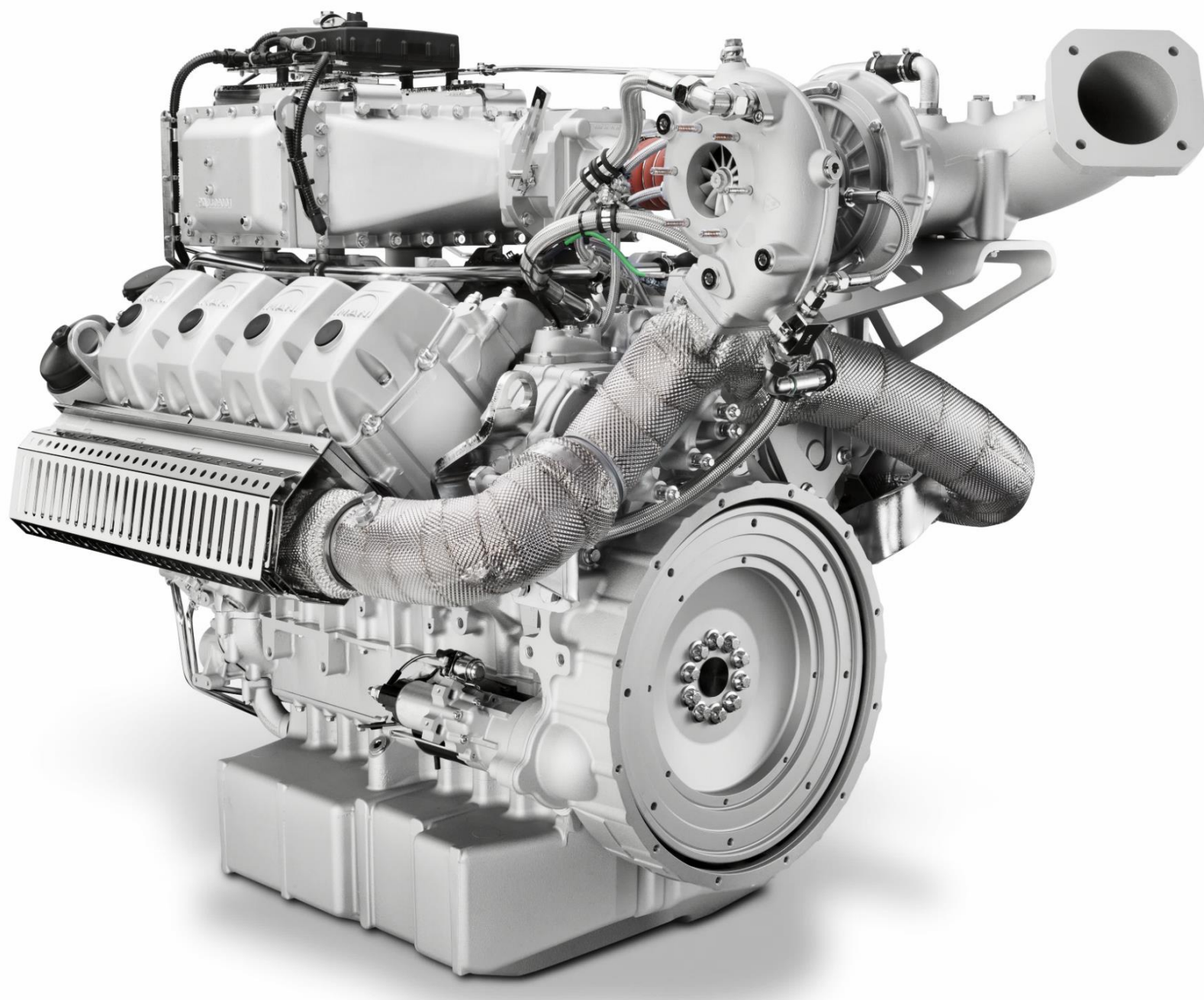


Technical Data

E3268 LE232



Since our products are in continuous development,
we reserve the right to make technical modifications.

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Content

Engine Specification	Page	3
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Resistance Curve of Engine	Page	5
Resistance Curve of HT - Mixture Cooling	Page	7
Resistance Curve of NT - Mixture Cooling	Page	9

Technical Data - Variants of Operation Mode

Gastype	Speed	NOx - Emission		Mixture Temp.			
Special Gas	1500 min ⁻¹ (50 Hz)	500 mg/m _N ³	0,4 g/bhp-hr	50 °C	122 °F	Page	11

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**Engine Specification****4 - Stroke Otto - Gas - Engine (lean burn operation)**

Specification	metric		standard	
No. of cylinders / type of construction		8	8	V - type (90°)
Bore	mm	132	in	5,20
Stroke	mm	157	in	6,18
Displacement	l	17,19	cu in	1049
No. of valves per cylinder		4		4
Direction of rotation looking on		left		left
Flywheel housing		SAE 1		SAE 1
Ring gear with number of teeth	Z	137	Z	137
Compression ratio	ϵ	12:1	ϵ	12:1

Equipment

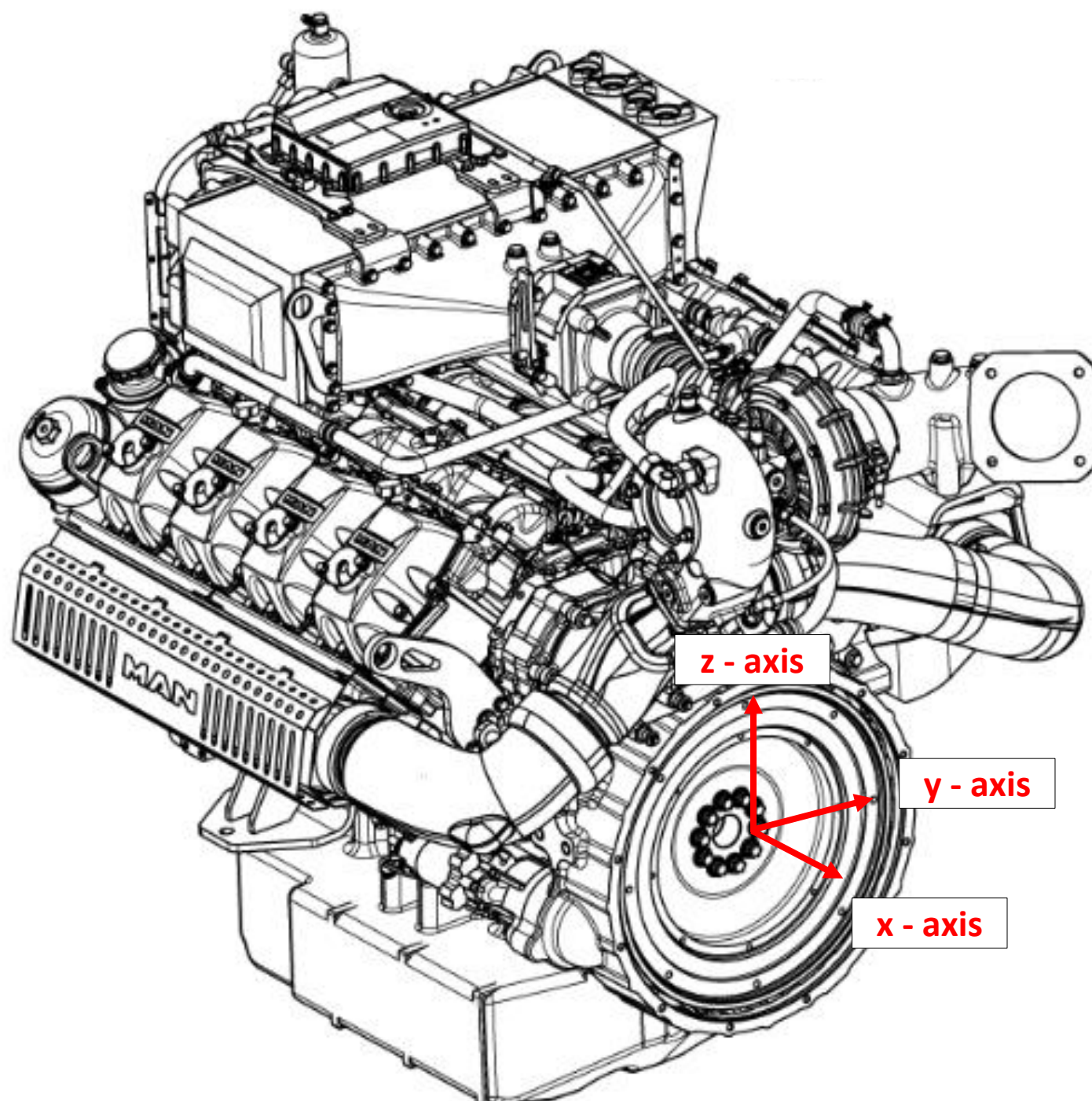
Piston:	Aluminium piston with compression ratio 12:1
Cylinder liners:	Wet cylinder liners
Camshaft:	Induction - hardened camshaft
Crankshaft:	Forged crankshaft with balancing weights
Exhaust pipes:	Dry exhaust pipes with heat insulation cover and cover against direct contact
Turbocharging:	Pressure oil lubricated turbocharger with water cooled bearing block and water cooled turbine housing
Mixture cooling / engine cooling:	Double-stage mixture cooler without cooling water pump or engine water pump; for LT - coolant circuit and for HT- and engine coolant circuit each necessary a cooling water pump with mixture temperature regulation for 50 °C (122 °F)
Lubrication:	Forced oil lubrication with two oil pumps; two exchangeable lubrication filters in the main circuit and lubrication cooler in engine coolant circuit
Oil pan / Oil capacity:	Oil pan with capacity 95 l (25 Imp. gal.)
Spark plugs:	Spark plug M18 for industrial engines
Starter:	Electric starter 24 V - 7 kW
Required capacity of starter battery:	140 / 225 Ah (min./max.) / 24 V
Engine monitoring acc. to scope of delivery:	Intake air temperature Intake air suction pressure Coolant temperature inlet Coolant temperature outlet Oiltemperature Oilpressure Exhaust temperature or optional: Dataloggerbox with CAN - Interface J1939
Documentation:	Installation instructions 51.99496-8236 Repair Manual 51.99598-8313 Operating instructions 51.99587-8006 Maintanace instructions 51.99597-8072 Assembly drawing 51.00508-7132

