VOLVO PENTA D13-1000 IB, Volvo Penta IPS 1350	Document No 23102081	Issue Index 03

General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in³	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		17,1
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 R5	rpm	2400
Propeller selection range R5	rpm	2400-2450
Dry weight engine BT	kg lb	1635 3605
Dry weight engine IPS (BT) (with flec coupling and protecting casing)	kg lb	1730 3814
Dry weight with ZF 500-1A	kg lb	1885 4156
Dry weight with ZF 500-1IV	kg lb	1935 4266

Performance	**Rating**	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Crankshaft power 1), 5)	5	kW	84	250	345	382	453	525	665	730	735	735
		hp	114	340	469	520	616	714	904	993	1000	1000
Propeller shaft power 1) (At full load)	5	kW	77	234	324	359	426	494	626	688	693	693
With drive IPS		hp	105	319	441	488	579	671	852	935	942	942
Propellershaft power at prop. load $x^{2,5}$	5	kW	22	44	78	98	150	214	337	439	496	693
With drive IPS		hp	29	60	106	134	203	291	459	597	675	942
Propellershaft power at prop. load x^3	5	kW	11	26	50	67	110	169	292	401	464	693
With drive IPS		hp	15	35	68	91	150	230	397	545	631	942
Torque at crankshaft 2)	5	Nm	1337	2984	3295	3316	3328	3342	3528	3485	3342	2924
		lbf ft	986	2201	2430	2446	2454	2465	2602	2571	2465	2157
Mean piston speed	5	m/s	3.2	4.2	5.3	5.8	6.8	7.9	9.5	10.5	11.1	12.6
		ft/s	10.4	13.8	17.3	19.0	22.5	25.9	31.1	34.6	36.3	41.5
Effective mean pressure 2)	5	MPa	1.31	2.93	3.24	3.26	3.27	3.29	3.47	3.43	3.29	2.88
		psi	190.7	425.7	469.9	473.0	474.7	476.7	503.2	497.2	476.7	417.2
Max combustion pressure 2)	5	MPa	13.8	22.9	23.1	23.4	23.4	23.1	23.5	23.7	23.6	23.8
		psi	2002	3321	3350	3394	3394	3350	3408	3437	3423	3452

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

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Lubricating system

Specific lubricating oil consumption.	g/kWh	0.085
Max. oil volume including filters for all allowed installation inclinations:	litres US gal	45 11.89
Max. oil volume excluding filters for all allowed installation inclinations:	litres US gal	40 10.57
Min. oil volume excluding filters for all allowed installation inclinations:	litres US gal	32 8.45

Fuel system	**Rating**	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Specific fuel consumption 2)	5	g/kWh	224	199	184.4	183.5	186	189.6	198.1	202.2	204.5	209.1
		lb/hph	0.363	0.322	0.299	0.297	0.301	0.307	0.321	0.328	0.331	0.339
Fuel consumption, Test cycle E5	5	g/kWh	210.5									
		lb/hph	0.34									
Fuel consumption, Test cycle E3	5	g/kWh	205.6									
		lb/hph	0.33									
Fuel consumption at prop. load x [2,5]	5	l/h	6.4	12.4	20.6	25.3	37.0	54.1	85.5	112.4	128.7	185.7
		US gal/h	1.7	3.3	5.4	6.7	9.8	14.3	22.6	29.7	34.0	49.1
Fuel consumption at prop. load x [3]	5	l/h	3.7	7.8	14.2	18.5	28.3	43.9	75.5	103.3	120.4	185.3
		US gal/h	1.0	2.1	3.8	4.9	7.5	11.6	19.9	27.3	31.8	49.0
Fuel consumption at full load	5	l/h	22.5	59.5	76.1	83.9	100.8	119.1	157.6	176.6	179.9	183.9
		US gal/h	5.9	15.7	20.1	22.2	26.6	31.5	41.6	46.7	47.5	48.6

Intake and exhaust system	**Rating**	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Specific exhaust heating effect in percent of crankshaft power	5	%	60.6	64	53.4	50.7	55.6	60.6	69.5	72.6	73.8	75.3
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	5	°C	484	514	399	362	382	426	483	490	488	466
		°F	903	957	750	684	720	799	901	914	910	871
Permitted exhaust back pressure after turbocharger at rated speed. (Installed back pressure)		kPa							Max	18		
		psi								2.6		
		kPa							Min	0		
		psi								0.0		

Intake and exhaust system	**Rating**	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA and relative humidity 30%.	5	m³/min	4.7	13.2	21.5	25.5	30.3	34.6	43.7	49.3	51.4	55.5
		cu.ft./min	166	466.2	759.3	900.5	1070	1222	1543	1741	1815	1960
Charge air pressure Inlet manifold	5	kPa	40	196	309	332	336	349	380	402	406	406
		psi	5.8	28.4	44.8	48.2	48.7	50.6	55.1	58.3	58.9	58.9
Exhaust gas flow	5	m³/min	13.3	36.4	50.4	55.8	68.9	81.5	106.9	118.4	121.5	124.8
		cu.ft./min	469.7	1285	1780	1971	2433	2878	3775	4181	4291	4407

