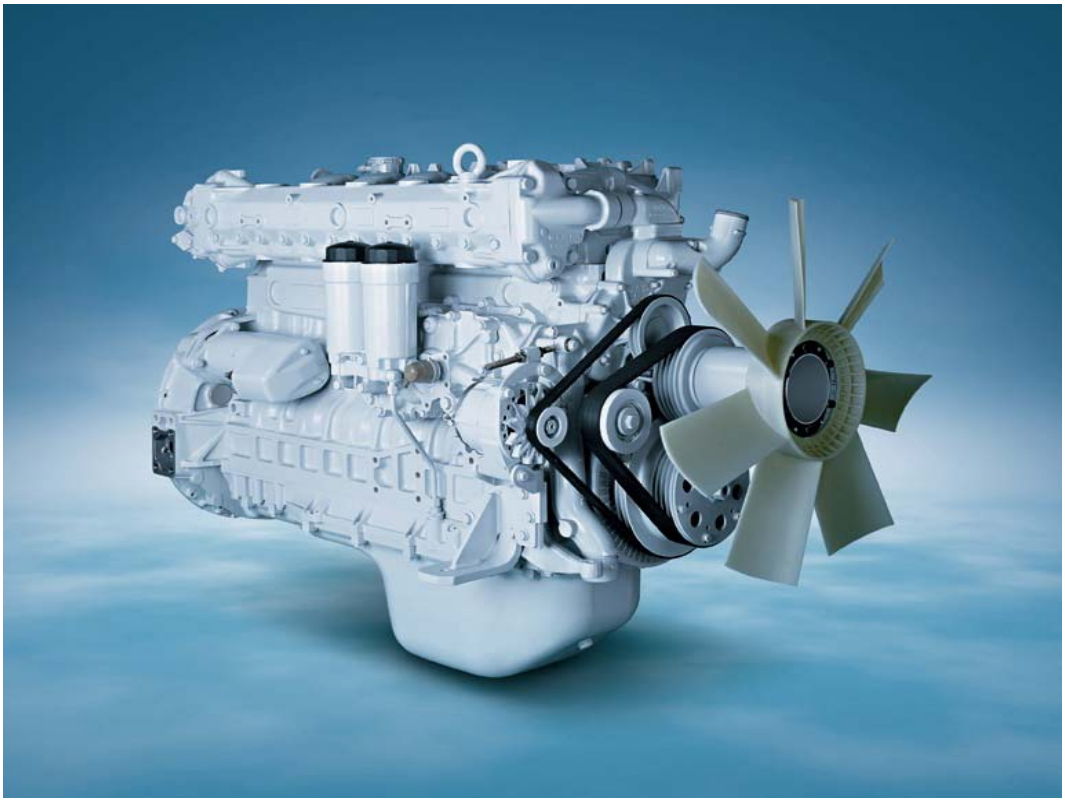


Principle:	4-stroke Otto gas engine
No of cylinders :	6 in line
Engine cooling :	Engine cooling water pump, without radiator for engine cooling water. Pressure fan ⌀ 680 mm, drive via power band
Lubrication :	Pressure lubrication by gear-driven pump, exchangeable lube-oil filter in full flow and lube oil cooler integrated in engine coolant circuit.
Spark plugs:	Special spark plug for industrial gas engines.
Alternator:	24 V / 35 A drive via power band
Starter motor:	With or without pre-engaged-drive starter 24 V - 6.5 kW Starter battery capacity: 88 Ah, 24 V