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Geometric Data

	metric		standard	
Dimensions				
Engine width	mm	1210	in	47,6
Engine length	mm	1620	in	63,8
Engine height	mm	1422	in	56,0
Weight				
Engine weight, dry	kg	1497	lb	3300
Gravity data				
Center of gravity, longitudinal axis Reference: Flywheel housing, rear edge	mm	-531	in	-20,9
Center of gravity, transversal axis Reference: Crankschaft axis in direction of flywheel housing	mm	-7	in	-0,28
Center of gravity, vertical axis Reference: Crankschaft axis in direction of flywheel housing	mm	215	in	8,5
Mass moments of inertia				
Mass moment of inertia, longitudinal axis	kgm²	131	lbin²	447649
Mass moment of inertia, transversal axis	kgm²	152	lbin²	519410
Mass moment of inertia, vertical axis	kgm²	147	lbin²	502324

Origin of the coordinate system in the crankshaft / flywheel - housing - rear edge



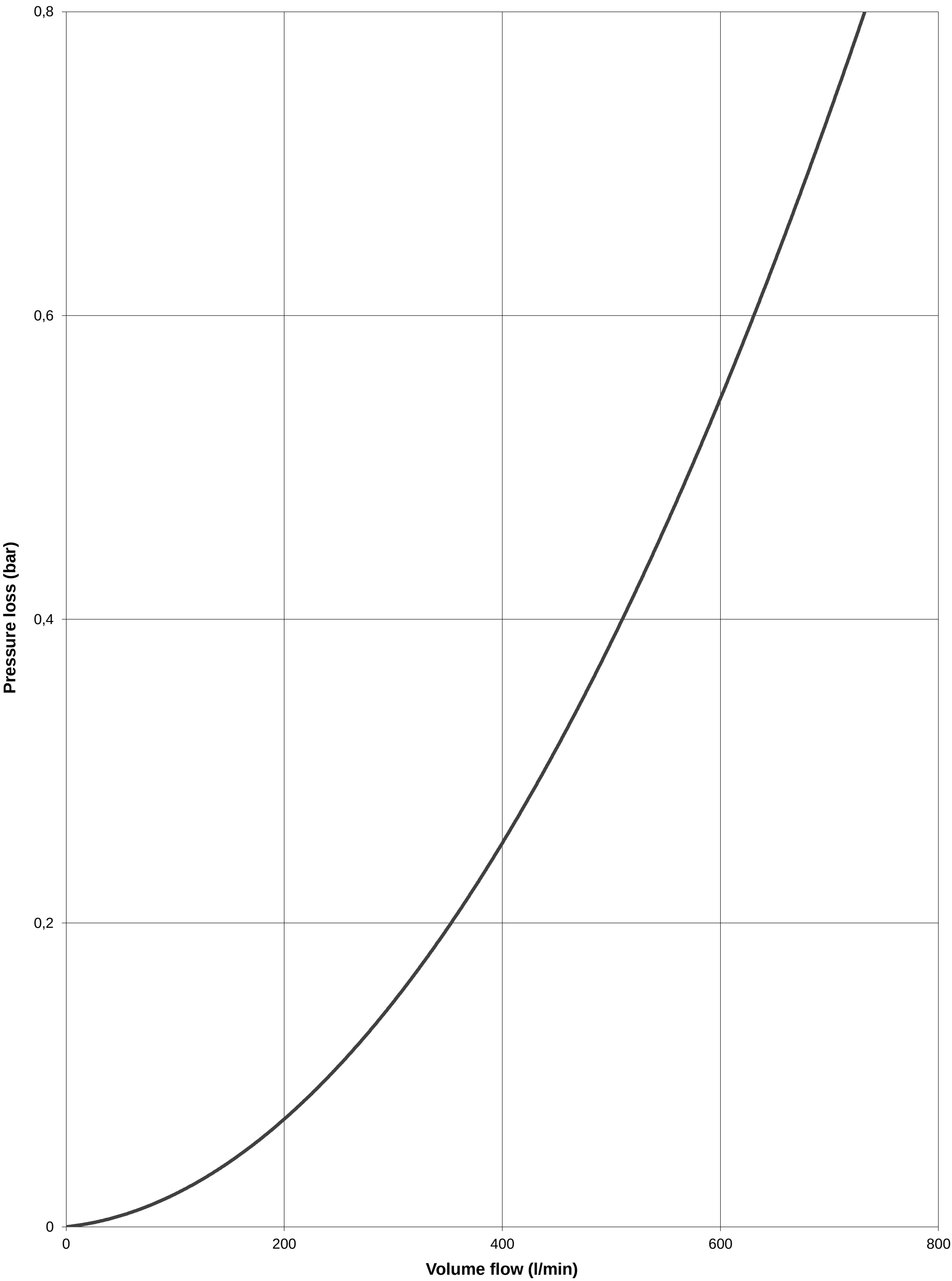
Torsional Mass Elastic System

see data sheet 51.99431-8935

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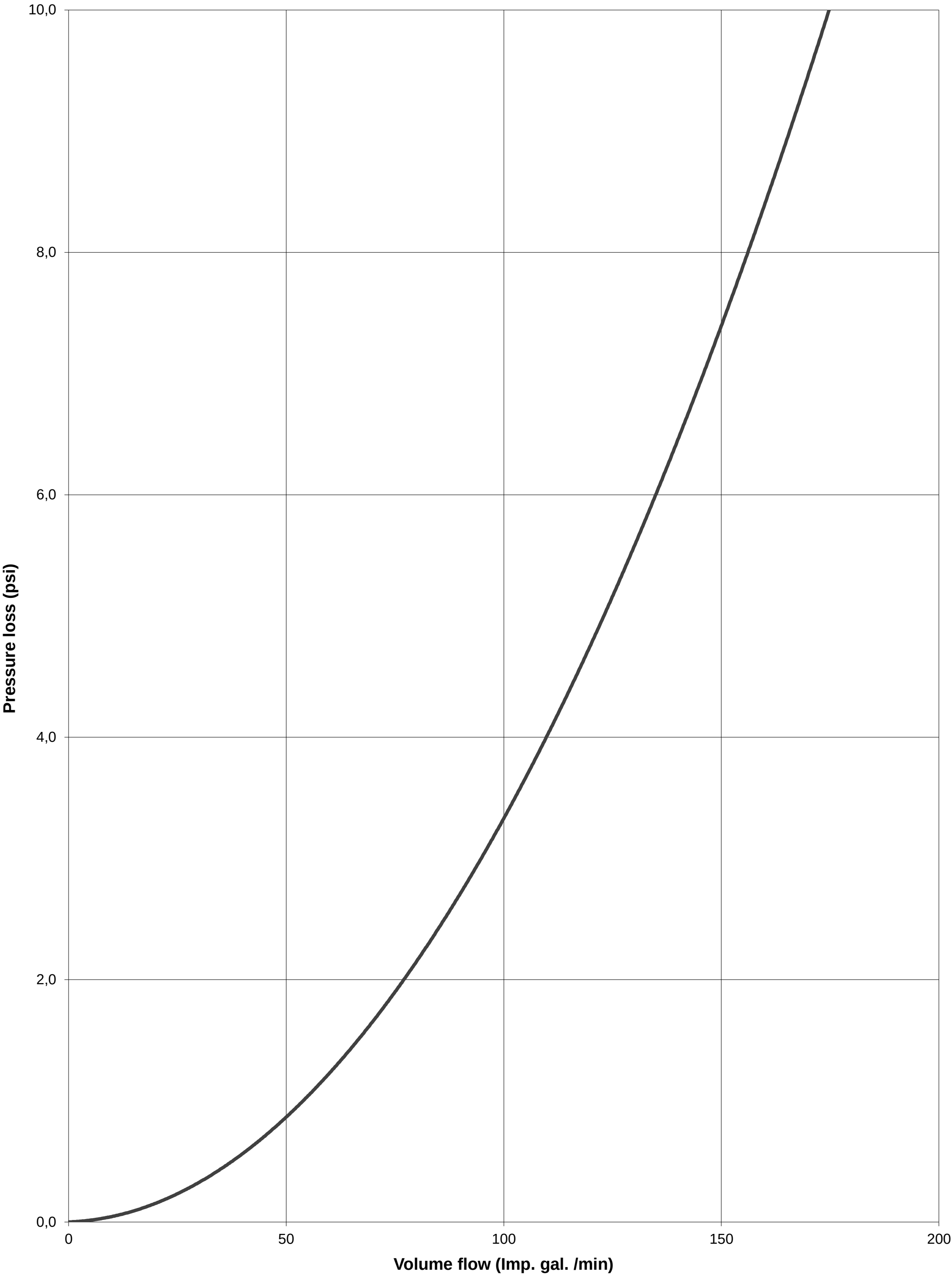
Resistance Level Engine
metric



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Resistance Level Engine
standard

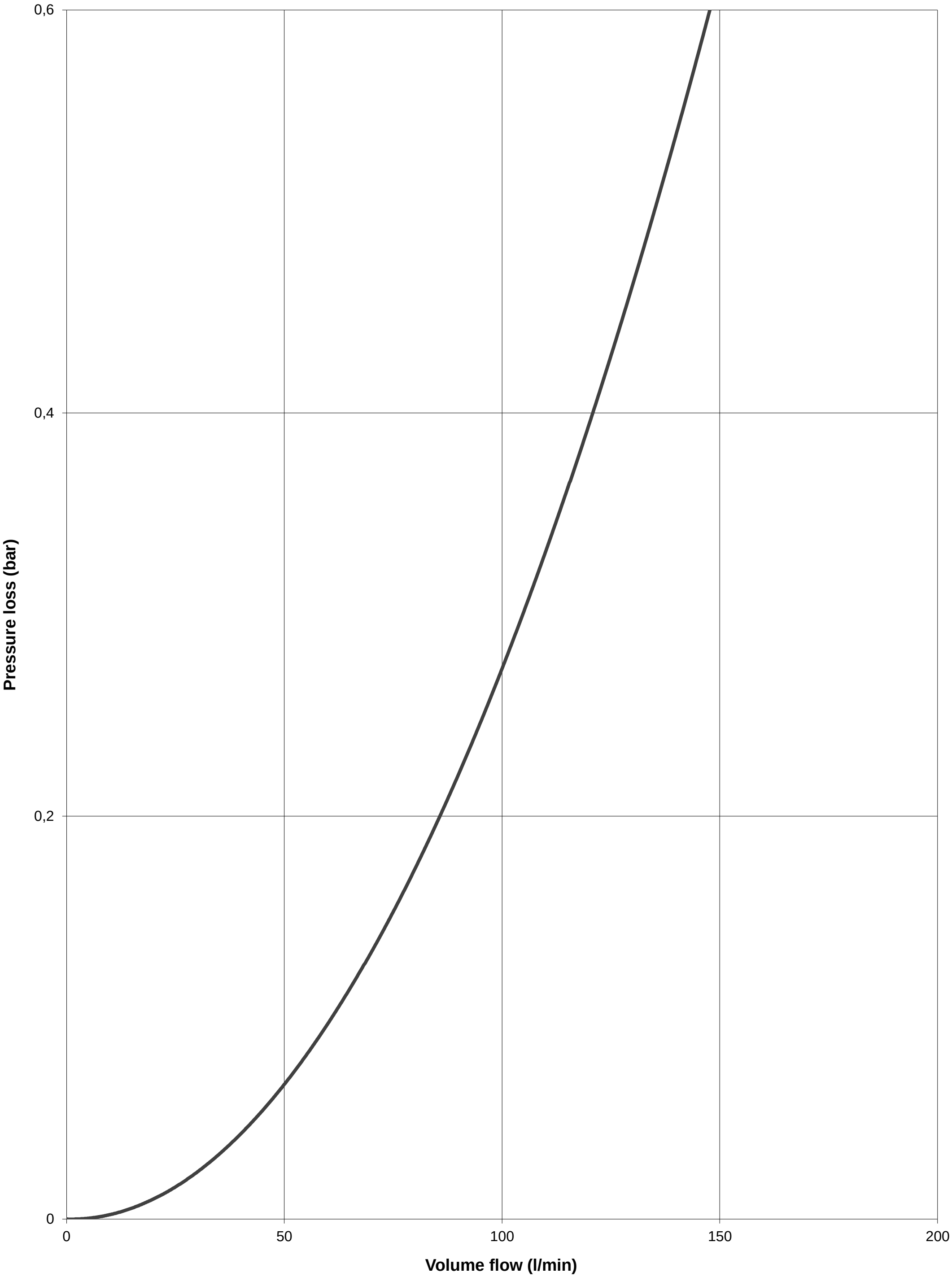


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Resistance Curve of HT - Mixture Cooler

metric
(Screwed socket, inner - Ø 34 mm)