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Cooling system	**Rating**	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Radiated heat (per engine)	5	kW	5.2	6.7	6.8	7.1	7.2	7.7	8.8	8.8	8.9	8.9
Heat rejection to charge air coolers	5	kW	4	33	69	87	102	117	160	189	199	217
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air coolers.	5	kW	86	151	164	172	196	226	287	320	328	339
Coolant flow with fully open thermostat and std cooling system		l/min	29	54	90	107	140	172	218	248	263	303
		cu.ft./min	1.0	1.9	3.2	3.8	4.9	6.1	7.7	8.8	9.3	10.7
Water pump flow through charge air coolers (total)		l/min	22	45	52	56	62	68	78	84	87	94
		cu.ft./min	0.8	1.6	1.8	2.0	2.2	2.4	2.8	3.0	3.1	3.3
Max. permissible temperature on coolant in engine outlet		°C	98									
		°F	208									
Coolant volume engine, including heat exchanger and charge air cooler		litres	59.5									
		US gal.	15.72									
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									

Raw water circuit	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Nominal raw water design flow	l/min	167	220	276	304	355	398	438	433	428	406
	cu.ft/min	5.9	7.8	9.7	10.7	12.5	14.1	15.5	15.3	15.1	14.3
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	32									
	°F	90									

Emissions	**Rating**	**rpm**	**600**	**800**	**1000**	**1100**	**1300**	**1500**	**1800**	**2000**	**2100**	**2400**
Smoke at prop. load $x^{2,5}$	5	*BSU	0.1	0.4	0.6	0.4	0.2	0.0	0.1	0.1	0.1	0.2
Smoke at prop. load x^3	5	*BSU	0.0	0.1	0.4	0.6	0.3	0.1	0.1	0.1	0.1	0.2
Noise at prop. load $x^{2,5}$. 4)	5	dBA	103.3	105.4	106.6	107.5	107.9	110.7	113.7	115.3	116	118.5
Noise at prop. load x^3. 4)	5	dBA	102.4	105.6	108.1	107.9	108.3	110.3	113.6	114.8	115.8	118.3

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

1) ISO 3046, fuel temp 40°C.
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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 / 11 sec	Low (ON / Closed)	NA	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	NA	Warning only
Engine speed crank	Frequency		rpm	Instant	Lost signal	NA	Warning only
Exhaust gas temperature	PT200	-40 - 750 ± 2.5%	°C	30 sec from start / 2 sec	545	555	See derating map
Oil level sensor	Digital	± 1.9 mm		30 sec from start / 5 sec	Low level	NA	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
Water In fuel switch	Digital	ON/OFF		Instant	Water in fuel	NA	Warning only
Wet Exhaust temp	PT200	-40 - 750 ±	°C	30 sec from start / 5 sec	192	200	See derating map

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Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Comment
Charge air pressure	0,5-4,5 V	50-600 ±4.2 kPa	kPa		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2400 rpm**	*From prop curve 2.5 with IPS drive*
Warning Level			kPa	30 sec from start/2.2 sec	465	445	315	397	523	
Derating Level			kPa	10% trq. decr. per sec	470	450	320	402	528	
Charge air temperature	50-0 kΩ	-40 - 130 ±4%	°C		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2400 rpm**	
Warning Level			°C	60 sec from start /15 sec	82	77	72	67	67	
Derating Level			°C		90	85	80	75	75	**See derating map**
Coolant pressure	0,5-4,5 V	0-300 ± 3%	kPa		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2400 rpm**	*Only for Type approved*
Warning Level			kPa	30 sec from start / 1.5 sec	-5	0	25	50	120	
Derating Level			kPa	10% trq. decr. per sec	-10	-5	20	45	115	
Fuel pressure	0,5-4,5 V	0-700 ±2.5%	kPa		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2400 rpm**	
Warning Level			kPa	60 sec from start / 5 sec	80	80	205	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**	**1500 rpm**	**2000 rpm**	**2400 rpm**	
Warning Level			kPa	30 sec from start / 3 sec	140	200	260	260	260	
Derating Level			kPa	10% trq. decr. per sec	105	175	235	235	235	
Seawater pressure	0,5-4,5 V	0-300 ±3%	kPa		**600 rpm**	**1000 rpm**	**1500 rpm**	**2000 rpm**	**2400 rpm**	*Only for Type approved*
Warning Level			kPa	30 sec from start/5sec	-5	10	30	50	50	
Derating Level			kPa	10% trq. decr. per sec	-15	0	20	40	40	

Warning = Yellow Lamp active

Derating = Red Lamp active

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Remarks

Charge Air Temp [°C]	**rpm**	**69°C**	**83°C**	**87°C**
Remaining torque in %	600	100%	100%	100%
	1200	100%	97%	93%
	1800	100%	50%	0%

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**	**555°C**	**570°C**	**575°C**
Remaining torque in %	600	100%	100%	100%	100%
Max 1000 rpm in engine prot.map	1200	100%	97%	95%	93%
>565°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**	**192 °C**	**210°C**	**215°C**	**220°C**
Remaining torque in %	600	100%	100%	100%	100%
	1200	100%	97%	95%	93%
	1800	100%	50%	25%	0%

Tranmission: 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						
Sensors	**Signal**	**Range**	**Unit**	**Warning Initial Delay / Warning Delay**	**Shutdown level**	**Engine protection action**
Coolant temperature	Digital	ON/OFF	°C	12sec from start/1 sec	105	Shutdown
Eng. overspeed SDM 2400+15%	Frequency	153 puls./rev	rpm / Hz	Instant	2760 rpm/7038 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 ON= Shutdown	kPa	12 sec from start / 1 sec	NA	120 ±20	120 ±20	120 ±20	120 ±20	Shutdown
Gear oil pressure (IPS)	Digital	ON/OFF ON= Shutdown	kPa	12 sec from start / 1 sec	NA	400 ±20	400 ±20	400 ±20	400 ±20	Shutdown
Gear oil pressure (Reverse gear ZF)	Digital	ON/OFF ON= Shutdown	kPa	12 sec from start / 1 sec	NA	2100±20	2100±20	2100±20	2100±20	Shutdown
Gear oil pressure (Reverse gear Other)	Digital	ON/OFF ON= Shutdown	kPa	12 sec from start / 1 sec	NA	X±20	X±20	X±20	X±20	Shutdown Level depending on type of gearbox

