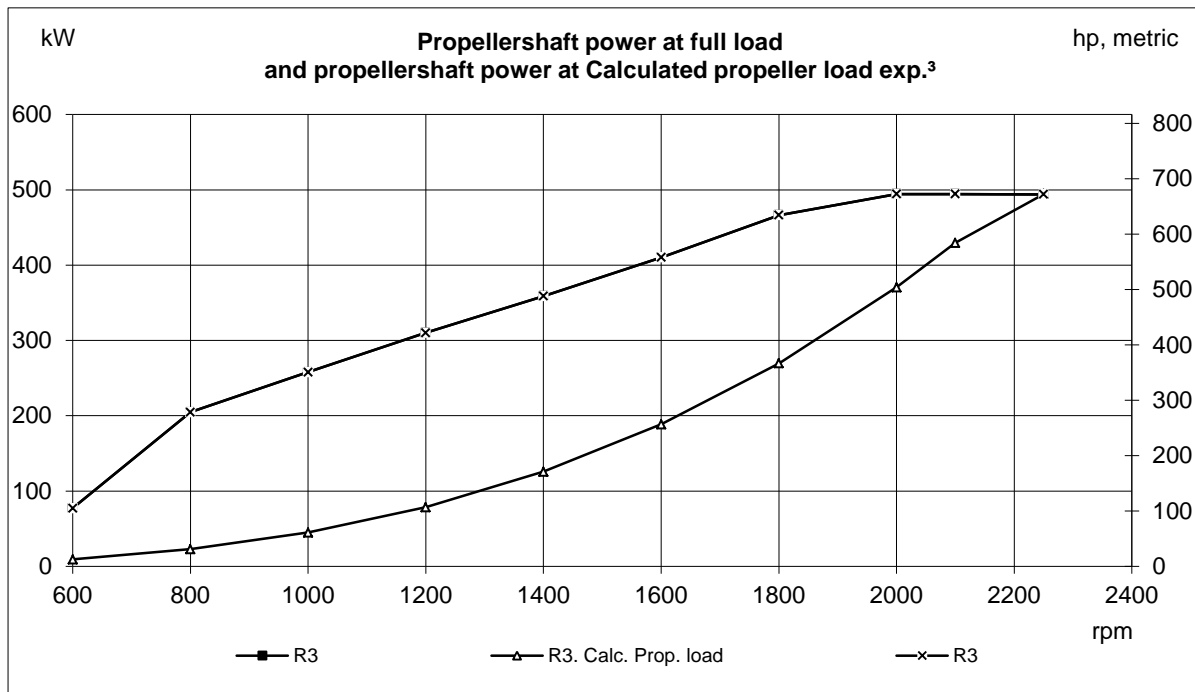
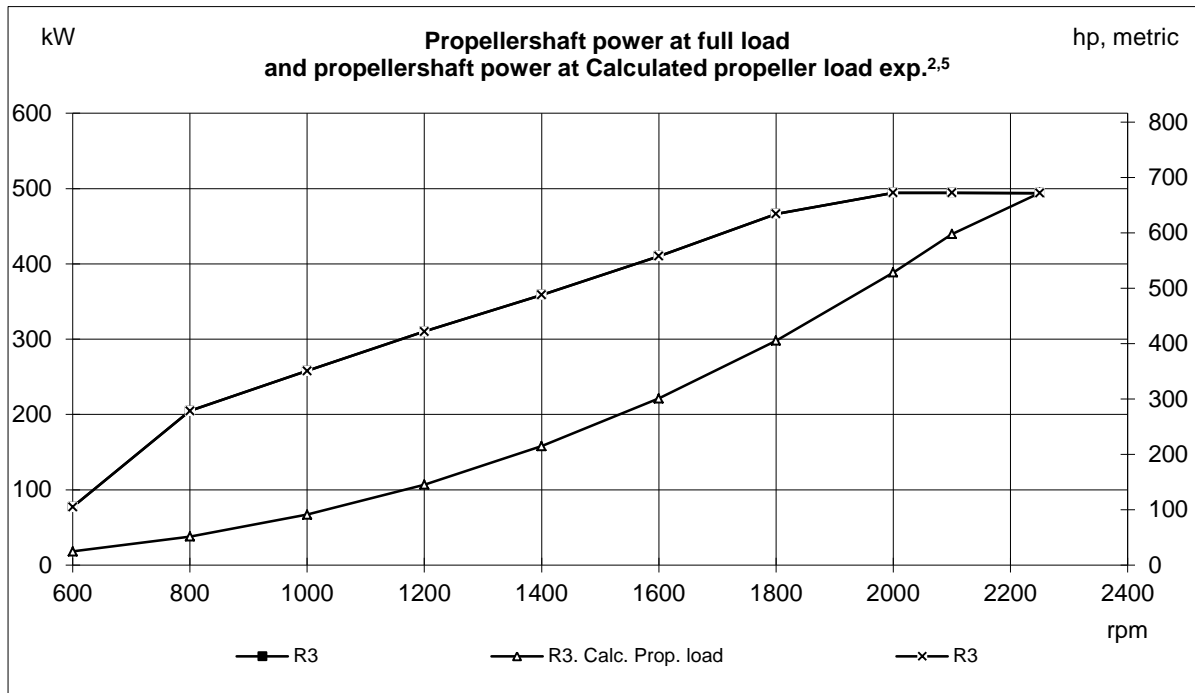
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|-------------------------------------|-------------------------------------|
| 1. Engine | 7. Catalytic converter (SCR) |
| 2. AUS pump | 8. ACM (After Treatment Module) |
| 3. Sensor connector QLT | 9. Front NOx sensor |
| 4. AUS tank with QLT | 10. Rear NOx sensor |
| 5. Front exhaust temperature sensor | 11. Injector pipe |
| 6. AUS injector | 12. Rear exhaust temperature sensor |