ENGINE DATA

λ = 1.00	METRIC		ENGLISH	
Rated speed	rpm	1500	rpm	1500
ISO standard power (COP)	kW	140	bhp	188
Air ratio	λ	1.00	λ	1.00
Configuration		in-line engine		in-line engine
No of cylinders		6		6
Bore	mm	128	in	5,04
Stroke	mm	166	in	6,54
Swept volume	L	12,82	cu in	782
Direction of rotation looking on flywheel		counter clockwise		counter clockwise
Flywheel housing		SAE 1		SAE 1
Ring gear with number of teeth	Z	160	Z	160
Compression ratio	ε	12:1	ε	12:1
Mean effective pressure	bar	8,74	psi	126,8
Mean piston speed	m/s	8,30	in/s	326,8
Lube oil consumption	kg/h	0,06	lb/hr	0,016
Lube oil filling quantity min./max.	l	41/30	U.S. gal	10.8/7.9
Coolant filling quantity	l	16	U.S. gal	4,23
max. operating pressure	bar	2	psi	29,0
min. engine coolant circulation quantity	l/min	350	U.S. gal/min	92,5
Pressure reserve water pump	bar	0,3	psi	4,4
Coolant temperature min.	°C	80	°F	176
max. coolant temperature	°C	88	°F	190
Difference (inlet - outlet max.)	K	6	K	6
max. suction pressure	mbar	15	psi	0,22
max. exhaust back pressure	mbar	40	psi	0,58
Engine width	mm	835	in	32,87
Engine length	mm	1610	in	63,39
Engine height	mm	1115	in	43,90
Engine weight, dry	kg	920	lb	2028

Lube oil to MAN works standard M 3271 and coolant to MAN works standard M 324 N/NF/SNF
Gas quality to MAN data sheet - minimum requirement for the gas quality for MAN gas engines
Air ratio measured by lambdameter ETAS LA 4_E

RATING DATA		**50 Hz**		
λ = 1.00		**METRIC**		
Load	%	100	75	50
Ignition timing	°BTDC	18	18	18
ISO standard rating	kW	140	105	70
Coolant heat	kW	142	126	107
Exhaust heat up to 120 °C	kW	79	61	45
Radiation heat max.	kW	17		
Energy input	kW	398	319	244
Fuel consumption	MJ/kWh	10,2	10,9	12,5
Efficiency				
mechanical	%	35,2	32,9	28,7
thermal	%	55,6	58,6	62,4
total	%	90,8	91,5	91,1
Mass flows				
Combustion air	kg/h	493	396	302
Fuel	kg/h	29	23	18
Exhaust gas mass flow rate, wet	kg/h	522	419	320
Temperatures				
Exhaust gas temperature	°C	550	535	520
Fan				
Power input for fan	kW	4,8	4,9	
Cooling air supplied for fan-cooled radiator	m³/h	14400	9360	
Max static pressure in front of radiator	mbar	3	4	
Max static pressure after radiator	mbar	2	2	

Emissions at 100 % load	**Correlation**		**5 % O_2**	**15 % O_2**
NO_X	mg/Nm³	<	4551	1707
	ppm	<	3000	3000
CO	mg/Nm³	<	4095	1536
	ppm	<	4300	4300
THC	mg/Nm³	<	305	114
	ppm	<	640	640

Reference gas mixing unit: Woodward-Deltec 140/80 and ignition system IC 100

The technical data are based on natural gas with a calorific value of 10 kWh/Nm³ and a methane no. > 80
The technical data indicated is based on standard conditions acc to DIN ISO 3046-1

Standard conditions:		
	Atmospheric pressure absolute:	100 kPa
	Air temperature	25 °C
	Relative air humidity	30 %

Rating adaptation at ambient conditions acc to DIN ISO 3046-1
The tolerance for the specific fuel consumption is + 5 % at rated output
The tolerance for the usable heat is 7 % at rated output
The coolant data are based on a 40 % portion of antifreeze
Density of cooling air 1,05 kg/m³

RATING DATA		**50 Hz**		
λ = 1.00		**ENGLISH**		
Load	%	100	75	50
Ignition timing	°BTDC	18	18	18
ISO standard rating	Btu/min	7962	5971	3981
Coolant heat	Btu/min	8075	7165	6085
Exhaust heat up to 248 °F	Btu/min	4493	3469	2559
Radiation heat max.	Btu/min	938		
Energy input	Btu/min	22611	18147	13853
Fuel consumption	Btu/bhp-hr	7226	7733	8855
Efficiency				
mechanical	%	35,2	32,9	28,7
thermal	%	55,6	58,6	62,4
total	%	90,8	91,5	91,1
Mass flows				
Combustion air	lb/hr	1088	873	666
Fuel	lb/hr	64	51	39
Exhaust gas mass flow rate, wet	lb/hr	1152	924	706
Temperatures				
Exhaust gas temperature	°F	1022	995	968
Fan				
Power input for fan	bhp	6,44	6,57	
Cooling air supplied for fan-cooled radiator	cfm	8476	5509	
Max static pressure in front of radiator	psi	0,0435	0,0580	
Max static pressure after radiator	psi	0,0290	0,0290	