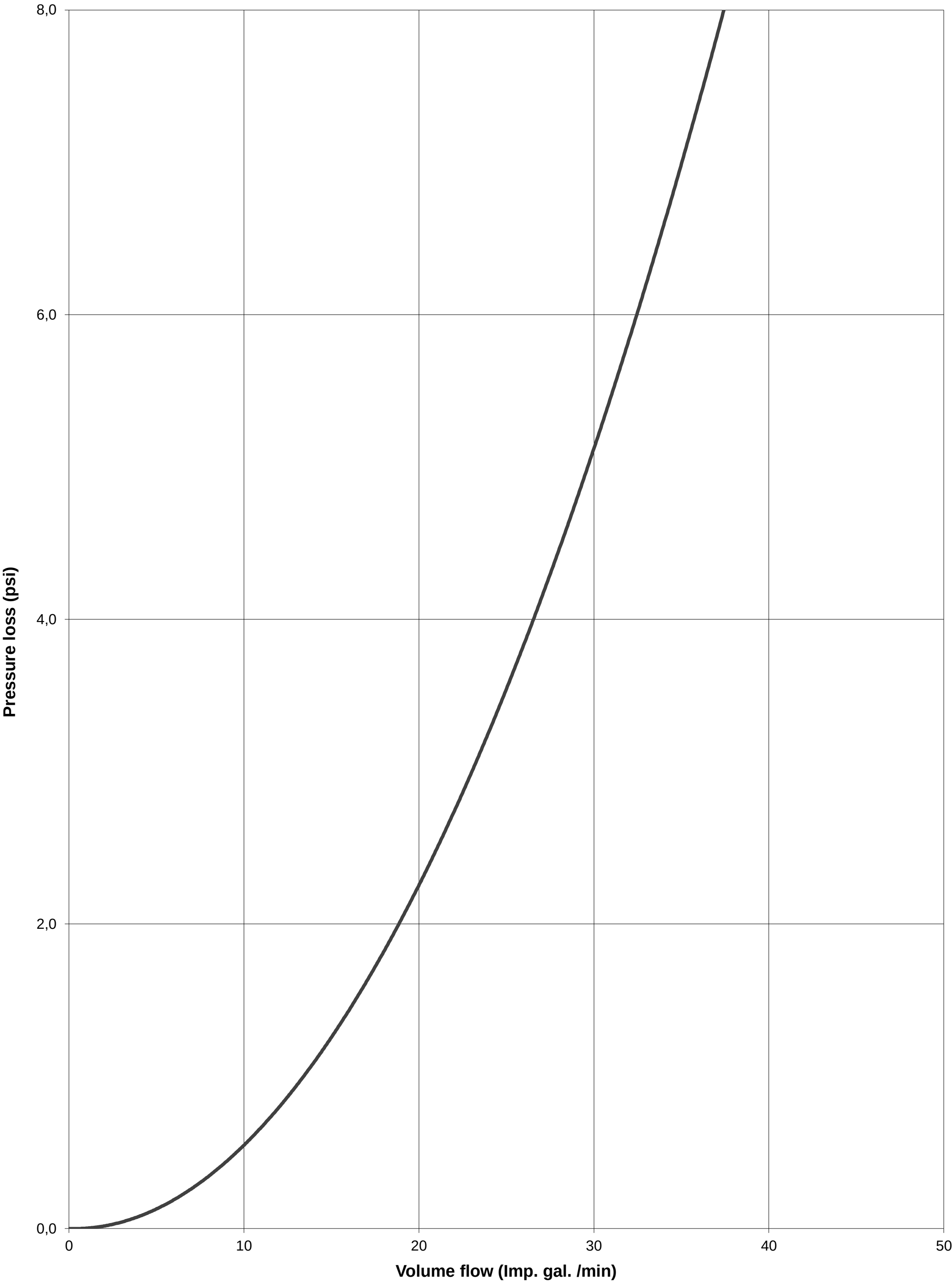


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Resistance Curve of HT - Mixture Cooler

standard
(Screwed socket, inner - Ø 1,3 in)

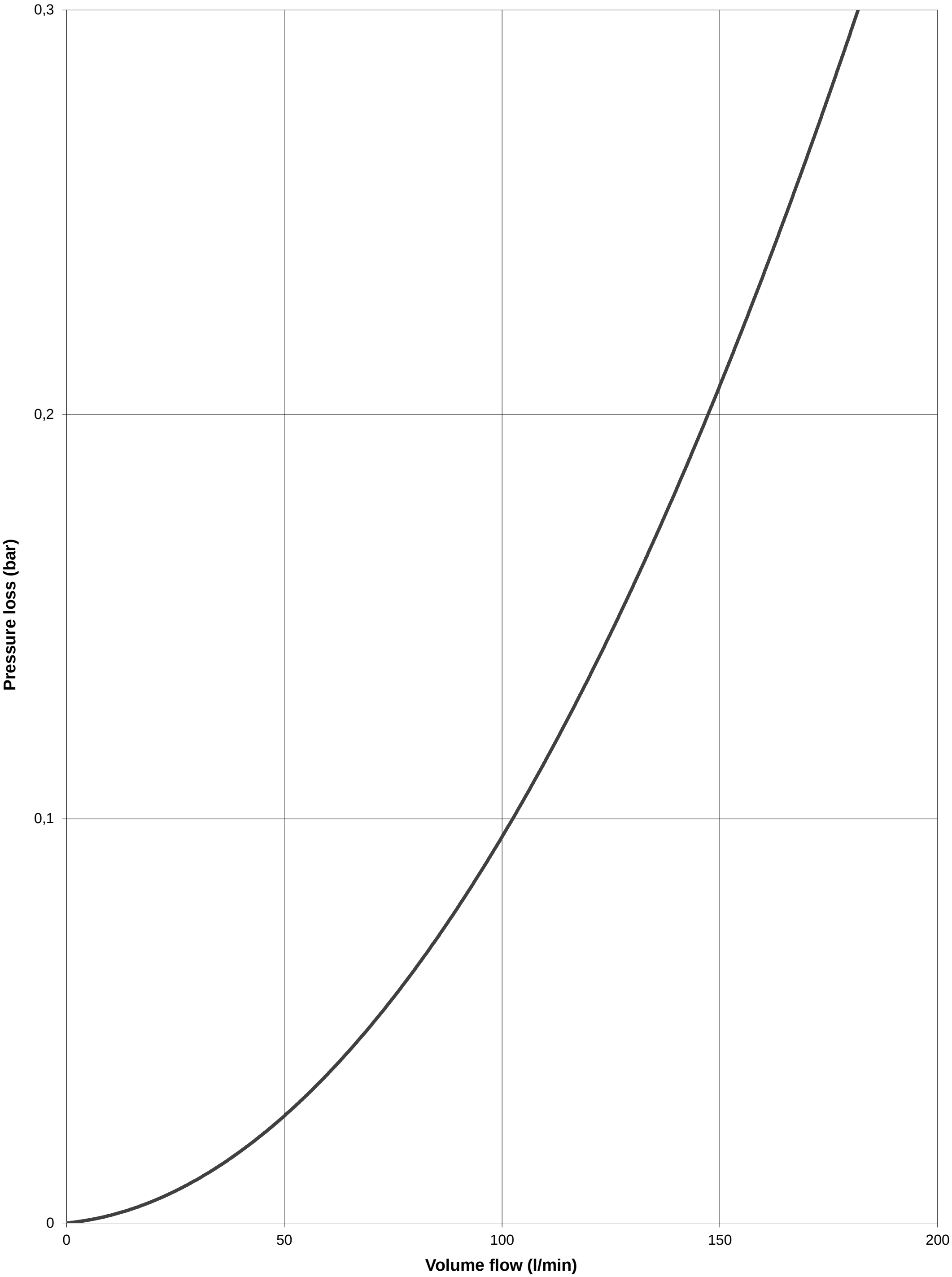


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Resistance Curve of LT - Mixture Cooler