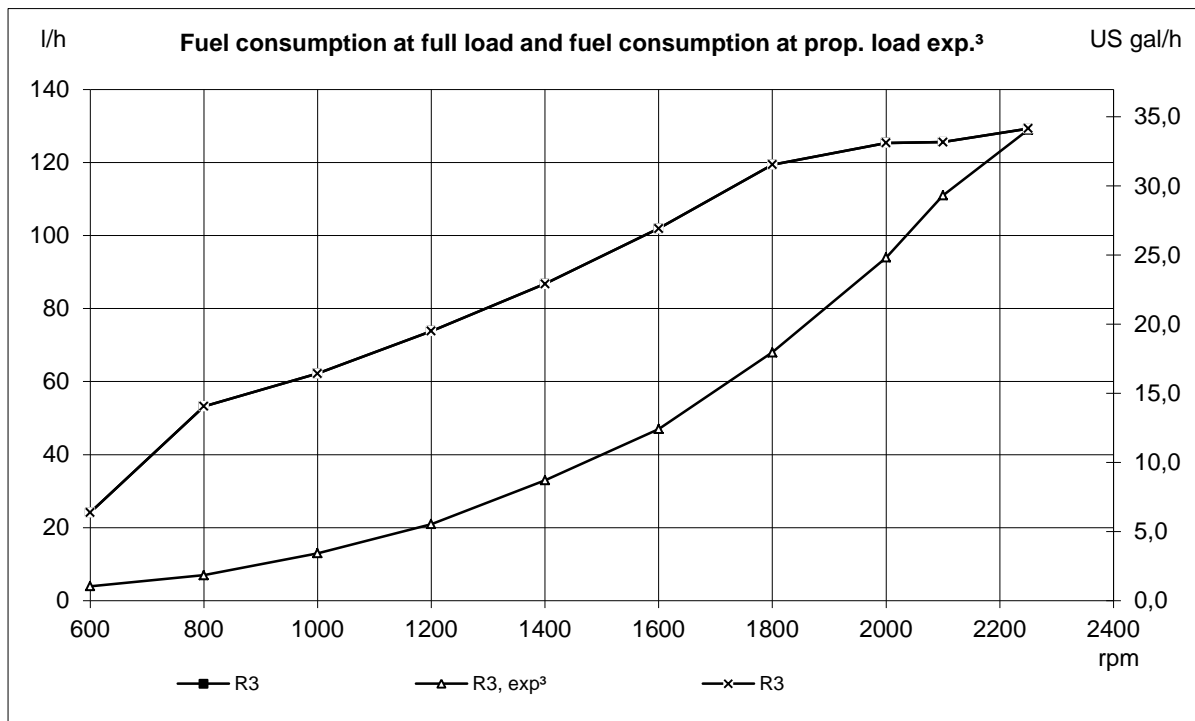
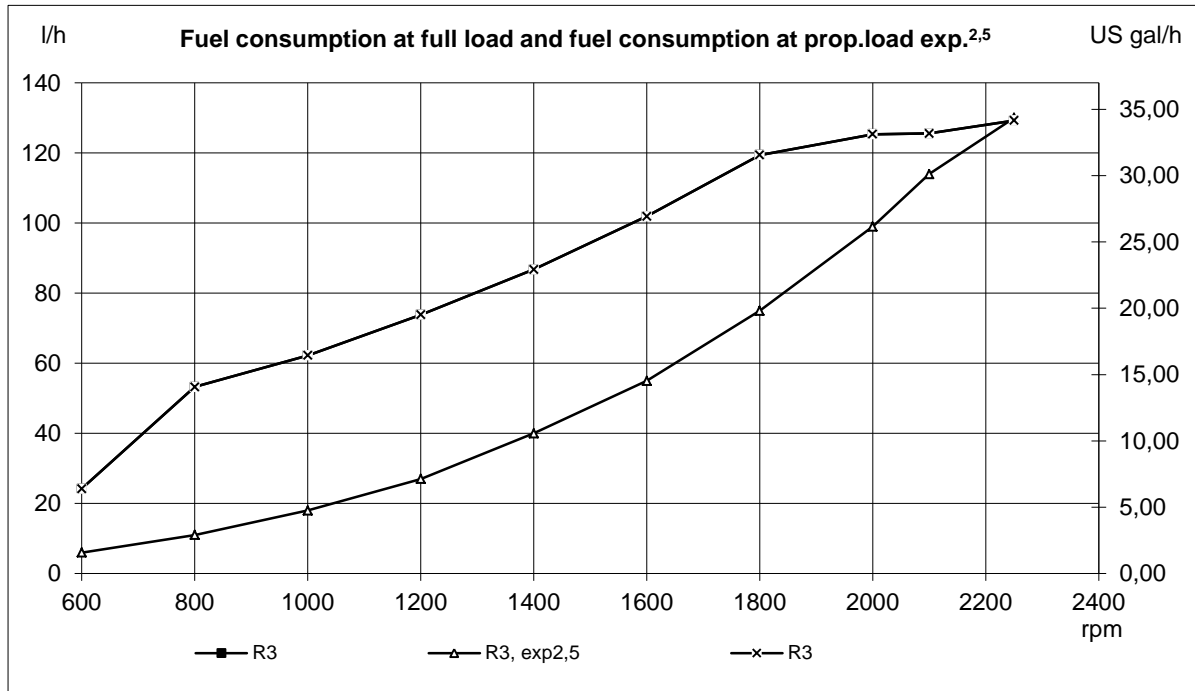
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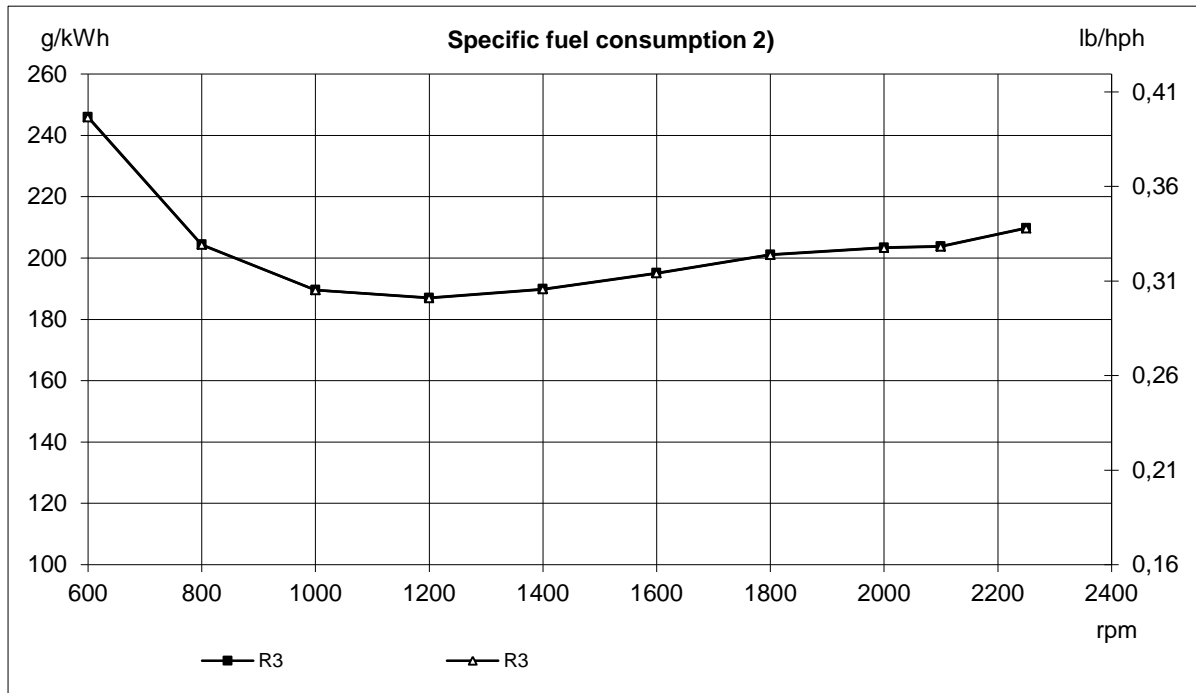
ACM	Aftertreatment Control Module
AUS	Aqueous Urea Solution
EATS	Exhaust Aftertreatment System
SCR	Selective Catalytic Reduction
UDS	Urea Dosing System
UQS	Urea Quality Sensor