Emissions at 100 % load	**Correlation**		**15 % O_2**
NO_X	g/bhp-hr	<	7,9
	ppm	<	3000
CO	g/bhp-hr	<	10,3
	ppm	<	4300
THC	g/bhp-hr	<	0,9
	ppm	<	640

Reference gas mixing unit: Woodward-Deltec 140/80 and ignition system IC 100

The technical data are based on natural gas with a calorific value of 970 Btu/cu ft and a methane no. > 80
The technical data indicated is based on standard conditions acc to DIN ISO 3046-1

Standard conditions:		
	Atmospheric pressure: 14,5 psi	or 328 ft above sea level
	Air temperature	77 °F
	Relative air humidity	30 %

Rating adaptation at ambient conditions acc to DIN ISO 3046-1
The tolerance for the specific fuel consumption is + 5 % at rated output
The tolerance for the usable heat is 7 % at rated output
The coolant data are based on a 40 % portion of antifreeze
Density of cooling air 0.0655 pound/ft³

ENGINE DATA

λ = 1.00	METRIC		ENGLISH	
Rated speed	rpm	1800	rpm	1800
ISO standard power (COP)	kW	160	bhp	215
Air ratio	λ	1.00	λ	1.00
Configuration		in-line engine		in-line engine
No of cylinders		6		6
Bore	mm	128	in	5,04
Stroke	mm	166	in	6,54
Swept volume	L	12,82	cu in	782
Direction of rotation looking on flywheel		counter clockwise		counter clockwise
Flywheel housing		SAE 1		SAE 1
Ring gear with number of teeth	Z	160	Z	160
Compression ratio	ε	12:1	ε	12:1
Mean effective pressure	bar	8,32	psi	120,7
Mean piston speed	m/s	9,96	in/s	392,1
Lube oil consumption	kg/h	0,06	lb/hr	0,016
Lube oil filling quantity min./max.	l	41/30	U.S. gal	10.8/7.9
Coolant filling quantity	l	16	U.S. gal	4,23
max. operating pressure	bar	2	psi	29,0
min. engine coolant circulation quantity	l/min	425	U.S. gal/min	112,3
Pressure reserve water pump	bar	0,4	psi	5,8
Coolant temperature min.	°C	80	°F	176
max. coolant temperature	°C	88	°F	190
Difference (inlet - outlet max.)	K	6	K	6
max. suction pressure	mbar	15	psi	0,22
max. exhaust back pressure	mbar	40	psi	0,58
pressure reserve radiator	mbar	2	psi	0,03
Engine width	mm	835	in	32,87
Engine length	mm	1610	in	63,39
Engine height	mm	1115	in	43,90
Engine weight, dry	kg	920	lb	2028

Lube oil to MAN works standard M 3271 and coolant to MAN works standard M 324 N/NF/SNF
Gas quality to MAN data sheet - minimum requirement for the gas quality for MAN gas engines
Air ratio measured by lambdameter ETAS LA 4_E

RATING DATA		**60 Hz**		
λ = 1.00		**METRIC**		
Load	%	100	75	50
Ignition timing	°BTDC	18	18	18
ISO standard rating	kW	160	120	80
Coolant heat	kW	163	140	123
Exhaust heat up to 120 °C	kW	104	82	59
Radiation heat max.	kW	21		
Energy input	kW	474	382	297
Fuel consumption	MJ/kWh	10,7	11,5	13,4
Efficiency				
mechanical	%	33,8	31,4	27,0
thermal	%	56,3	58,1	61,3
total	%	90,1	89,5	88,3
Mass flows				
Combustion air	kg/h	588	474	369
Fuel	kg/h	35	28	22
Exhaust gas mass flow rate, wet	kg/h	623	502	390
Temperatures				
Exhaust gas temperature	°C	595	580	555
Fan				
Power input for fan	kW	7	7,1	
Cooling air supplied for fan-cooled radiator	m³/h	18720	13500	
Max static pressure in front of radiator	mbar	5	6	
Max static pressure after radiator	mbar	2	2	

