HYPREX™ Formularium

NAME Englisch	NAME Deutsch	Symbol	Dimension	Formula
Relative throughput (for equal rotor geometry)	Relativer Durchsatz-parameter	S_{REL}	[-]	$S_{REL} = \frac{V_2.60}{\frac{\pi}{4}.D_R{}^2.L_R.n_{CX}}$
Relative throughput (for different rotor geometry)	Relativer Durchsatz-parameter	S*	[-]	$S^* = \frac{V_2.60}{\frac{\pi}{4}D_R{}^2.L_R.(1-NV^2).(1-k).z.n_{CX}}$
Relative mass throughput parameter	Relativer Massen Durchsatz-parameter	M_{REL}	[-]	$M_{REL} = \frac{V_2.60}{\frac{\pi}{4}D_R{}^2.L_R.(1-NV^2).(1-k).z.n_{CX}}.\Gamma_2$
Related speed	Relative HYPREX Drehzahl	n_{200}	[rpm]	$n_{200} = \frac{n_{CX}.L_R}{L_{200}}$ L_{200}=0.200[m]
cycle period	Zyklus Periode	Z_C	[ ]	$Z_C = \frac{60.a_0}{n_{CX}.z.L_R}$
cycle frequency	Zyklus Frequenz	f_C=n*	[ ]	$f_C = n^* = \frac{n_{CX}.z.L_R}{60.a_0}$
Volumetric flow rate aIC	Volumenstrom nach LLK	$\dot{v}_{2aIC}$	[m³/s]	$\frac{v_H * n_M * \eta_{VOL}}{T_{2aIC} * p_2}$
Volumetric flow rate in 2	Volumenstrom vor LLK	$\dot{v}_2$	[m³/s]	$\frac{P_{2aIC} * T_2 * \dot{v}_{2aIC}}{T_{2aIC} * p_2}$
Volumetric flow rate in 2	Volumenstrom vor LLK	$\dot{v}_2$	[m³/s]	$\dot{v}_{2aIC} * \Gamma_{IC}$
Pressure ratio	Ladedruck-verhältnis	π	[-]	$\frac{p_2}{p_1}$
Compression efficiency	Kompressions-Wirkungsgrad	ψ	[-]	$\psi = \frac{\left(\frac{p2}{p1}\right)^{\frac{\kappa-1}{\kappa}}-1}{\frac{T2}{T1}-1}$
Total efficiency	Total Wirkungsgrad	η_{TOT}	[-]	$\eta_{TOT} = \frac{\left(\frac{P2}{P1}\right)^{\frac{\kappa-1}{\kappa}}-1}{\frac{h_{k3}}{h_{k1}}-\left(\frac{P4}{P3}\right)^{\frac{\kappa-1}{\kappa}}.\frac{h_{e3}}{h_{k1}}}$
High pressure difference	Hochdruck-Differenz	$\Delta p2-3$	[Pa]	$p2-p3$
Low pressure difference	Niederdruck-Differenz	$\Delta p4-1$	[Pa]	$p4-p1$
EGR ratio	Abgas-rezirkulation	EGR	[%]	$\frac{CO_{2(2)}-CO_{2(1)}}{CO_{2(3)}-CO_{2(1)}}$
Scavenging ratio	Spülgrad	ηsc	[-]	$\frac{\dot{m}_1-\dot{m}_2}{\dot{m}_2}$

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Density (general)	Dichte (allgemein)	Q	[kg/m³]	$\frac{p}{R*T}$
Density ratio after Charger	Dichteverhältnis nach Lader zu vor Lader	r_2	[-]	$\frac{Q_2}{Q_1}$
Density ratio after IC	Dichteverhältnis nach LLK zu vor Lader	r_{2aIC}	[-]	$\frac{Q_{2aIC}}{Q_1}$
Density ratio through IC	Dichteverhältnis nach LLK zu vor LLK	Γ_{IC}	[-]	$\frac{Q_{2aIC}}{Q_2}$
Efficiency charge air cooler	Ladeluftkühler Wirkungsgrad	ε_{IC}	[-]	$\frac{T_2 - T_{2aIC}}{T_2 - T_C}$
Efficiency charge air cooler	Ladeluftkühler Wirkungsgrad	η_{IC}	[-]	$\frac{T_2 * p_{2aIC}}{T_{2aIC} * p_2}$
Air / fuel ratio	Luft / Kraftstoff Verhältnis	λv	[-]	$\frac{\dot{m}_2 * 1000}{b_e * P_{eff} * L_{\min}} = \frac{\dot{m}_2}{B * L_{\min}}$
Effective air / fuel ratio	Effektives Luft / Kraftstoff Verhältnis	λe	[-]	$\lambda v * (1 - RZ)$