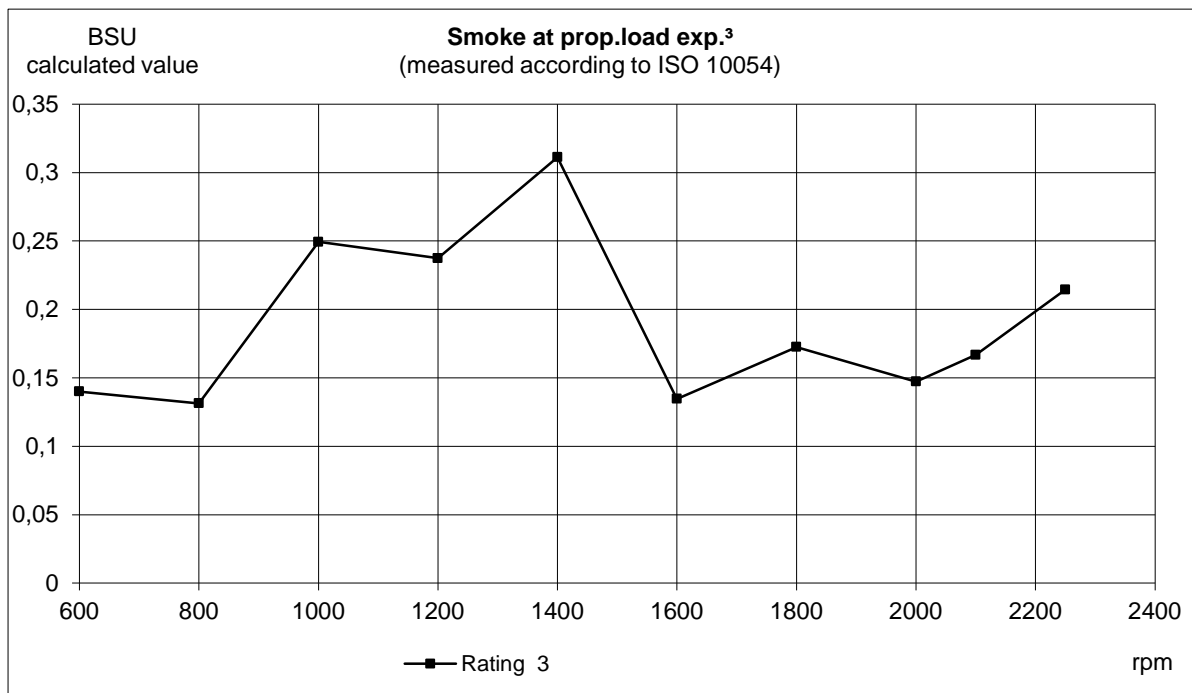
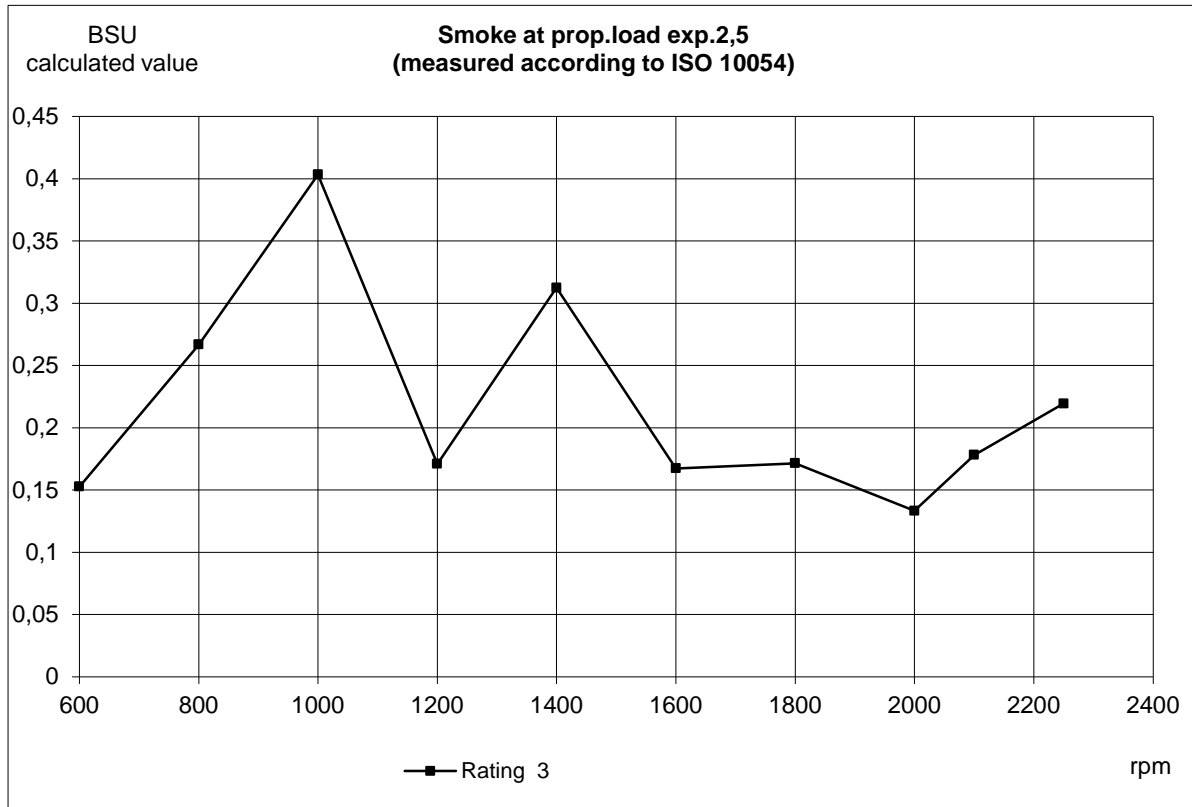