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Technical data - Drive unit

Drive line		IPS1350
Transmission type		IPS30-D
Gear ratio (total)		1,88:1
Steering angle, max.		± 27º
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		Q1-Q7

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

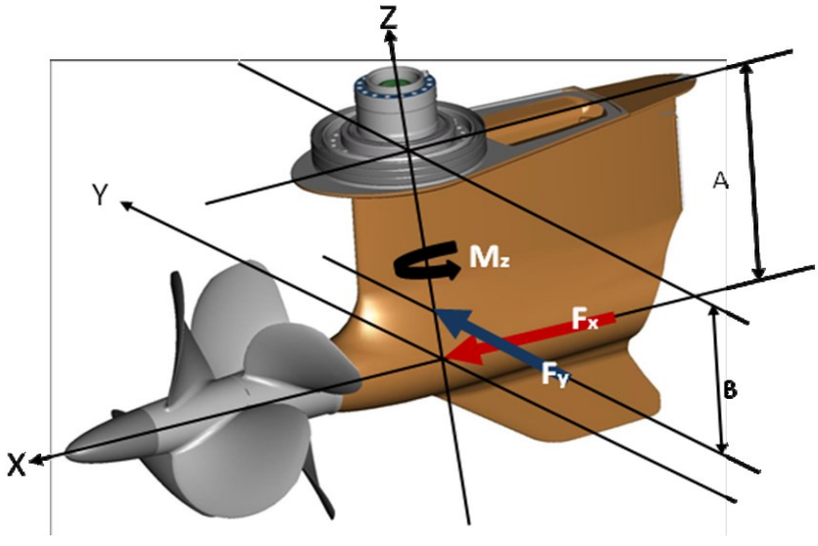
"Generalized maximum load document"for IPS3

Valid products	Drive Unit	Gear Ratio
IPS1350	IPS30	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	Fx	57
	Fy (+/-)	32
	Mz (+/-)	12
28-42 kn	Fx	52
	Fy (+/-)	72
	Mz (+/-)	12

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.

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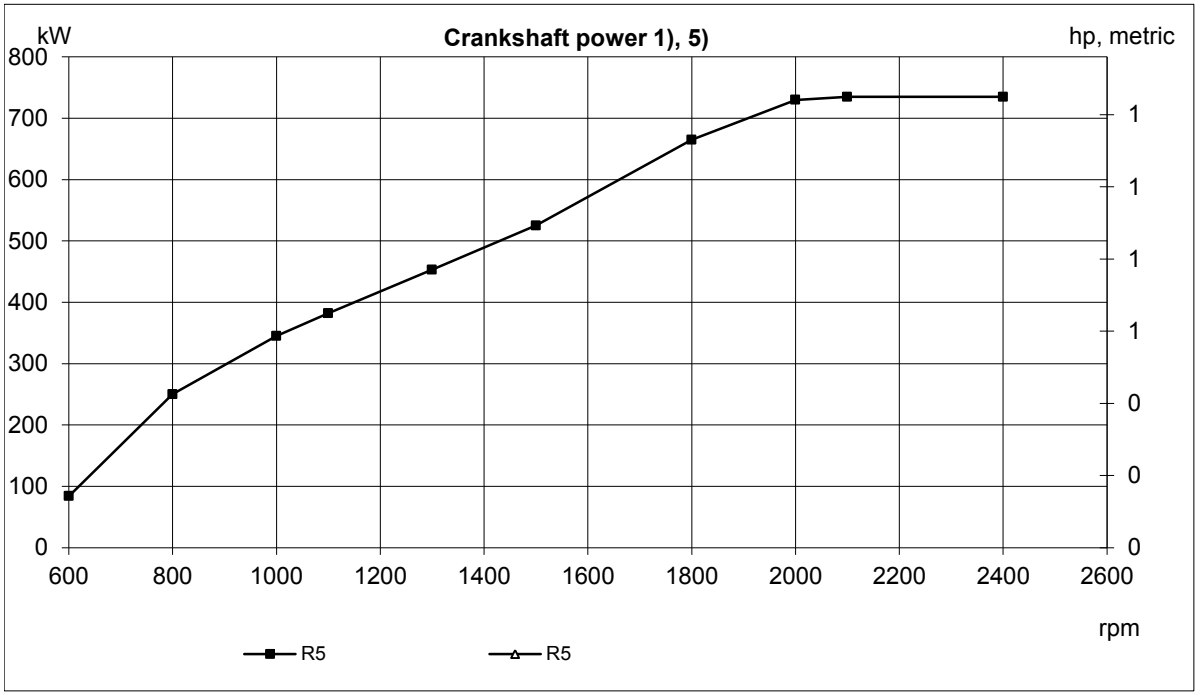