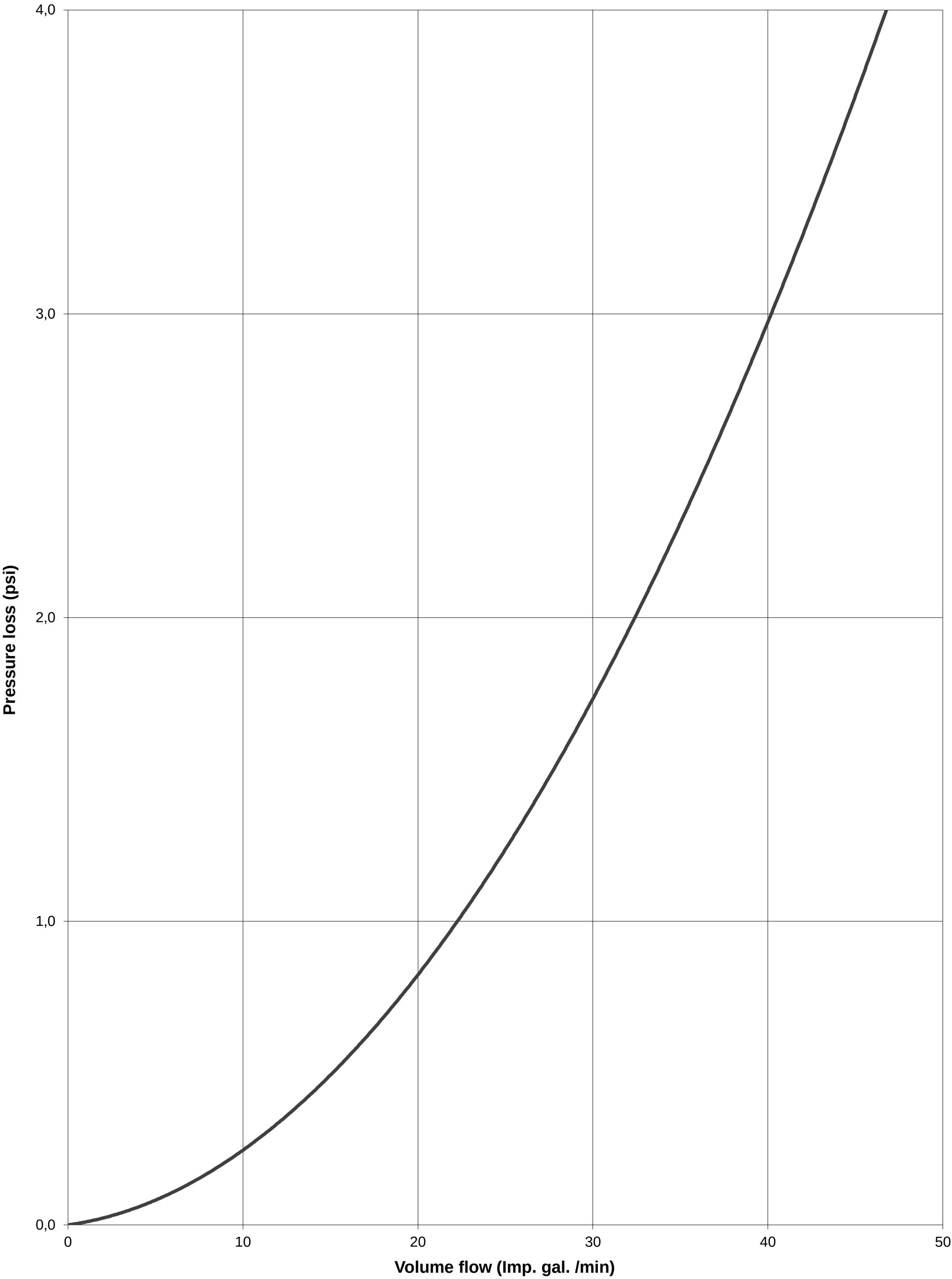
metric
(Screwed socket, inner - Ø 34 mm)



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Resistance Curve of LT - Mixture Cooler
standard
(Screwed socket, inner - Ø 1,3 in)



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Mode of Operation

Special Gas - 1500 min⁻¹ (50 Hz) - NO_x < 500 mg/m_N³ - 50 °C

Special Gas - 1500 rpm (50 Hz) - NO_x < 0,4 g/bhp - 122 °F

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**Special Gas - 1500 min⁻¹ / 1500 rpm (50 Hz) - NO_x < 500 mg/m_N³ / 0,4 g/bhp - 50 °C / 122 °F****Basic Data**

	metric			standard		
Engine Data						
Rated speed	min ⁻¹	1500		rpm	1500	
ISO standard power (COP)	kW	370		bhp	496	
Engine Torque max. (ISO 1585) at rated speed	Nm	2356		Nm	2356	
Mean effective pressure	bar	17,2		psi	249,4	
Mean piston speed	m/s	7,85		m/s	7,9	
Oil circuit						
Mean oil consumption	g/h	70		lb/hr	0,154	
Max . Permissible lubricating oil consumption	g/h	140		lb/hr	0,309	
Lube oil filling quantity min. / max.	l	75	95	Imp.gal.	20	25
Cooling circuit						
Coolant filling quantity	l	34		Imp.gal.	9,0	
- therefrom mixture cooler HT	l	4		Imp.gal.	1,1	
Coolant filling quantity mixture cooler LT	l	3		Imp.gal.	0,8	
Coolant operating pressure max. (coolant pump on engine inlet side)	bar	3		psi	43,5	
Engine cooling water circulation quantity min.	l/min	512		ft³/min	18,1	
Coolant temperature min.	°C	80		°F	176	
Coolant temperature max.	°C	88		°F	190	
Difference inlet - outlet max.	K	6		K	6	
Mixture temperature after throttle valve max.	°C	170		°F	338	
Mixture temperature after mixture cooler max.	°C	50		°F	122	
Mixture cooling water inlet temperature LT	°C	42		°F	108	
Mixture cooling water circulation quantity LT	l/min	47		ft³/min	1,7	
Difference inlet - outlet max. LT max.	K	5		K	5	
Mixture cooling water inlet temperature HT	°C	82		°F	180	
Mixture cooling water circulation quantity HT	l/min	117		ft³/min	4,1	
Difference inlet - outlet HT max.	K	5		K	5	
Coolant concentration min . / max.	%	40	50	%	40	50
Pressure conditions						
Intake air pressure after air filter max. (measured at new condition)	mbar	15		psi	0,22	
Gas flow pressure before zero pressure regulator min. / max.	mbar	30	100	psi	0,44	1,45
Pressure loss over gas mixer max.	mbar	35		psi	0,51	
Boost pressure before throttle valve n	bar	1,6		psi	23,20	
Pressure loss over mixture cooler	mbar	20			0,29	
Exhaust back pressure min. / max.	mbar	5	40	psi	0,07	0,58
Emissions						
NO _x	mg/m _N ³	< 500	(5 % O ₂)	g/bhp	< 0,4	(15 % O ₂)
CO	mg/m _N ³	< 600	(5 % O ₂)	g/bhp	< 0,5	(15 % O ₂)
HCHO (measured by FTIR)	mg/m _N ³	< 60	(5 % O ₂)	g/bhp	< 0,1	(15 % O ₂)
HC	mg/m _N ³	< 450	(5 % O ₂)	g/bhp	< 0,5	(15 % O ₂)
NMHC	ppm	< 50		ppm	< 50	
NMNEHC (VOC)	ppm	< 10		ppm	< 10	
TOC (ohne Methan)	mg/m _N ³	< 100	(5 % O ₂)	g/bhp	< 0,1	(15 % O ₂)

Lube oil to MAN works standard M 3271-4 and coolant to MAN works standard MAN 324 NF
Gas quality to MAN data sheet - minimum requirement for the gas quality for MAN gas engines

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Special Gas - 1500 min⁻¹ (50 Hz) - NO_x < 500 mg/m_N³ - 50 °C

Flow and Heat Balance

MZ > 100 / IT 19 °CA / 370 kW
metric

Performance Data

Load	%	100	75	50
Ignition timing	°CA	19	19	19
ISO standard power ¹	kW	370	277	185
Coolant heat ²	kW	193	162	132
Mixture heat HT ²	kW	37	15	1
Mixture heat LT ²	kW	16	10	0
Exhaust heat up to 120 °C	kW	222	174	122
Radiation heat max.	kW	22	20	17
Energy input	kW	918	703	487
Specific fuel consumption	MJ/kWh	8,9	9,1	9,5
Air ratio ³		1,47	1,44	1,40

Efficiency Data

mechanical ¹	%	40,3	39,4	38,0
thermal	%	49,2	50,0	52,4
total	%	89,5	89,4	90,4

Mass flows

Combustion air	kg/h	1665	1249	841
Fuel	kg/h	187	143	99
Exhaust gas mass flow rate, wet	kg/h	1853	1393	940
Exhaust gas volume flow rate, dry ⁴	Nm ³ /h	1447	1088	735
Engine coolant mass flow rate	kg/h	31564		
Mixture cooling water mass flow rate LT	kg/h	2809		
Mixture cooling water mass flow rate HT	kg/h	7220		

Temperatures

Measured exhaust gas temperature before turbocharger (average)	°C	638
Measured exhaust gas temperature after turbocharger (average)	°C	481

Reference setting: Gasmixer Heinzmann VE-200-1001-S22-12x9,8 / 12x11,0
Ignition System Motortech MIC 4

¹ The stated power data refers to the below-mentioned values acc to ISO 3046-1.
The stated mechanical efficiency data is related to the ISO standard power.