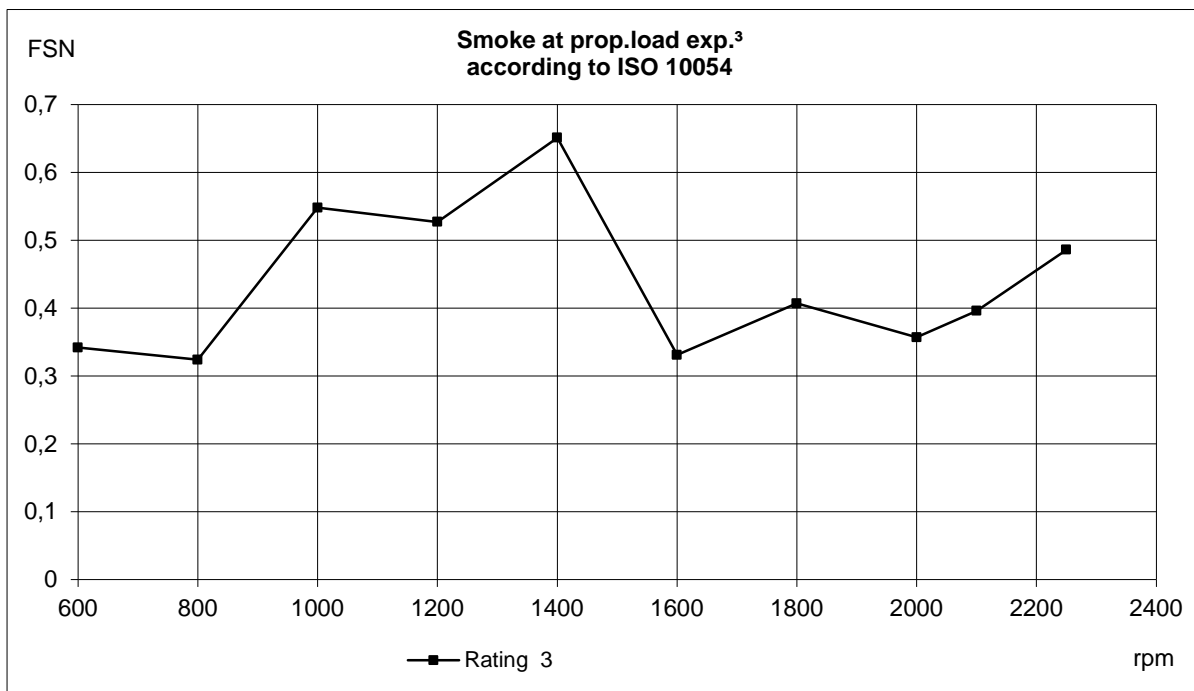
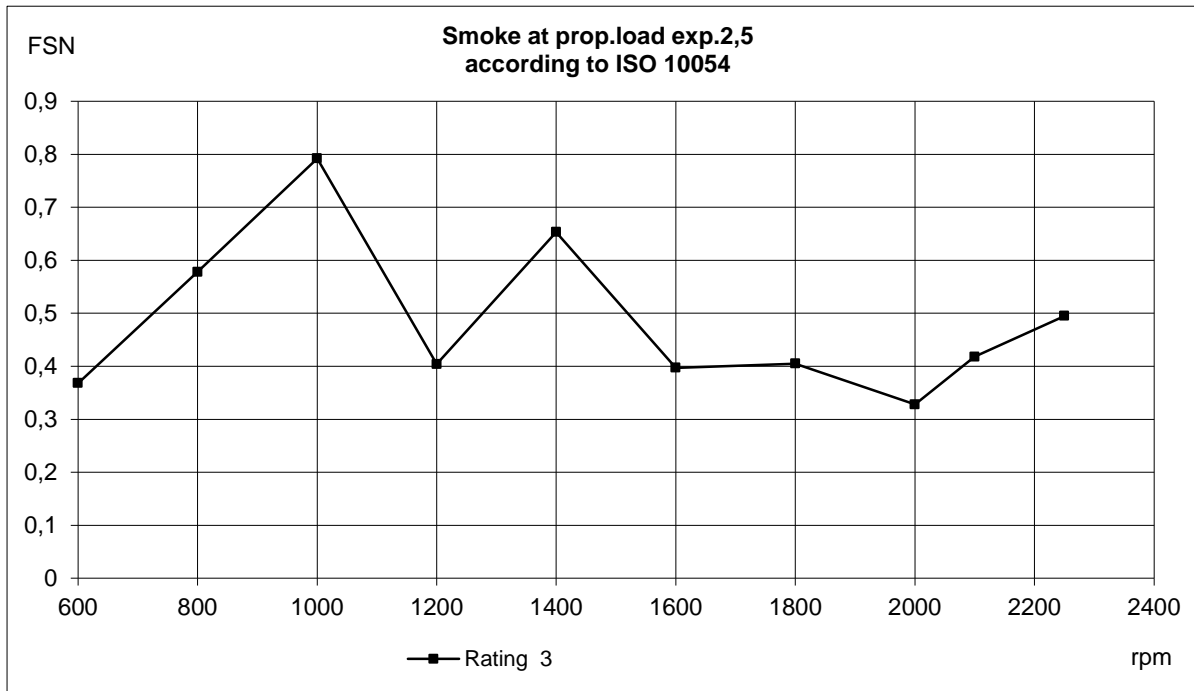