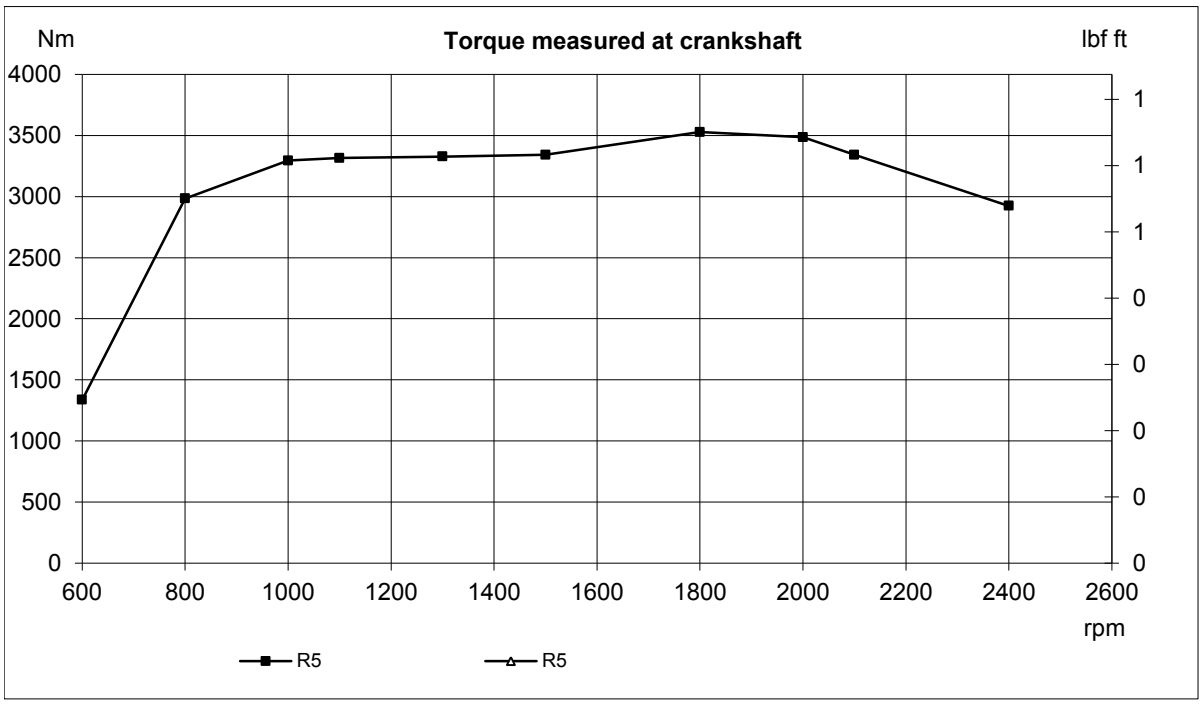

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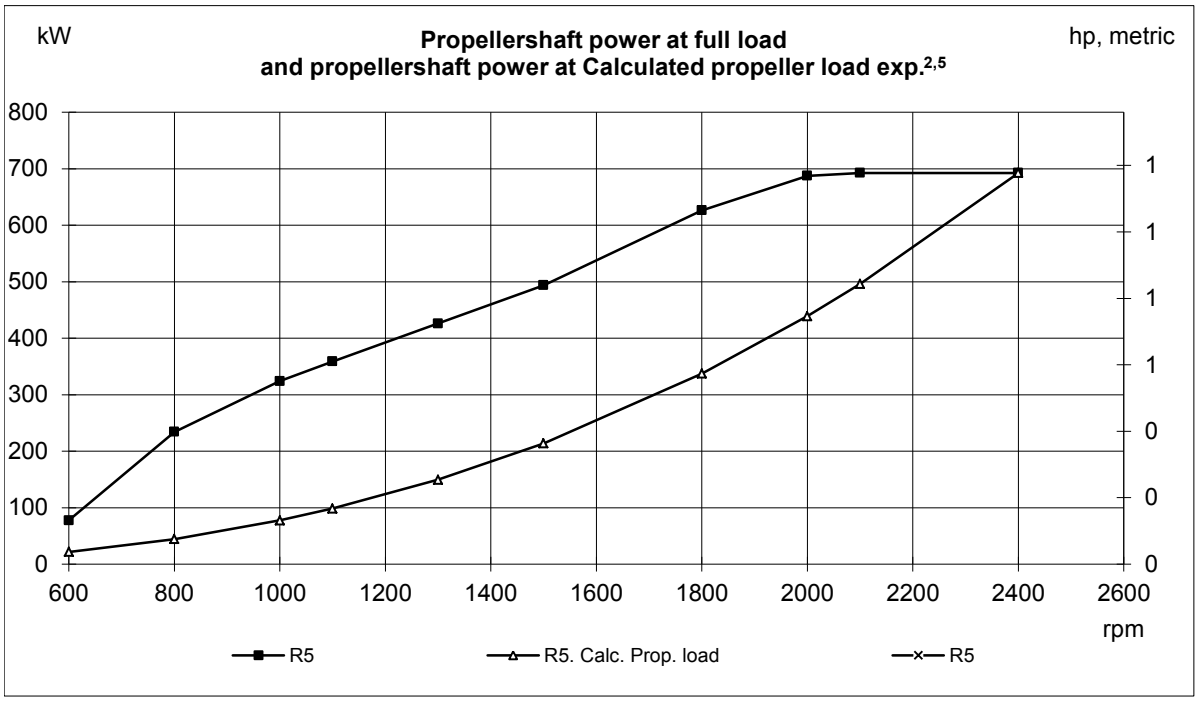

