

DIN EN 15243:2007-10 (E)

Ventilation for buildings - Calculation of room temperatures and of load and energy for buildings with room conditioning systems

Contents		Page
Foreword		6
Introduction		7
1	Scope	8
2	Normative references	9
3	Terms and definitions	10
4	Symbols and abbreviations	13
5	General approach	15
6	Room temperature calculation without room conditioning system	17
6.1	Choice of rooms	17
6.2	Calculation method	17
6.3	Boundary conditions	17
6.3.1	Climatic data	17
6.3.2	Internal loads	17
6.3.3	Window opening	17
6.3.4	Acceptable comfort conditions	17
7	Room cooling load calculation	17
7.1	Basic sensible room cooling load calculation	17
7.2	System dependent sensible room cooling load calculation	17
7.3	Latent room cooling load calculation	18
7.4	Boundary conditions	18
7.4.1	Definition of room conditions (temperature, humidity, tolerances)	18
7.4.2	Climatic data	18
7.4.3	Internal loads	18
7.4.4	Ventilation rates	18
8	Room heating load calculation	18
8.1	Calculation procedure	18
8.2	Climatic data	18
8.3	Ventilation rates	18
9	Room based equipment sizing	19
10	Zone load calculation	19
11	System heating and cooling load calculation	19
12	Central system equipment sizing	19
13	Room and building energy calculation	19
13.1	General	19
13.2	Humidification and dehumidification energy demand	19
13.3	Relation to system energy calculation methods	20

14	System energy calculation	21
14.1	General approach	21
14.1.1	System structure and boundaries	21
14.1.2	Energy calculation structure	21
14.1.3	Calculation methods	24
14.1.4	HVAC System Overview	25
14.2	Required functionality of detailed and simplified calculation methods	27
14.2.1	General	27
14.2.2	General principles and reporting of procedure	27
14.2.3	Verification of building and HVAC system calculation methods	28
14.2.4	Calculation procedures: Information in other standards	38
14.3	Simplified system losses and energy demand calculation methods	39
14.3.1	General remarks	39
14.3.2	Emission losses	39
14.3.3	Emission auxiliary energy demand calculation	40
14.3.4	Calculation of cold water distribution	40
14.3.5	Humidification and dehumidification energy demand	40
14.3.6	Cold generation and chiller energy performance	40
14.3.7	Example calculation procedures	40
14.4	Detailed system losses and energy demand calculation method	40
14.4.1	General remarks	40
14.4.2	Climatic data	40
Annex A (informative) Best procedure for design process		41
Annex B (informative) Proposed procedure for choice or typical rooms for temperature calculation		43
Annex C (informative) System overview		44
Annex D (informative) Schematic relationship between HVAC system energy procedure, building energy demand calculations, data and outputs		51
Annex E (informative) Example simplified system losses and energy demand calculation methods		60
E.1	Example 1 (Dutch proposal)	60
E.1.1	Emission losses	60
E.1.2	Distribution losses	60
E.1.3	Storage losses	64
E.1.4	Generation efficiency and energy consumption	64
E.1.5	HVAC system annual energy consumption	66
E.2	Example 2 (German proposal)	67
E.2.1	Scope	67
E.2.2	Method	67
E.2.3	Application for the territory of federal republic of Germany	68
E.2.4	Specific guide values	73
E.2.5	Energy demand for air transport	79
E.2.6	Conversion and calculation of specific values	79
E.2.7	Example	83
E.3	Example 3: Monthly HVAC system cooling energy calculations using degree-day methods	85
E.3.1	Theory	85
E.3.2	Worked example	89
Annex F (informative) EDR Verification of building and installation calculation methods		93
F.1	Introduction	93
F.1.1	General	93
F.1.2	Brief description of EDR	93
F.1.3	How to obtain the attest (quality certificate)	95
F.1.4	Importance of EDR	96
F.1.5	Relations: EDR, CEN, ISO, IEA HVAC BESTEST etc	96

F.2	Method description	96
F.2.1	General	96
F.2.2	Functionality Matrix	97
F.2.3	Masks	98
F.2.4	Reference/Test cases	98
F.2.5	Results of reference cases should fall within certain ranges	98
F.2.6	Example of the Functionality Matrix	98
F.2.7	Example: Mask - generation of cold	102
F.3	EDR Calculation method for reference values	103
F.3.1	Introduction	103
F.3.2	Centre of the reference area	103
F.3.3	Structure of the reference area	103
F.3.4	Size of the reference area (bandwidth)	103
F.3.5	Examples	104
Annex G (informative) Example values for emission losses		105
G.1	Zones including several groups	105
G.2	Control accuracy	106
Annex H (informative) Calculation of latent energy demand		107
H.1	Presentation	107
H.2	Application for hourly calculation	108
Annex I (informative) Example Calculation of Seasonal Efficiency of Cold Generators and Chillers in Air Conditioning Systems		111
I.1	Introduction	111
I.2	Theory	111
I.2.1	The objective	111
I.2.2	Combination of load frequencies and part-load performance measurements	112
I.2.3	Seasonal performance indices	113
I.2.4	Calculation of representative EIRs	113
I.2.5	Multiple chillers	113
I.2.6	Calculations for systems	113
I.3	Practical application	114
I.3.1	Background	114
I.3.2	Simplification of load frequency data	115
I.3.3	Approximation of chiller performance data	116
I.4	Illustrative example of estimation of seasonal EER	118
I.4.1	General	118
I.4.2	Load frequency distributions	118
I.4.3	Combined chiller performance	119
I.4.4	Mapping the chiller ratings on to the load frequency	120
I.5	Example for calculated part-load-values	123
Annex J (informative) Auxiliary energy for cooling-water and cold-water distribution		127
J.1	Electrical energy demand	127
J.1.1	General	127
J.1.2	Electrical energy demand of distribution	129
J.2	Hydraulic energy demand for distribution	130
J.2.1	General	130
J.2.2	Pressure head at the design-rating operating point	131
J.2.3	p approximation values	132
J.2.4	Pump operating times	133
J.2.5	Mean distribution load	134
J.2.6	Correction factor f_{Abgl} for hydraulic adjustment	135
J.3	Demand coefficients	136
J.3.1	General	136
J.3.2	Efficiency factor f_e of the pump	136

J.3.3	Correction factor f_{Adap} for adaptation	137
J.3.4	Pump power adaptation during operation	137
J.3.5	Switching of individual pumps in parallel-pump installations	138
J.4	Other auxiliary energy demands (auxiliary drives)	138
J.4.1	Pump heating registers	138
J.4.2	Pumps and drives for heat recovery	138
J.4.3	Water humidifier pumps	139
J.4.4	Electrical energy demand for central HVAC unit controls	140
J.5	Guideline for calculating the electrical energy demand of cooling-water and cold- water distribution systems	140
J.5.1	General	140
J.5.2	Specific volume flow in the distribution circuit	141
J.5.3	Pressure head p_Z at the design-rating operating point	141
J.5.4	Annual pump operating times $I_{d,t}$	143
J.5.5	Specific electrical power of distribution	143
J.5.6	Electrical energy demand of distribution	143
Annex K (informative) Thermal and dehumidification distribution losses in cooling systems		145
K.1	Cooling for the HVAC system	145
K.2	Cooling energy supply for space cooling	146
Annex L (informative) Auxiliary energy use by terminals		148
L.1	Energy demand for space cooling - fans	148
Annex M (informative) Auxiliary energy demand, heat rejection		149
M.1	Calculation	149
M.2	Partial-load index values of heat rejection systems	152
Bibliography		154