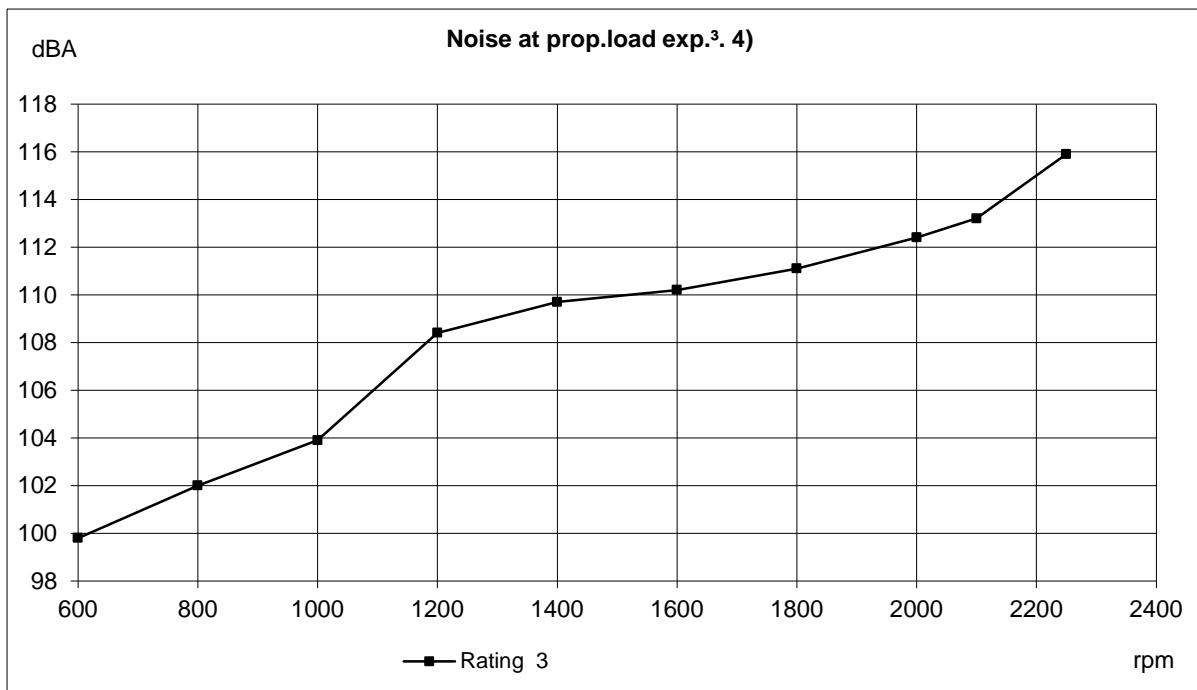
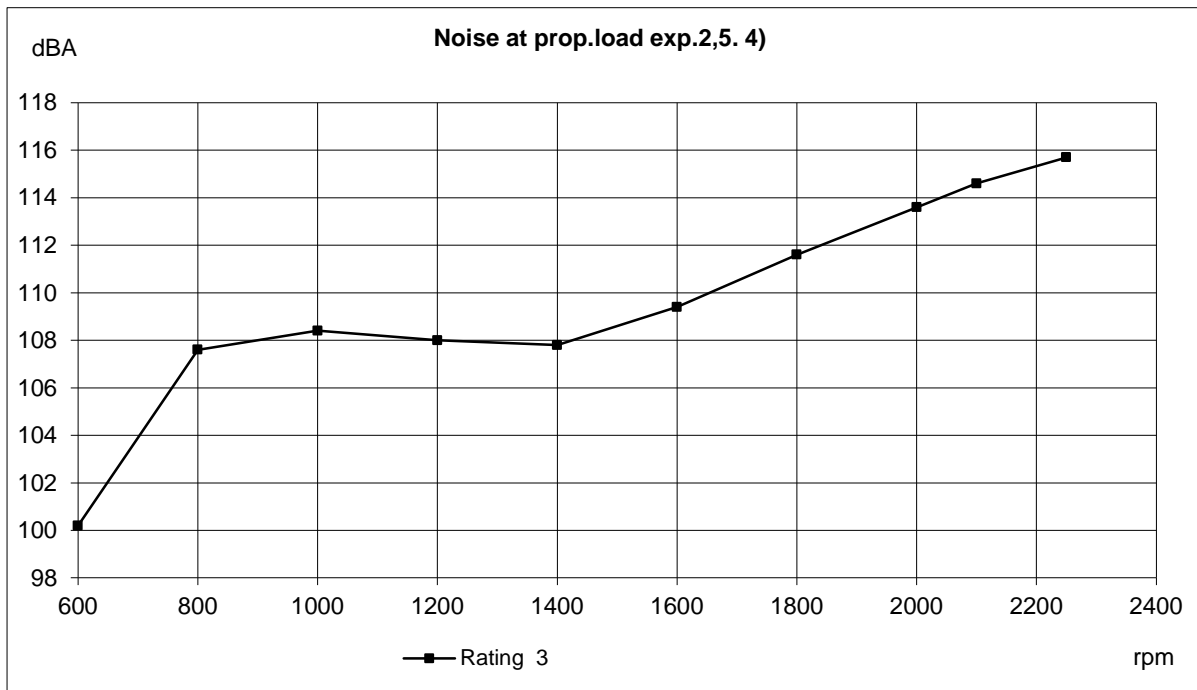