Emissions at 100 % load	**Correlation**		**5 % O_2**	**15 % O_2**
NO_X	mg/Nm³	<	4248	1707
	ppm	<	2800	3000
CO	mg/Nm³	<	4095	1536
	ppm	<	4300	4300
THC	mg/Nm³	<	252	114
	ppm	<	530	640

Reference gas mixing unit: Woodward-Deltec 140/80 and ignition system IC 100

The technical data are based on natural gas with a calorific value of 10 kWh/Nm³ and a methane no. > 80
The technical data indicated is based on standard conditions acc to DIN ISO 3046-1
Standard conditions: Atmospheric pressure absolute: 100 kPa
Air temperature 25 °C
Relative air humidity 30 %

Rating adaptation at ambient conditions acc to DIN ISO 3046-1
The tolerance for the specific fuel consumption is + 5 % at rated output
The tolerance for the usable heat is 7 % at rated output
The coolant data are based on a 40 % portion of antifreeze
Density of cooling air 1,05 kg/m³

RATING DATA		**1800 rpm**		
λ = 1.00		**ENGLISH**		
Load	%	100	75	50
Ignition timing	°BTDC	18	18	18
ISO standard rating	Btu/min	9099	6824	4550
Coolant heat	Btu/min	9270	7962	6995
Exhaust heat up to 248 °F	Btu/min	5914	4663	3355
Radiation heat max.	Btu/min	1194		
Energy input	Btu/min	26956	21724	16890
Fuel consumption	Btu/bhp-hr	7538	8100	9446
Efficiency				
mechanical	%	33,8	31,4	27,0
thermal	%	56,3	58,1	61,3
total	%	90,1	89,5	88,3
Mass flows				
Combustion air	lb/hr	1297	1045	813
Fuel	lb/hr	76	61	48
Exhaust gas mass flow rate, wet	lb/hr	1373	1107	860
Temperatures				
Exhaust gas temperature	°F	1103	1076	1031
Fan				
Power input for fan	bhp	9,39	9,52	
Cooling air supplied for fan-cooled radiator	cfm	11018	7946	
Max static pressure in front of radiator	psi	0,0725	0,0870	
Max static pressure after radiator	psi	0,0290	0,0290	

Emissions at 100 % load	**Correlation**		**15 % O_2**
NO_X	g/bhp-hr	<	11,5
	ppm	<	2800
CO	g/bhp-hr	<	10,8
	ppm	<	4300
THC	g/bhp-hr	<	0,8
	ppm	<	530