Standard conditions	Atmospheric pressure abs.	kPa	100		
	Air temperature	°C	25		
	Relative air humidity	%	30		
Measured efficiency data	Load	%	100	75	50
	Efficiency mech.	%	39,5	38,6	37,2
Conditions at measurement	Installation location	m	310		
	Atmospheric pressure abs.	kPa	98,8		
	Inlet air temperature	°C	24,9		
	Relative air humidity	%	43		
Gas conditions at measurement	Calorific value	MJ/kg	17,65		
	Methane number		140		
	Ratio CH ₄ / CO ₂	%	60 / 40		

² Cooling water data based on	Antifreeze proportion	%	45
	Spec. effective heat capacity c _p	kJ/kg K	3,67
	Difference (inlet - outlet max.)	K	6

³ Air ratio Measured with ETAS LA 4_E. Please see chapter "Values / limits"

⁴ Standard conditions acc. to TA-Luft	Air temperature	°C	0
	Atmospheric pressure abs.	kPa	100

Tolerance for usable heat at rated output	%	±7
Tolerance for specific fuel consumption at rated output	%	+5

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Special Gas - 1500 rpm (50 Hz) - NO_x < 0,4 g/bhp - 122 °F

Flow and Heat Balance

MZ > 100 / IT 19 °CA / 496 bhp
standard

Performance Data

Load	%	100	75	50
Ignition timing	°CA	19	19	19
ISO standard rating ¹	bhp	496	371	248
Coolant heat ²	bhp	259	217	177
Mixture heat HT ²	bhp	50	20	1
Mixture heat LT ²	bhp	21	13	0
Exhaust heat up to 248 °F	bhp	298	233	164
Radiation heat max.	bhp	30	27	23
Energy input	bhp	1231	943	653
Specific fuel consumption	BTU/bhp-hr	6290	6432	6714
Air ratio ³		1,47	1,44	1,40

Efficiency Data

mechanical ¹	%	40,3	39,4	38,0
thermal	%	49,2	50,0	52,4
total	%	89,5	89,4	90,4

Mass flows

Combustion air	lb/hr	3671	2754	1854
Fuel	lb/hr	412	315	218
Exhaust gas mass flow rate, wet	lb/hr	4085	3071	2072
Exhaust gas volume flow rate, dry ⁴	Nm ³ /h	1447	1088	735
Engine coolant mass flow rate	lb/hr	69587		
Mixture cooling water mass flow rate LT	lb/hr	6193		
Mixture cooling water mass flow rate HT	lb/hr	15917		

Temperatures

Measured exhaust gas temperature before turbocharger (average)	°F	1180
Measured exhaust gas temperature after turbocharger (average)	°F	898

Reference setting: Gasmixer Heinzmann VE-200-1001-S22-12x9,8 / 12x11,0
Ignition System Motortech MIC 4

¹ The stated power data refers to the below-mentioned values acc to ISO 3046-1.
The stated mechanical efficiency data is related to the ISO standard power.

Standard conditions	Atmospheric pressure abs.	psi	14,50		
	Air temperature	°F	77		
	Relative air humidity	%	30		
Measured efficiency data	Load	%	100	75	50
	Efficiency mech.	%	39,5	38,6	37,2
Conditions at measurement	Installation location	ft	1017		
	Atmospheric pressure abs.	psi	14,3		
	Inlet air temperature	°F	77		
	Relative air humidity	%	43		
Gas conditions at measurement	Calorific value	MJ/kg	17,7		
	Methane number		140		
	Ratio CH ₄ / CO ₂	%	60 / 40		

² Cooling water data based on

Antifreeze proportion	%	45
Spec. effective heat capacity c _p	kJ/kg K	3,67
Difference (inlet - outlet max.)	K	6

³ Air ratio Measured with ETAS LA 4_E. Please see chapter "Values / limits"

⁴ Standard conditions acc. to TA-Luft

Air temperature	°F	32
Atmospheric pressure abs.	psi	14,5

Tolerance for usable heat at rated output	%	±7
Tolerance for specific fuel consumption at rated output	%	+5

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Special Gas - 1500 min⁻¹ / 1500 rpm (50 Hz) - NO_x < 500 mg/m_N³ / 0,4 g/bhp - 50 °C / 122 °F

Values / limits for 100 % load*

	metric		standard	
Methane number	> 100		> 100	
Performance Data	Hz	50	Hz	50
Ignition timing (±2 °CA)	°CA	19	°CA	19
ISO standard power	kW	370	bhp	496
O ₂ - proportion in the exhaust gas min.	Vol-%	7,0	Vol-%	7,0
NO _x - proportion in the exhaust gas	mg/Nm ³	500	g/bhp	0,4
Operating parameters				
Coolant operating pressure max. (pump in pressure operation)	bar	3,0	psi	44
Intake air pressure after air filter max. (measured at new condition)	mbar	15	psi	0,22
Gas flow pressure before zero pressure regulator min. / max.	mbar	30 100	psi	0,44 1,45
Pressure loss over gas mixer max.	mbar	35	psi	0,51
Boost pressure before throttle valve max.	bar	1,6	psi	23
Pressure loss over mixture cooler max.	mbar	20	psi	0,29
Exhaust back pressure min. / max.	mbar	5 40	psi	0,07 0,58

* The values and limits are valid with standard conditions acc. to ISO 3046-1 at 100 m / 328 ft above sea level

Standard conditions:			metric	standard	
	Atmospheric pressure abs.	kPa	100	psi	14,5
	Air temperature	°C	25	°F	77
	Relative air humidity	%	30	%	30

