DIN EN 13384-2:2019-09 (E)

Chimneys - Thermal and fluid dynamic calculation methods - Part 2: Chimneys serving more than one combustion ap pliance (includes Amendment A1:2019)

Contents

Page

European foreword 5

Introduction 7

1 Scope 8

2 Normative references 8

3 Terms and definitions 9

4 General symbols and abbreviations 10

5 Calculation method 10
5.1 General principles 10
5.2 Pressure equilibrium condition 12
5.2.1 Negative pressure chimneys 12
5.2.2 Positive pressure chimneys 13
5.3 Mass flow requirement 14
5.4 Pressure requirements 14
5.4.1 Negative pressure chimneys 14
5.4.2 Positive pressure chimneys 15
5.5 Temperature requirement 16
5.6 Calculation procedure 17

6 Flue gas data characterising the !combustion" appliance 19

7 Data for chimney and connecting flue pipes 21

8 Basic data for the calculation 21
8.1 General 21
8.2 Air temperatures 21
8.2.1 External air temperature (TL) 21
8.2.2 Ambient air temperature (Tu) 21
8.3 External air pressure (pL) 21
8.4 Gas constant 21
8.4.1 Gas constant of the air (RL) 21
8.4.2 Gas constant of flue gas (R) 21
8.5 Density of air (L) 21
8.6 Specific heat capacity of the flue gas (cp) 21
8.7 Water vapour content ((H2O),j) and condensing temperature (Tsp) 22
8.8 Correction factor for temperature instability (SH) 22
8.9 Flow safety coefficient (SE) 22
8.10 External coefficient of heat transfer 22

9 Determination of temperatures 22

10 Mixing calculations 24
10.1 General 24
10.2 Flue gas mass flow (j,m) 24
10.3 Flue gas temperature at the inlet of the chimney segment (Te,j) 24
10.4 CO2-content of the flue gas in the chimney segment ((CO2),j) 24

10.5 H2O-content of the flue gas ((H2O),j) ... 25
10.6 Gas constant of the flue gas (R,j) ... 25
10.7 Flue gas data ... 25
10.7.1 Specific heat capacity (cpV,j), (cp,j) ... 25
10.7.2 Thermal conductivity of the flue gas (AV,j), (A,j) ... 26
10.7.3 Dynamic viscosity (AV,j), (A,j) ... 26
10.7.4 Condensing temperature (TSP) ... 26

11 Density and velocity of the flue gas ... 27

12 Determination of the pressures ... 27
12.1 Pressures at each inlet of the chimney segments ... 27
12.1.1 Draught ... 27
12.1.2 Positive pressure ... 28
12.1.3 Draught due to chimney effect in the chimney segment (PH,j) ... 28
12.1.4 Pressure resistance in the chimney segment (PR,j) ... 28
12.2 Minimum draught required at the flue gas inlet into the chimney and maximum allowed draught (PZe and PZemax) and maximum and minimum differential pressure at the flue gas inlet into the chimney (PZOe and PZOemin) ... 31
12.2.1 Minimum required and maximum allowed draught ... 31
12.2.2 Maximum available and minimum allowed differential pressure ... 31
12.2.3 Calculated pressure resistance of the connecting flue pipe (PV,j) ... 31
12.2.4 Calculated pressure resistance of the air supply (PBc,j) ... 33

13 Inner wall temperature ... 34

14 Cascade installations ... 35
14.1 Principle of the calculation method ... 35
14.2 Pressure equilibrium condition ... 35
14.2.1 Negative pressure cascade installation ... 35
14.2.2 Positive pressure cascade installation ... 36
14.3 Mass flow requirement ... 37
14.4 Pressure requirements ... 37
14.4.1 Negative pressure chimneys ... 37
14.4.2 Positive pressure chimneys ... 38
14.5 Temperature requirement ... 39
14.6 Calculation procedure ... 39
14.7 Pressures at the outlet of the connecting flue pipe and pressures at the inlet of the collector segment ... 40
14.7.1 Pressure at the flue gas inlet into the collector segment (PZC,j,l or PZOC,j,l) ... 40
14.7.2 Pressures required or available at the outlet of the connecting flue pipe (PZeC,j,l, PZOeC,j,l) ... 43
14.8 Inner wall temperature (TiobC,j,l) ... 45

15 Balanced flue chimney ... 45
15.1 Principle of the calculation method ... 45
15.2 Pressure equilibrium condition ... 46
15.3 Mass flow requirement ... 46
15.4 Pressure requirements ... 46
15.4.1 Negative pressure chimneys ... 46
15.4.2 Positive pressure chimneys ... 47
15.5 Temperature requirements ... 48
15.6 Calculation procedure for balanced flue chimneys ... 48
15.7 Mass flow of the !combustion" air ... 50
15.8 Determination of the temperatures in balanced flue chimneys ... 51
15.8.1 Separate ducts ... 51
15.8.2 Concentric ducts ... 51
15.8.3 Concentric connection pipes ... 59
15.9 Pressures of the air supply ducts ... 65
15.9.1 Draught due to chimney effect of the air supply duct of chimney segment j ... 65
15.9.2 Draught due to chimney effect of the air supply duct of connection pipes ... 65
15.9.3 Pressure resistance of the air supply duct of the chimney segment j (PRB,j) ... 66

15.9.4 Pressure resistance of the air supply duct of the connection pipe j (PRBV,j) 67
15.10 Density and velocity of the !combustion" air 69
15.10.1 Density and velocity of the !combustion" air in the air supply duct averaged over the length of the chimney segment 69
15.10.2 Density and velocity of the !combustion" air averaged over the length of the connection pipes 70

16 Consideration of chimney fans 70
16.1 General 70
16.2 Inline fans 71
16.3 Exhaust fans 72

Annex A (informative) Recommendations 74

A.1 General 74
A.2 Recommendations for the chimney and !combustion" appliances 74
A.3 Recommendations for connecting flue pipes 74

Annex B (informative) Characteristics for the !combustion" appliance 75