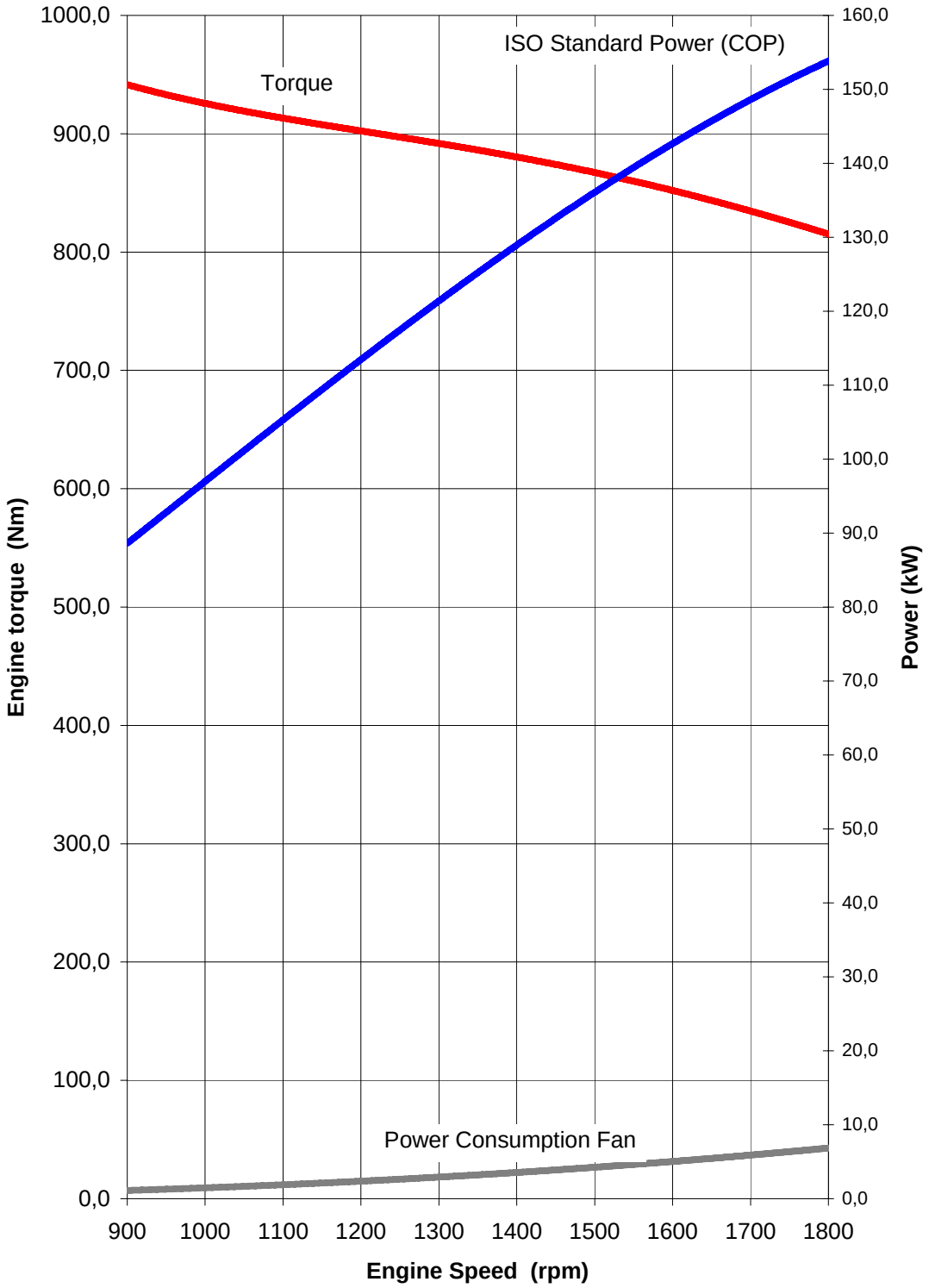
Reference gas mixing unit: Woodward-Deltec 140/80 and ignition system IC 100

The technical data are based on natural gas with a calorific value of 970 Btu/cu ft and a methane no. > 80
The technical data indicated is based on standard conditions acc to DIN ISO 3046-1