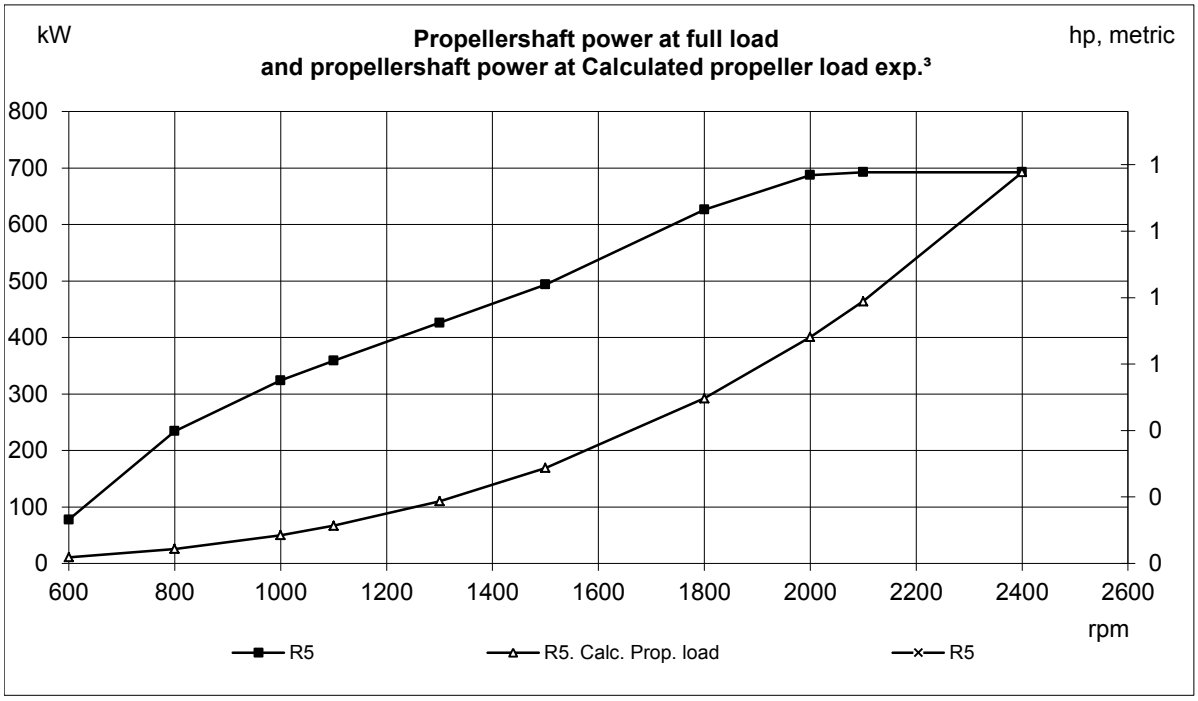

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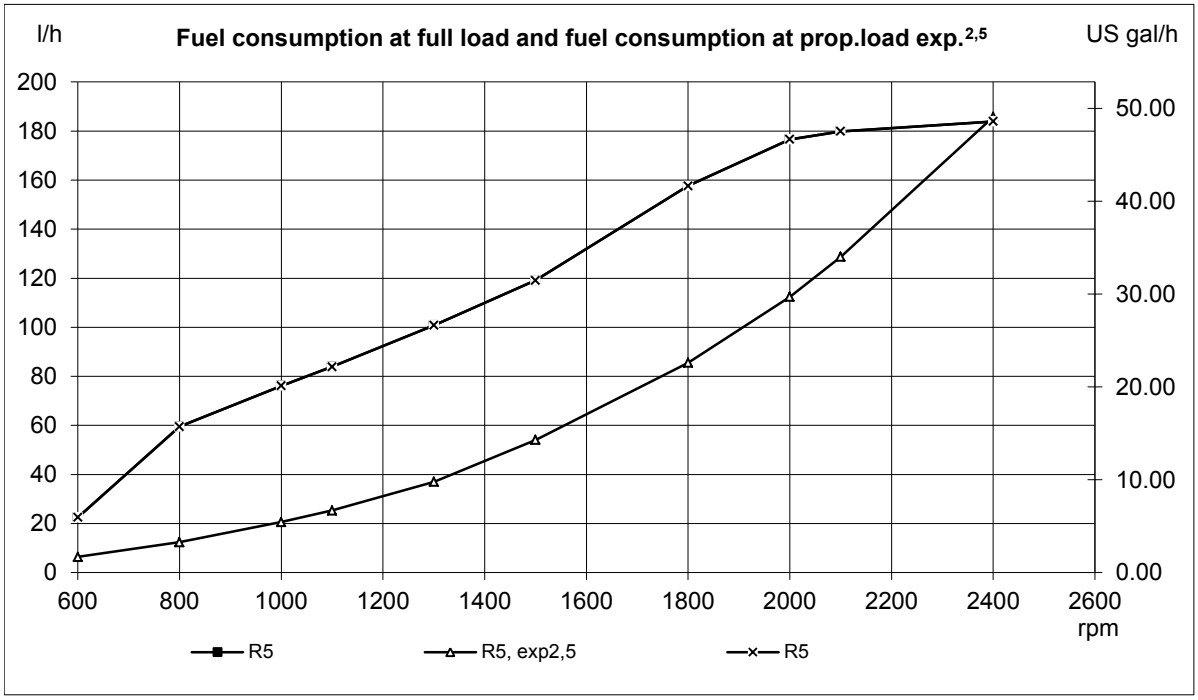