CONSTANT VALUES

Q_f	=	820	[kg/m³]	:	Average diesel fuel density at 20°C
R	=	287.04	[J/kgK]	:	Constant gas value for air
ℵ	=	1.4	[-]	:	Adiabatic exponent of gas for air
$H_{u\,d}$	=	42500 *	[kJ/kg]	:	Specific caloric value of diesel fuel
$H_{u\,g}$	=	43500 *	[kJ/kg]	:	Specific caloric value of gasoline fuel (super)
$L_{min\,d}$	=	14.5 *	[kg_a/kg_f]	:	Theoretical minimum air need for diesel fuel combustion
$L_{min\,g}$	=	14.7 *	[kg_a/kg_f]	:	Theoretical minimum air need for gasoline fuel combustion

* values out of Bosch automotive handbook

QUANTITY

A	[m²]	:	Area	B	[kg/h]	:	Fuel ratio
b_e	[g/Wh]	:	Specific fuel rate	CO_2	[VOL %]	:	CO_2
D_{ROT}	[m]	:	Rotor diameter	Γ	[-]	:	Density ratio
ε_{IC}	[-]	:	After cooler efficiency	F	[N]	:	Brake lever force
η_{TOT}	[-]	:	Total efficiency	η_{SC}	[-]	:	Scavenging ratio
η_{VOL}	[-]	:	Volumetric efficiency	η_{eff}	[-]	:	Effective engine efficiency
i	[-]	:	i = 0.5 : 4 stroke i = 1.0 : 2 stroke	h	[kJ/kg]	:	Enthalpy
l	[m]	:	Brake lever length	L_{ROT}	[m]	:	Rotor length
λ_v	[-]	:	Air / fuel ratio	M_d	[N]	:	Torque
$\dot{m}$	[kg/s]	:	Mass flow	n_{Hx}	[min $^{-1}$]	:	HYPREX speed

HYPREX™ Formularium

QUANTITY

n_M	[min^{-1}]	:	Engine speed	n_P	[min^{-1}]	:	Injection pump speed
N_{200}	[min^{-1}]	:	Specific CX speed	p_{eff}	[kW]	:	Brake power output
p_{me}	[bar]	:	Mean working press.	p_{max}	[-]	:	Peak pressure
p	[Pa]	:	Absolute pressure	π	[-]	:	Pressure ratio
Ψ	[-]	:	Compress. efficiency	RZ	[%]	:	EGR Ratio
ϱ	[kg/m^3]	:	Density	SREL	[-]	:	Relative throughput
T	[°K]	:	Absolute temperature	$\dot{v}$	[m^3/s]	:	Volumetric flow rate
$\dot{v}_2$	[m^3/s]	:	Vol. flow rate in 2	$\dot{v}_{2aIC}$	[m^3/s]	:	Vol. flow rate aIC
V_E	[mm^3]	:	Inject. rate / stroke	V_H	[m^3]	:	Engine displacement
V_{ROT}	[m^3]	:	Rotor volume	w	[rad/s]	:	Angular speed
z	[-]	:	Number of cylinders	ζ	[-]	:	Low pressure restriction factor

a:	Air	AMB:	Barometric
c:	coolant (20-25°C)	HX:	HYPREX
eff:	Effective	f:	Fuel
IC:	Intercooler (charge air cooler)	aIC:	After charge air cooler
K:	Geometry of HYPREX	k:	Bar factor of rotor cells
LDA:	Manifold pressure compens.	M:	Engine, motor
m:	Measured at D1, D4	NV:	Hub ratio of rotor
PWS:	Pressure wave supercharger	r* :	Related value
ROT:	Rotor	s:	Isentropic
SÜV:	Bypass valve	SV:	Starting valve
sc:	Scavenging	TOT:	Total
VOL:	Volumetric	VGPC:	Variable gas pocket control
WG:	Waste gate	wIC:	Water-air charge air cooler