LFE-FlowCal

TetraTec Instruments

Flow Calculation of Laminar Flow Elements LFE for Air and Gases according to Hagen-Poiseuille and Uniflow

Version 01 - 05.08.2008 **KI**
Revsion 01 supports LFE with HP and uniflow calibration

yellow background fields
Enter here please the orifice data and standard conditions
orange background fields
Enter here please the actual measurement values
green background fields
Contain the calculation results
blue background fields
Warning hints

Language Selection English

LFE Calibration and Evaluation

LFE Evaluation Method		Hagen-Poiseuille	
Calibration Conditions			
Calibration Media		Air_dry	
Calibration pressure	P_{Cal}	1013,25	mbar
Calibration temperature	T_{Cal}	21,11	°C
Calibration rel. humidity	RH_{Cal}	0,0	%
Calibration viscosity (dyn.)	η_{Cal}	1,8187E-05	Pa·s
Standard Conditions			
Standard pressure	P_N	1013,25	mbar
Standard temperature	T_N	0,00	°C
Standard rel. humidity	RH_N	0,0	%

SLFE Measurement and Operation Values

Pipe Inner diameter	D	12,000	mm
Operation Media		Air_humid	
DP pressure + against - connection	DP	6,500	mbar
Absolute pressure at inlet	P	5000,00	mbar
Temperature at in- or outlet	T	20,8	°C
Rel. Humidity at inlet	RH	37,3	%

Flow Results

Mass Flow	Q_m	0,6284	kg/h
Actual Volume Flow	Q_{act}	0,106127	m³/h
Standard Volume Flow	Q_N	0,4860	Nm³/h
Flow velocity (pipe)	v	0,2607	m/s
Sonic velocity	c	343,9259	m/s
Critical pressure ratio	r*	0,5282	= P_{aus}/P_{ein}
Mach number pipe	Ma	0,0008	= v / c

Results Orifice and Gas Properties

Real gas factor	Z	1,00000	-
Actual density	ρ	5,9212058	kg/m³
Actual viscosity (dyn.)	η	1,81714E-05	Pa·s
Actual viscosity (kin.)	ν	3,06886E-06	m²/s
Standard density	ρ_N	1,29299	kg/m³
Standard viscosity (dyn.)	η_N	1,71756E-05	Pa·s
Standard viscosity (kin.)	ν_N	3,06886E-06	m²/s
Actual molar humidity ratio	x_{v_act}	0,00186	-
Molar humidity ratio (Standard)	x_{v_N}	0,0000	-
Molar mass (actual)	M_{act}	28,9431	g/mol
Molar mass (Standard)	M_N	28,9635	g/mol
Isentropic exponent	κ	1,40078	-
General gas constant	R	8314,41	J/(kmol*K)
Specific gas constant	Rs	287,267426	J/(kg*K)
Reynolds number (pipe)	Re_D	1019,2	-

Data validity: Allow List
LFE Evaluation Method acc. Certificate:
Hagen-Poiseuille
Uniflow

LFE Calibration Coefficients acc. Certificate:

A or a0	0,00000E+00	
B or a1	2,73094E-01	
C or a2	-1,86293E-04	
D or a3	0,00000E+00	
E or a4	0,00000E+00	
F or a5	0,00000E+00	
G or a6	0,00000E+00	
H or a7	0,00000E+00	
I or a8	0,00000E+00	
J or a9	0,00000E+00	
Scaling Factor xF	1,00000E+00	xF, yF only for:
Scaling Factor yF	1,00000E+00	Uniflow, HP=1

LFE Calibration Units acc. Certificate:

DP_Unit	mbar	Only for:
Qcal_Unit	l/min	Hagen-Poiseuille

Media:
Air_humid
Air_dry
H2O_Steam
Ar
CO2
CO
H2
He
N2
O2
CH4
C2H6
C3H8
n-C4H10
iso-C4H10
Nat_GasH
Nat_GasL
N2O
NO
Xe

Allowed Units:

DP:	Pa	hPa	mbar	inH2O@	PSI
Qcal:	m³/s	m³/h	l/min	ml/min	cfm

Conversions:

10,4733	g/min	0,000	kg/s	10473	mg/min
1,7688	l/min	3E-05	m³/s	1768,8	ml/min
8,1000	Nl/min	0,0001	Nm³/s	8100	ml/min

Typical remaining pressure loss:
Across LFE: **6,50** mbar

Dynamical pressure of flow at inlet:
Typically **0,00** mbar
In outlet the remaining pressure drop is adding.

Minimum necessary DP: In to outlet
Typically **6,50** mbar

Straight inlet 10x D straight outlet 5x D after flow element
No disturbance should come closer than:
4x D before Plus-DP and after Minus-DP

Generally: Caution at Re-numbers bigger than 100000

At time only is supported the calculation for
the above listed Media and evaluation methods.
Other media and flow elements must be integrated
in the code (is marked in the code)

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