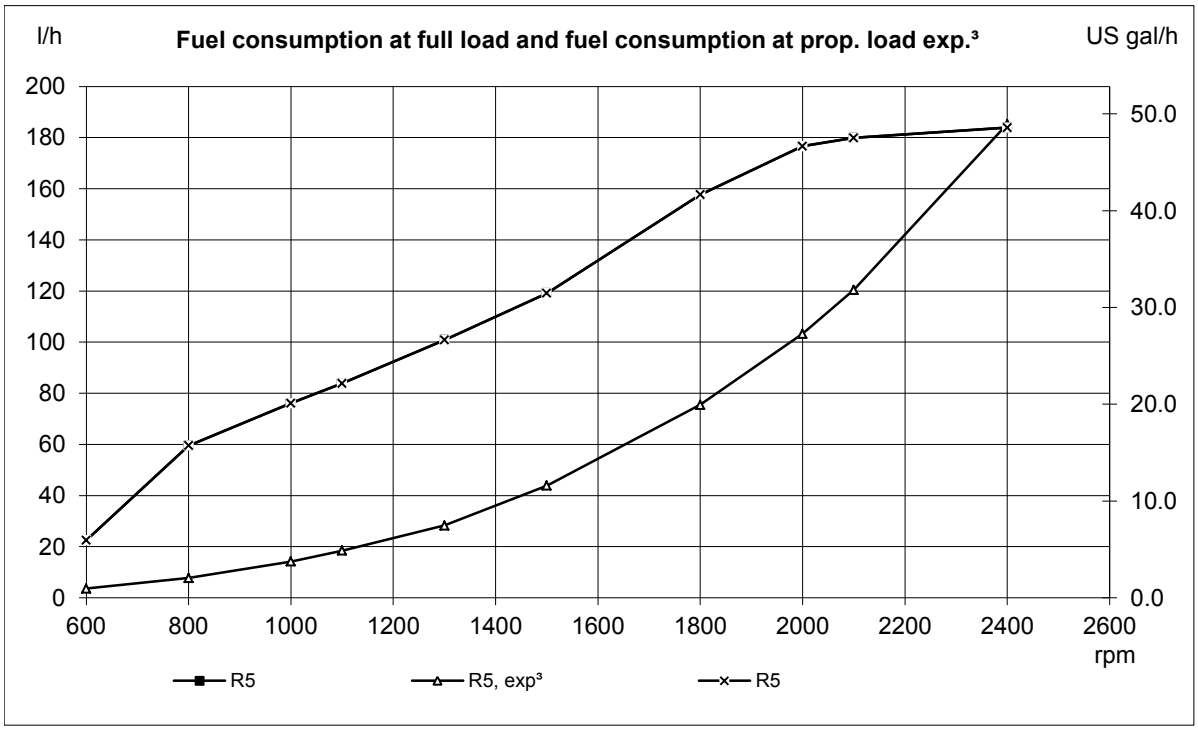

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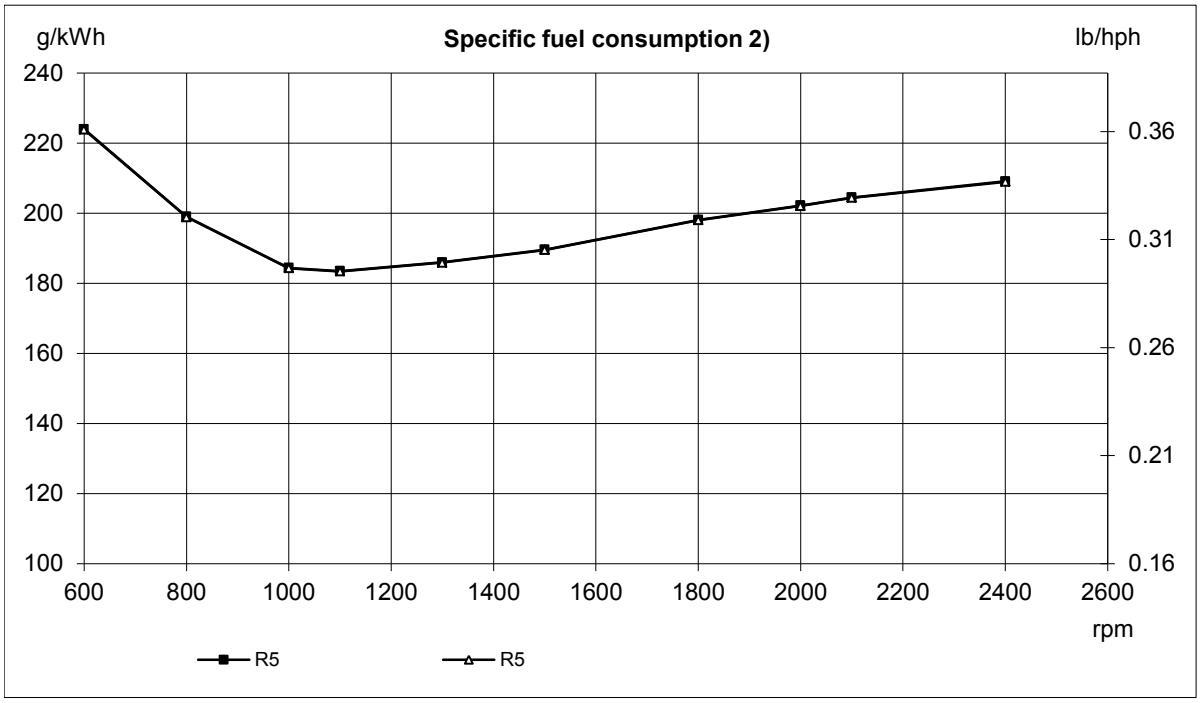