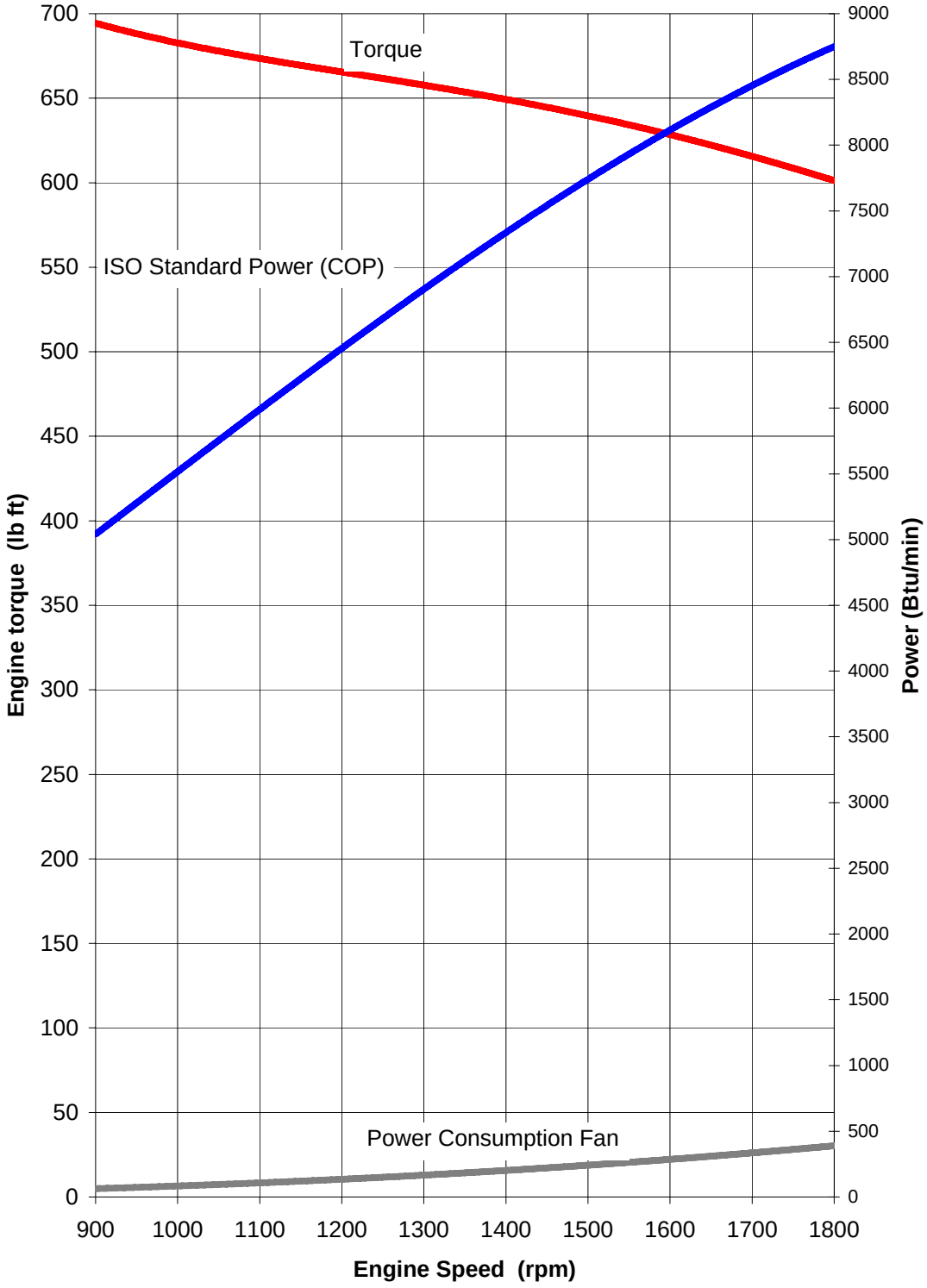
Standard conditions:		
	Atmospheric pressure: 14,5 psi	or 328 ft above sea level
	Air temperature	77 °F
	Relative air humidity	30 %

Rating adaptation at ambient conditions acc to DIN ISO 3046-1
The tolerance for the specific fuel consumption is + 5 % at rated output
The tolerance for the usable heat is 7 % at rated output
The coolant data are based on a 40 % portion of antifreeze
Density of cooling air 0.0655 pound/ft³