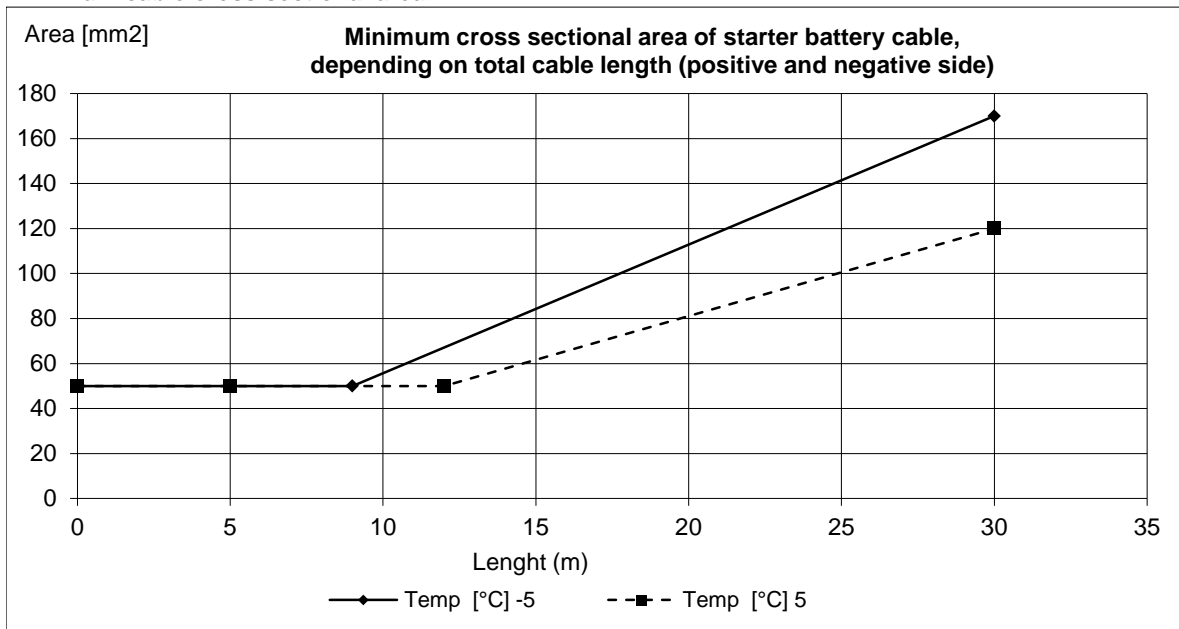




Battery capacity

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) [mm ²]
5					
-5					

Minimum cable cross sectional area



Fuses size:

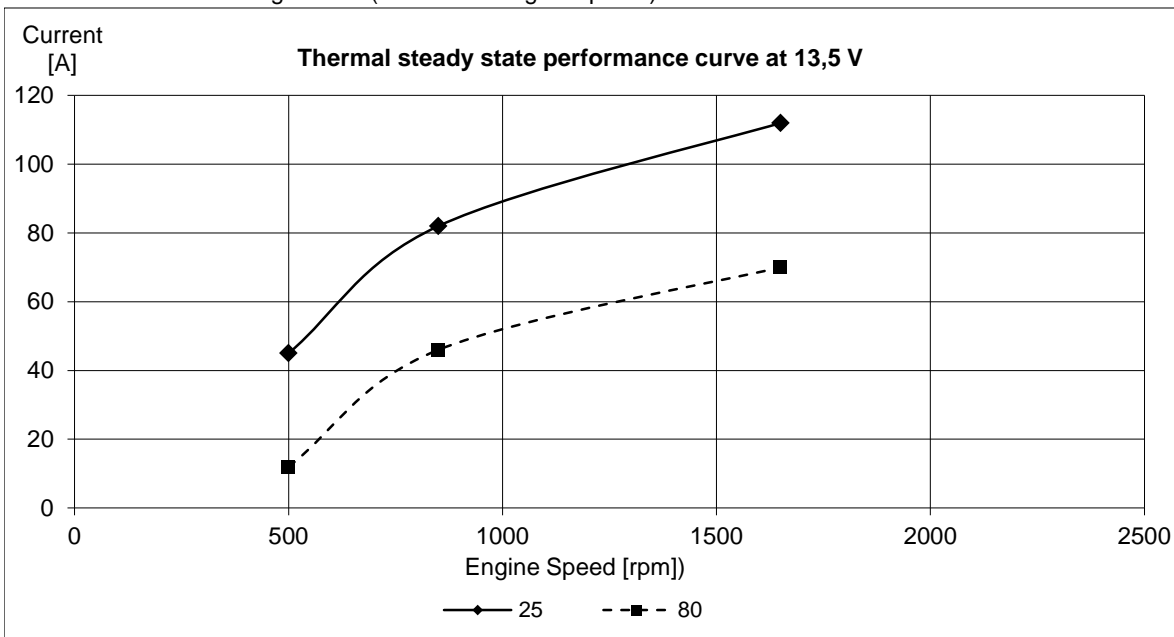
	[A]
Engine:	
Control system:	

Max current consumption during normal operation:

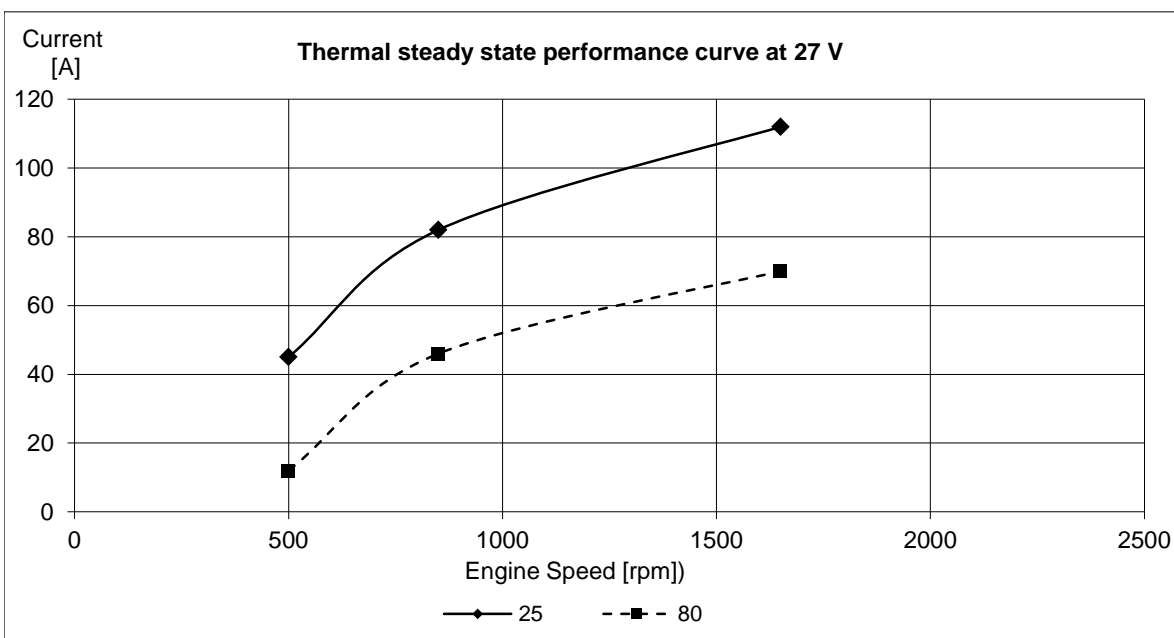
	[A]
Engine :	