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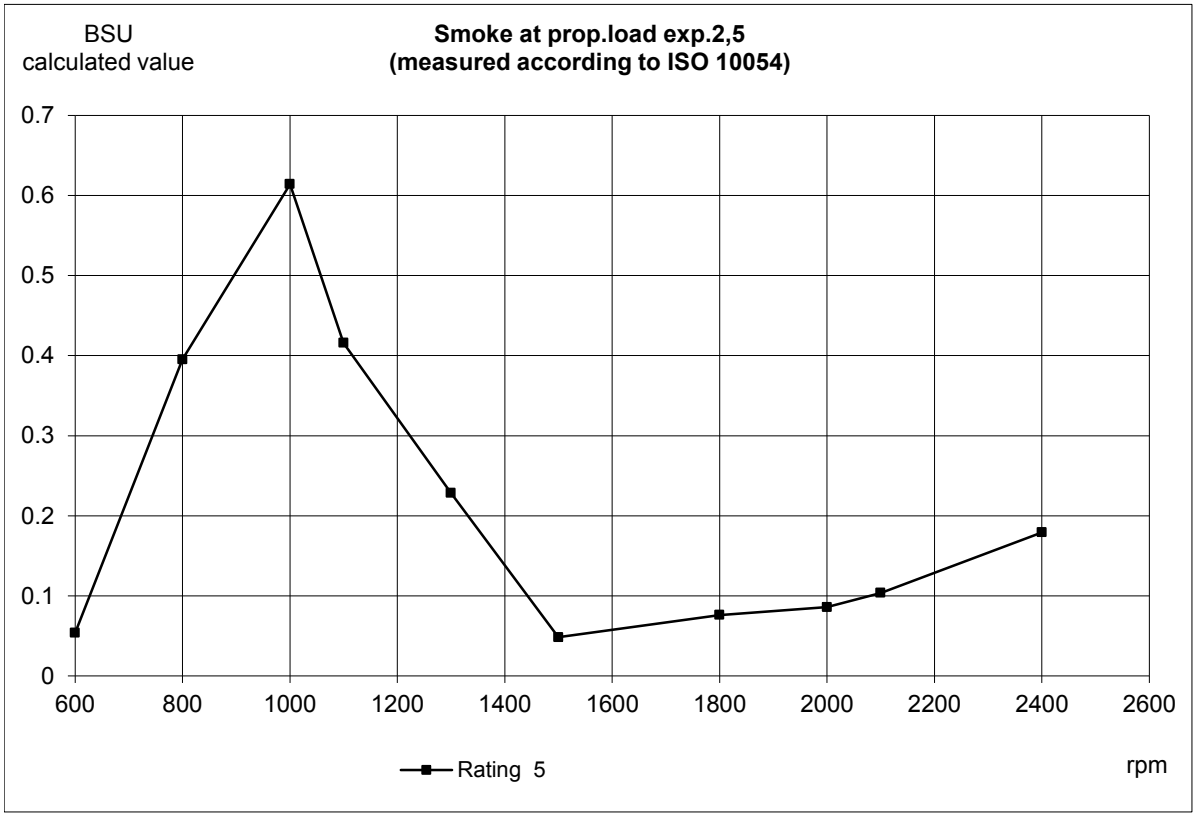