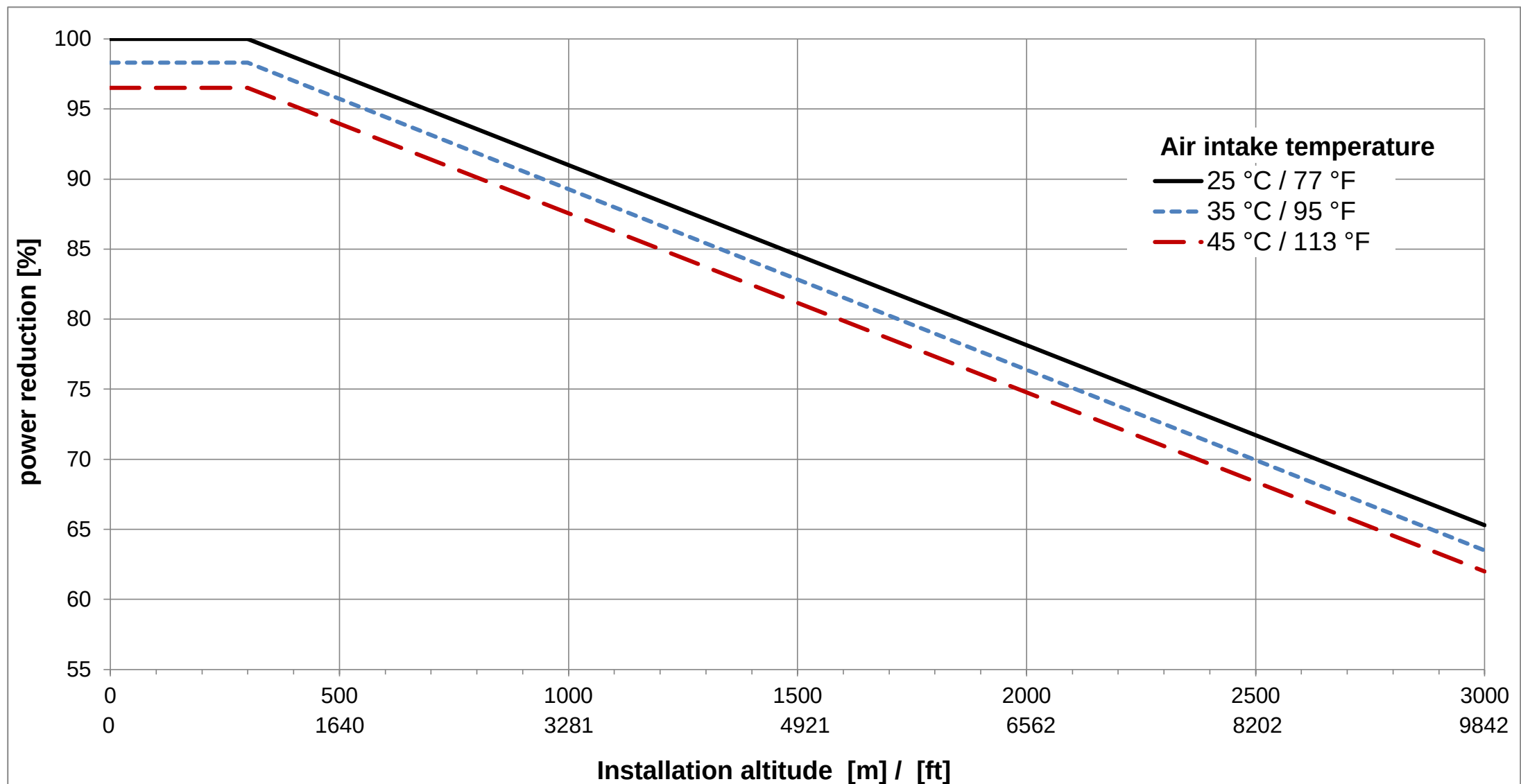
For alternative operating parameters please see chapter "Power reduction".

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Special Gas - 1500 min⁻¹ / 1500 rpm (50 Hz) - NO_x < 500 mg/m_N³ / 0,4 g/bhp - 50 °C / 122 °F

Power Reduction

Power reduction depending on installation altitude



Power reduction depending on installation altitude has to be implemented permanently in the system control.

Power reduction depending on mixture temperature

Mixture temperature after mixture cooler		Power reduction
°C	°F	%
≥ 55	≥ 131	2
≥ 60	≥ 140	6
≥ 65	≥ 149	Operation not permitted / Engine stop

Power reduction depending on exhaust gas temperature

Exhaust gas temperature before turbocharger		Power reduction
°C	°F	%
≥ 660	≥ 1220	2
≥ 670	≥ 1238	6
≥ 680	≥ 1256	Operation not permitted / Engine stop

Operation with methane numbers < 100

Operation with methane numbers < 100 is not permitted with this engine type.

The power reduction depending on mixture- and exhaust gas temperature has to be implemented in addition to the power reduction depending on installation altitude.

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Special Gas - 1500 min⁻¹ / 1500 rpm (50 Hz) - NO_x < 500 mg/m_N³ / 0,4 g/bhp - 50 °C / 122 °F

Acoustic Data

Engine surface noise according to DIN 45635 - 11 - KL2

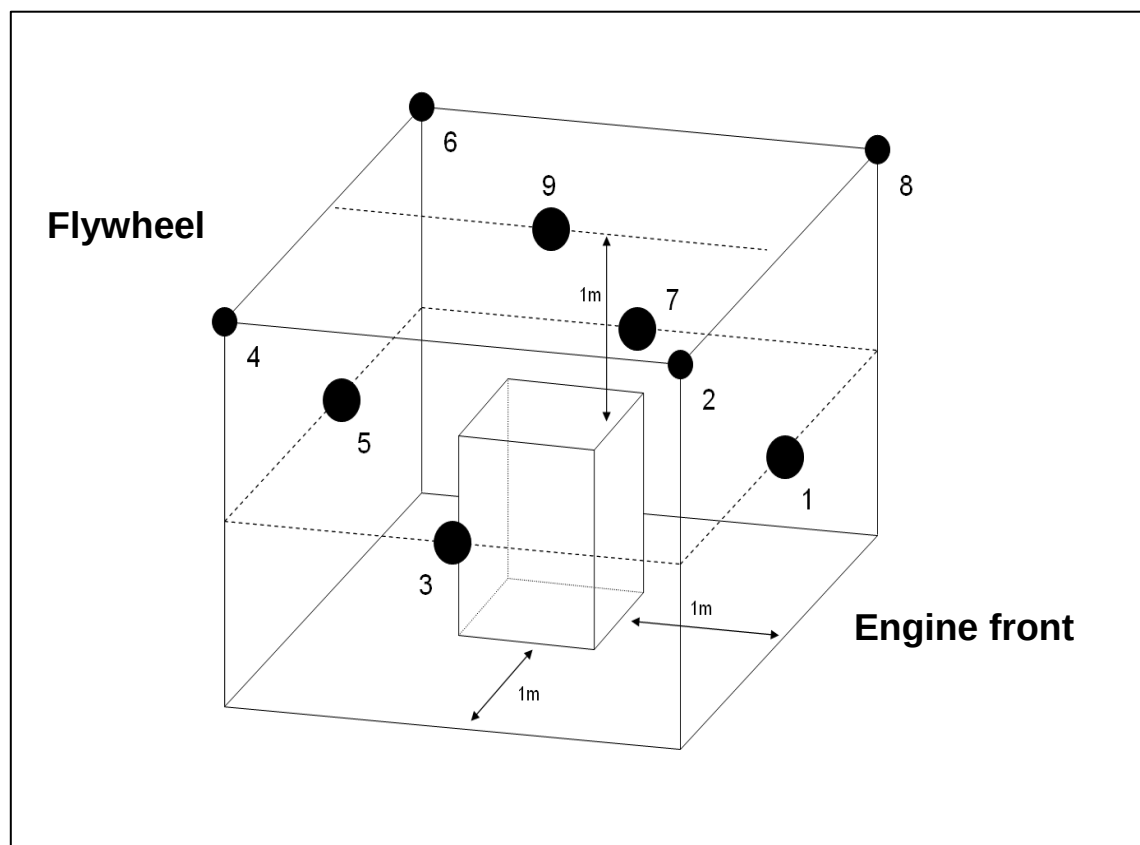
Sound pressure level of single measuring points (Octaves)

A - weighted measuring surface - sound pressure level
A - weighted sound power level
Surface dimension