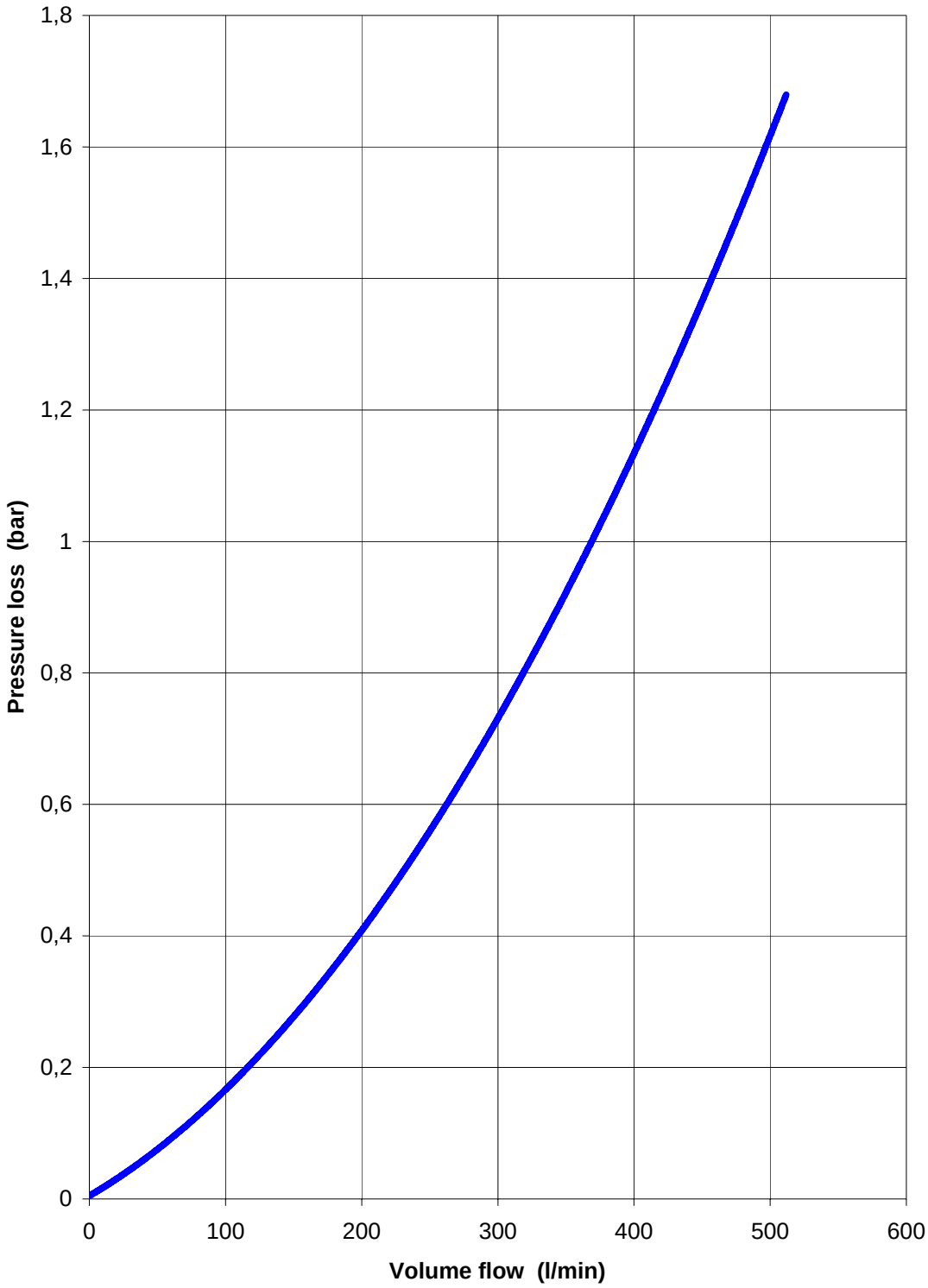
METRIC


ISO Standard Power (COP)
Torque
Power Consumption Fan
Engine torque (Nm)
Power (kW)
Engine Speed (rpm)
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
160,0
150,0
140,0
130,0
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
40,0
30,0
20,0
10,0
0,0
900
1000
1100
1200
1300
1400
1500
1600
1700
1800

ENGLISH


Torque
ISO Standard Power (COP)
Power Consumption Fan
Engine torque (lb ft)
Power (Btu/min)
Engine Speed (rpm)
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
900
1000
1100
1200
1300
1400
1500
1600
1700
1800

METRIC


1,8
1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
Pressure loss (bar)
0
100
200
300
400
500
600
Volume flow (l/min)

Resistance Curve of Engine

ENGLISH