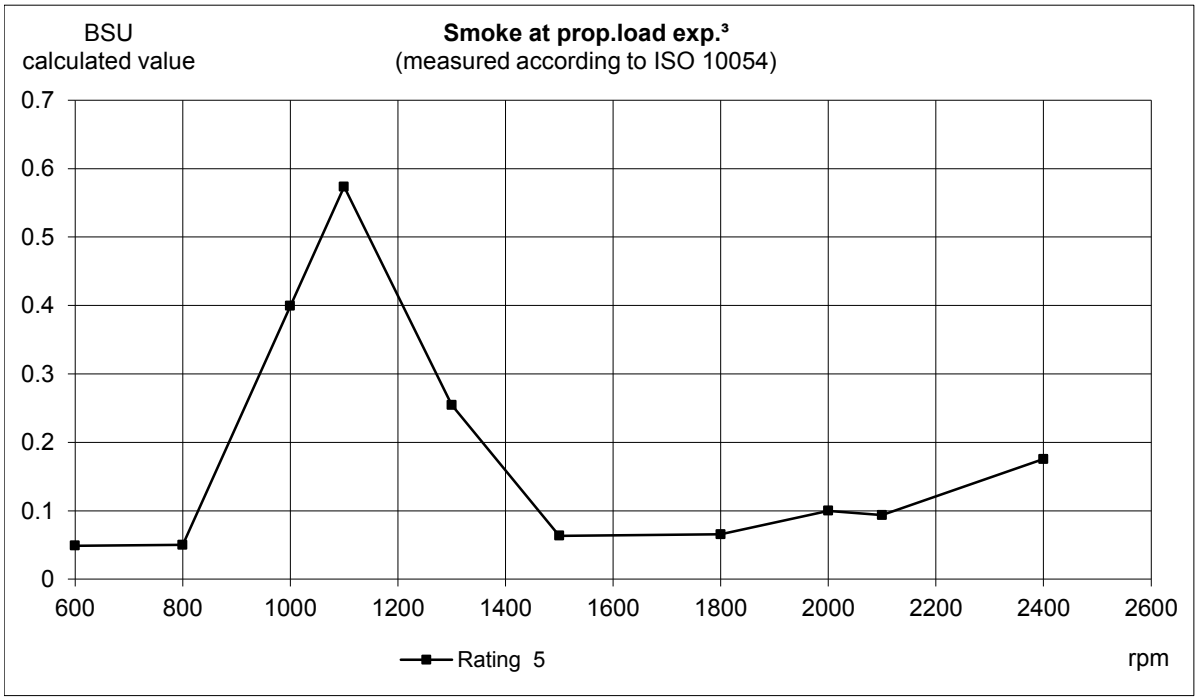

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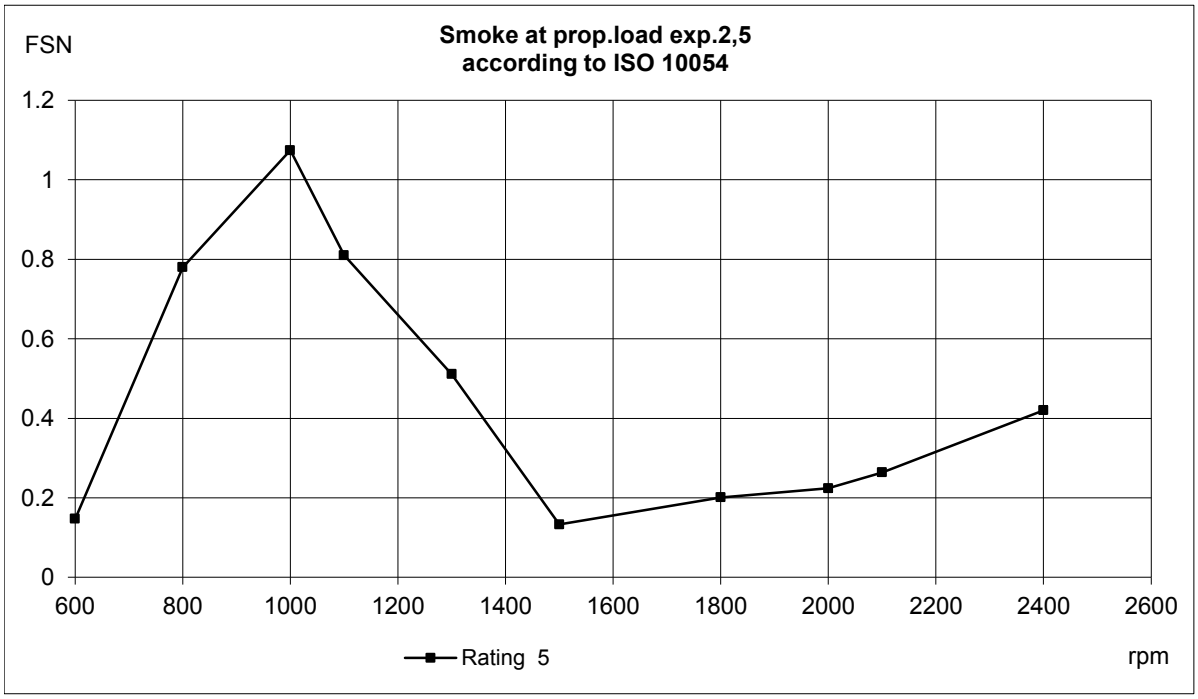

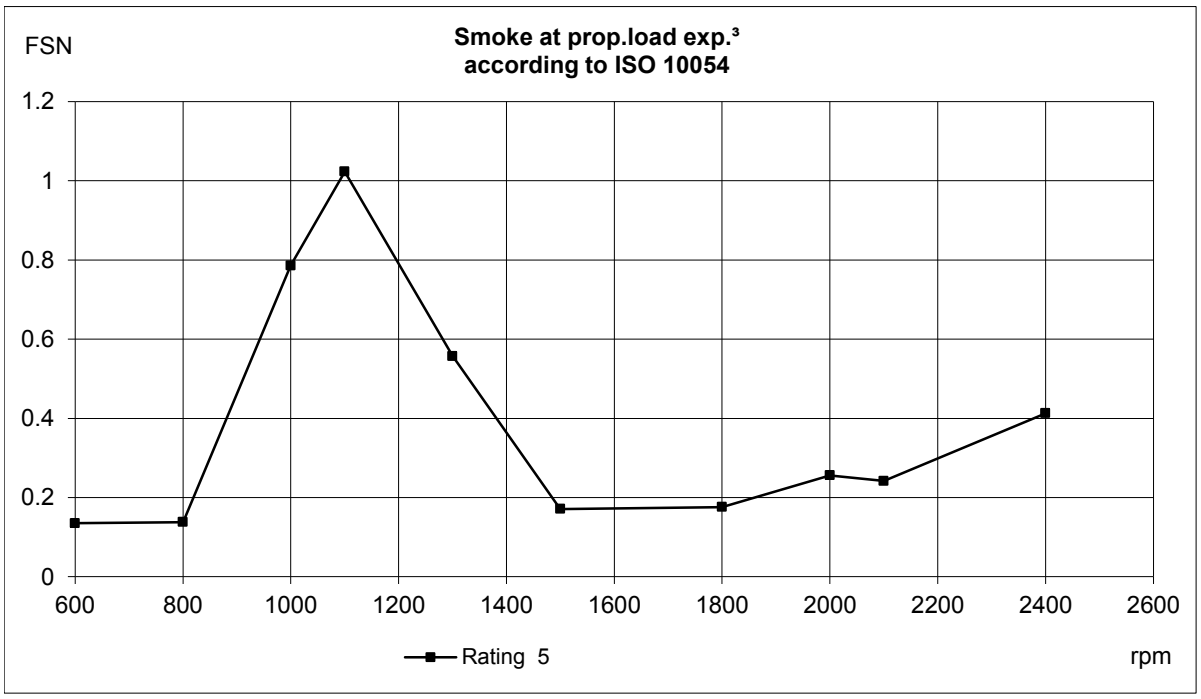

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