Alternator data:

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



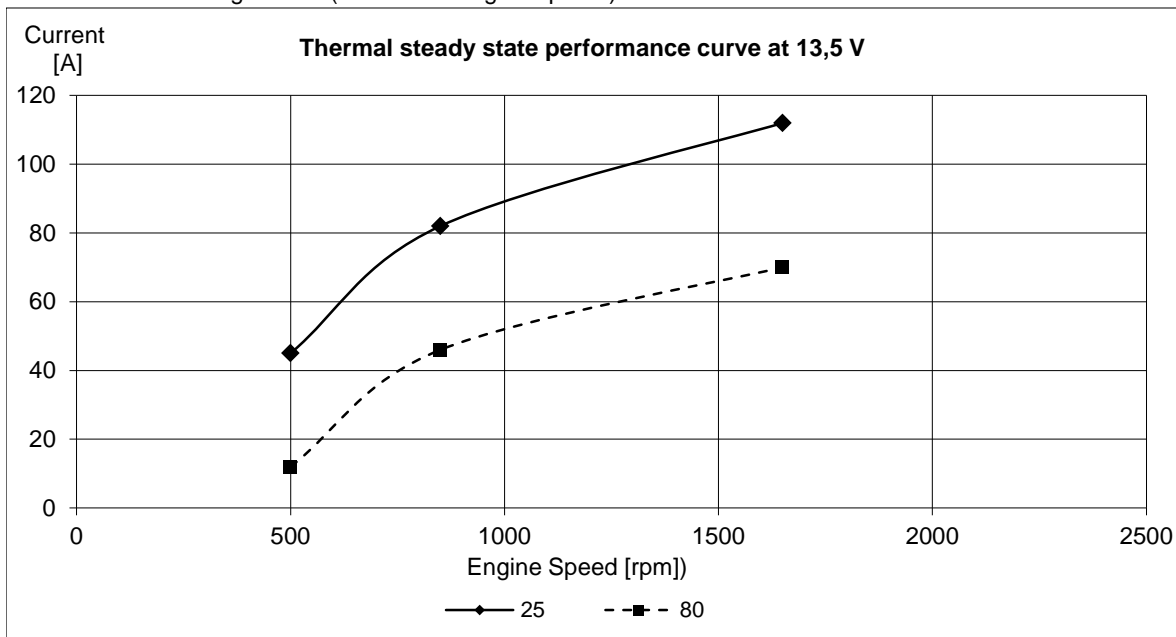
Constant charge voltage: [V]	14,3	+/- 0,3
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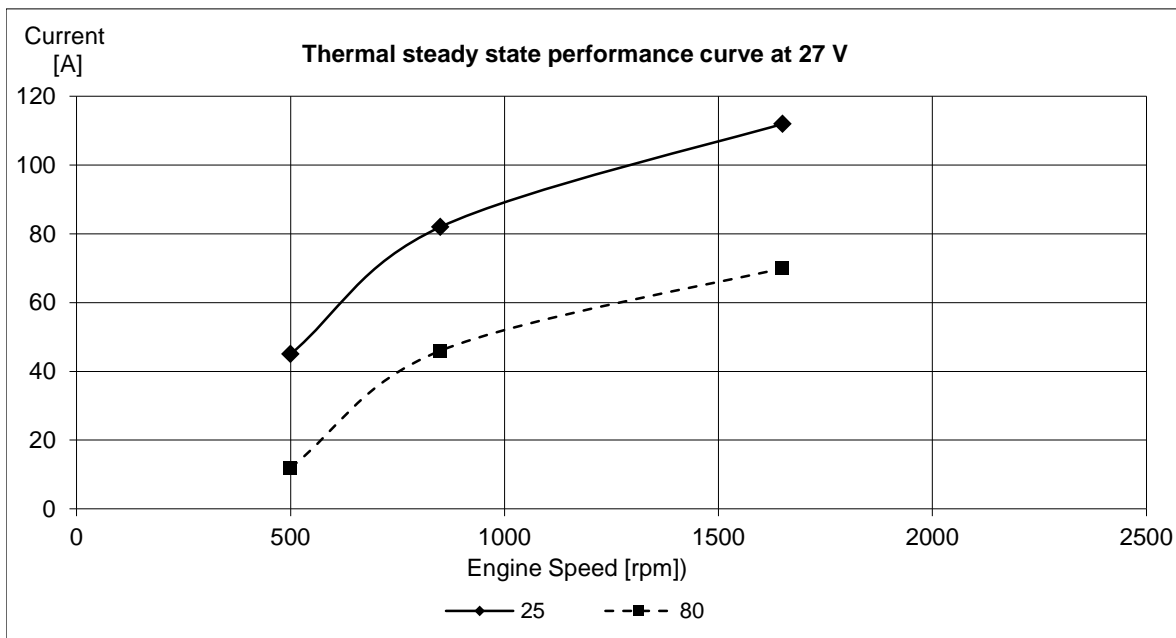
Constant charge voltage: [V]	28,3	+/- 0,3
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Alternator data:

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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