L_{pA} (re 20 µPa) dB(A) 90
L_{WA} (re 1 pW) dB(A) 107,0
L_S dB 16,7

Frequency [Hz]	MP 1 [dB(A)]	MP 2 [dB(A)]	MP 3 [dB(A)]	MP 4 [dB(A)]	MP 5 [dB(A)]	MP 6 [dB(A)]	MP 7 [dB(A)]	MP 8 [dB(A)]	MP 9 [dB(A)]	1-9 av. [dB(A)]
25	22,3	17,7	26,2	30,6	Measuring point 5 is not feasible for room technical reasons.	26,2	24,7	24,8	18,2	25,6
31,5	20,2	16,5	17,5	23,2		18,2	15,2	19,3	11,1	18,8
40	14,7	15,3	22,5	18,4		14,9	18,5	11,4	12,0	17,4
50	22,8	21,6	26,4	26,1		26,3	30,5	21,4	25,1	26,0
63	41,3	31,2	39,4	39,8		32,7	34,7	31,5	40,4	38,0
80	45,3	43,2	39,6	47,1		47,2	41,7	44,5	51,7	46,5
100	55,3	52,4	55,4	43,3		47,2	50,6	55,2	51,1	52,8
125	53,9	47,9	56,6	41,3		51,1	56,0	50,2	49,0	52,7
160	54,1	52,1	59,0	52,5		54,8	59,3	52,5	58,1	56,2
200	65,8	62,1	65,5	63,4		60,6	63,0	64,3	70,9	65,6
250	59,9	58,5	62,6	61,9		60,2	65,8	63,1	64,1	62,6
315	72,8	67,8	74,2	66,8		67,3	69,6	67,1	72,8	70,7
400	76,1	71,8	78,3	72,1		71,3	75,2	70,5	75,7	74,7
500	75,8	72,5	77,0	74,0		71,4	73,8	70,9	75,3	74,3
630	83,2	75,1	77,3	75,3		74,2	78,4	72,8	79,9	78,3
800	79,8	76,8	78,3	72,5		73,9	81,2	76,7	76,5	77,8
1000	78,8	76,5	78,5	73,8		74,3	78,7	76,5	78,2	77,3
1250	79,7	75,7	83,8	80,3		78,5	79,4	74,4	80,9	79,9
1600	83,2	76,2	83,9	76,4		74,7	84,9	78,7	82,4	81,5
2000	82,9	76,5	81,8	75,1		74,9	79,7	77,9	81,6	79,7
2500	81,2	75,2	80,8	73,6		73,4	79,4	74,3	79,4	78,2
3150	79,5	75,0	78,7	76,4		73,8	78,9	74,6	78,9	77,5
4000	80,5	74,2	78,9	75,8		74,6	78,9	75,2	79,9	77,9
5000	77,4	72,2	77,7	72,6		70,8	75,9	70,9	77,2	75,2
6300	73,5	69,7	75,3	70,8		69,2	73,3	68,0	76,0	72,8
8000	72,9	74,7	82,1	76,8		75,7	75,2	73,5	82,4	78,2
10000	67,3	67,2	72,7	69,0		68,2	71,1	66,4	73,7	70,2
12500	67,5	67,1	72,0	74,5		76,6	76,7	74,5	77,0	74,5
16000	70,6	71,0	75,6	79,0		81,3	80,9	79,1	81,3	78,9
20000	51,5	50,7	56,4	55,2		56,2	59,6	55,7	60,2	56,7
Sum	91,6	86,6	92,0	87,8	0,0	87,5	91,3	87,4	91,7	90,0

Placement of measuring points of engine noise surface



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Special Gas - 1500 min⁻¹ / 1500 rpm (50 Hz) - NO_x < 500 mg/m_N³ / 0,4 g/bhp - 50 °C / 122 °F

Acoustic Data

Exhaust outlet noise according to DIN 45635 - 11 - KL2

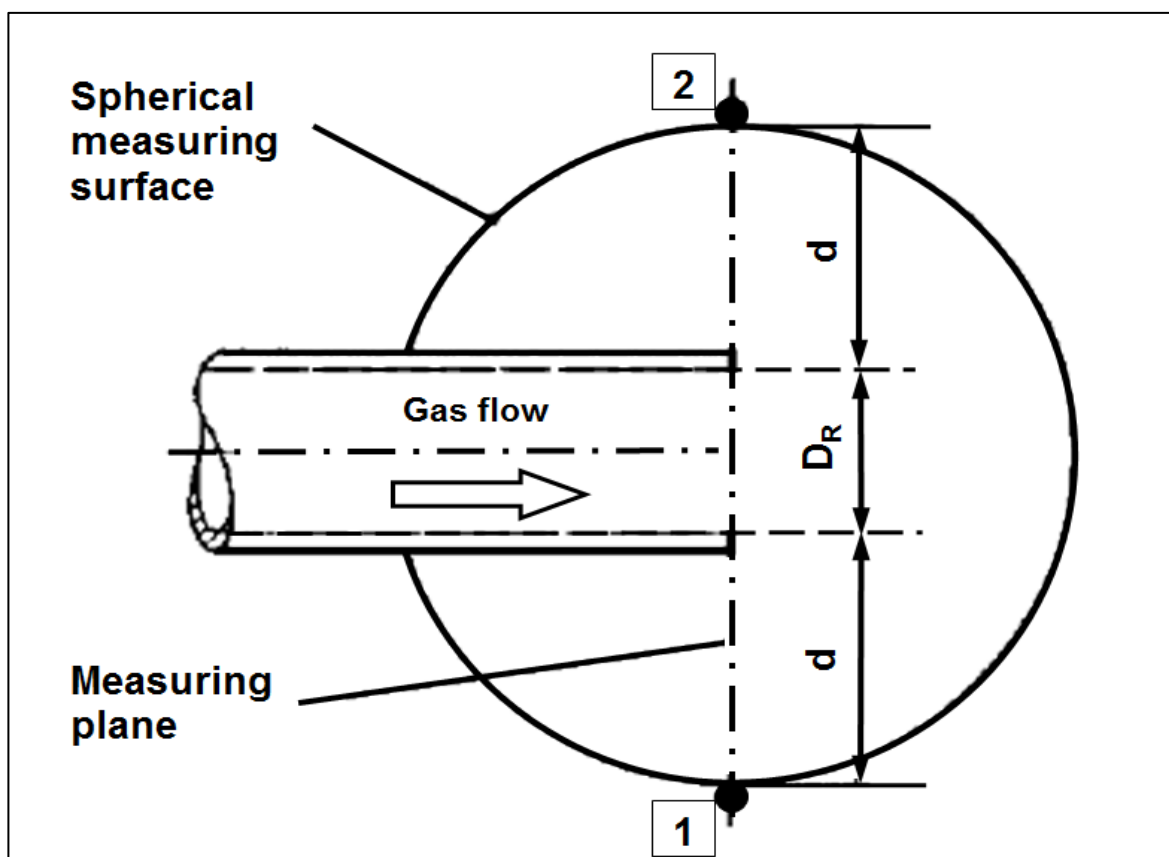
Sound pressure level of single measuring points (Octaves)

A - weighted measuring surface - sound pressure level
A - weighted sound power level
Surface dimension

L_{pA} (re 20 µPa) dB(A) 108,2
L_{WA} (re 1 pW) dB(A) 120,0
L_S dB 11,6

Frequency [Hz]	MP 1 [dB(A)]	MP 2 [dB(A)]	1-2 av. [dB(A)]
25	37,4	38,9	38,2
31,5	33,3	32,3	32,8
40	47,8	48,1	48,0
50	51,3	51,1	51,2
63	64,0	65,2	64,6
80	66,2	68,5	67,5
100	84,2	84,2	84,2
125	78,9	80,6	79,8
160	85,9	85,0	85,5
200	97,9	98,6	98,3
250	84,7	84,9	84,8
315	94,1	93,8	94,0
400	100,1	100,4	100,3
500	97,9	97,6	97,8
630	99,2	99,9	99,6
800	96,8	96,6	96,7
1000	96,0	97,1	96,6
1250	97,1	97,4	97,3
1600	95,3	96,0	95,7
2000	94,6	95,7	95,2
2500	93,7	94,1	93,9
3150	93,8	94,5	94,2
4000	92,5	93,0	92,8
5000	90,4	90,9	90,7
6300	87,4	87,7	87,6
8000	81,8	80,4	81,2
10000	77,1	75,4	76,3
12500	75,0	71,7	73,7
16000	77,9	73,4	76,2
20000	53,2	48,1	51,4
Sum	108,8	108,4	108,2

Placement of measuring points of exhaust outlet noise



	Date	Signature	No. of data sheet	Index
Created	04.12.2017	FM	51.99494-7092	
Released	11.12.2017	Kn		